



NGSS
National Report
Lithuania

Project Information

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1. Introduction

1.1. Context of the National Report

This document presents the state of STEM and STEAM in Lithuania. It also shows the framework provided by the national curriculum for science education. The report presents a summary of a focus groups interviews which shows teachers' understanding, knowledge, experience about STEM and STEAM.

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. Methods

The reserch methodology combine filed research (the Focus Group Interviews) and desk research.

For the Focus Group Interviews 25 participants were chosen: twelve (12) primary school teachers, four (4) female professionals in STEM fields, three (3) Art and Design practitioners and six (6) parents of primary school children; the parents have children of different gender.

The participants from Panevėžys District were chosen. The participants have already had a general idea about STEM contents. The potential participants were contacted through email or phone due to the pandemic conditions. All the invited participants agreed to take part in the interviews. The Focus Group Interviews took place in virtual space (online) using Teams. All participants signed a consent form.

There were three different meetings organized for different focus groups (one for primary teachers, the second for female professionals in STEM fields and Art and

Design practitioners and the third for parents). Each session took about one and a half hour.

The facilitator of the Focus Group Interviews: Reda Maknevičienė, female, 48, English teacher at Panevėžys Šaltinis Progymnazium.

2.2. Study population and samples:

A) Study population: Panevėžys Šaltinis Progymnazium was invited to collaborate in this project. Therefore, all the invited participants are the members of this community. Primary teachers and STEM and Arts professionals are experienced here and have a good knowledge what STEAM is. Parents were chosen so that they have children of both genders in order to discover the differences in learning habits and interests.

B) Samples

a) Teachers and stake-holders sample:

12 primary teachers of Panevėžys Šaltinis Progymnazium took part in the Focus Group Interview. Panevėžys is the fifth largest town in the Republic of Lithuania so all the teachers represent urban residence. All the participants in this group are women. The average age of the teachers is 50. Most of the teachers have been working in this school since its foundation in 1993. Therefore their teaching experience is on average 25+. Most primary teachers have a professional qualification of teacher-methodologist. Primary teachers teach children aged 7-10.

b) STEAM professionals sample

4 STEM professionals – teachers of Panevėžys Šaltinis Progymnazium were invited to take part in the Focus Group Interview. The teachers represent urban residence. The average age of the teachers is 45. All the participants in this group are female. Chemistry teacher has 5 years of teaching experience, Geography and Nature teacher has 2 years of teaching experience, Biology teacher has 15 years of teaching experience and Physics teacher has 31 years of experience. All the teachers work in grades 5-8, Biology teacher also teaches gymnasium classes in Panevėžys Minties Gymnazium. Three of the STEM professionals have a professional qualification of senior teacher. One of them has recently graduated from university.

Art professionals also work in Panevėžys Šaltinis Progymnazium. Music, Drama and Dance teachers were questioned. All the participants in this group are also women. The average age of this group is 49. All the professionals in this group are also experienced, two of them have a qualification of teacher-methodologist and

one is a senior teacher. Drama and Dance teachers have a lot of experience working in international projects. Dance teacher teaches primary students and also has gymnasium classes in Panevėžys Gymnazium No5. Music teachers has grades 1-8, Drama teacher works with all the students of the school.

c) Parents sample

Parents whose children learn in Panevėžys Šaltinis Progymnazium were chosen. All the parents have children of different genders. All the children are the students of the school at the moment. All the families live near the school and represent urban area. The age of the parents is 35-50. The professions of the parents include factory workers (2), sales assistants (2), a teacher's assistant and an IT teacher. All the parents who participated in the interview are female.

3. Results

3.1. Focus group interviews results

3.1.1. The synthesis of the participants answers:

The teachers and STEAM professionals define STEAM as one of the most modern ways of education which integrates natural sciences, technologies and engineering, art and mathematics relating them to real world and forms students' critical thinking and problem solving skills. All of them see the difference between STEM and STEAM.

All primary teachers have their experience teaching STEM/STEAM, they can apply STEM/STEAM strategies. Primary teachers say they are able to organize such activities at school. The teachers use videos made by Šiauliai University students, the school is a member of STEAM Network from 2020. Teachers organize different activities in the nature, do experiments and researches, organize educational activities and trips. Students work in groups, the results of work are presented to other students, active practical work is implemented. There is always a reflection of the activities, discussions and positive critics. As one of the most successful ways to teach STEAM teachers name short term integrated projects where several subjects are integrated and students produce some kind of product or solve a problem.

To motivate and attract students to STEAM activities teachers give students problematic question and offer them to find out the answer themselves working on projects, practical experiments and use learning-by-doing strategies. Thinking maps are used and different researches are compared, summarized and analyzed. One of

the methods which is attractive to students is a roleplay. Working in different places outside school is always interesting to students.

Poor teaching conditions, lack of finance and materials are the main difficulties for teachers. The school itself has a special laboratory for teaching sciences but it is not very professional. The town does not have a botanic garden or laboratories which would accept students to make experiments. There is a University in the town (Kaunas Technology University) and Panevėžys College but they are interested only in students from gymnasiums so students at primary level do not have any opportunity to work there. There is RoboLabas for those who like computers and robots but due to its popularity it is difficult to use its equipment and the activities are often the same. The teachers say that they would like to have some kind of a platform where STEAM lesson plans could be uploaded and made public.

The primary teachers state they receive the necessary support from the policy makers. There are a lot of seminars on methodology of STEAM. Therefore these training courses and collaboration allow teachers to work effectively. The school has a team responsible for STEAM education and activities so the members of the group provide all necessary information and organize different activities making teacher's work easier.

Most teachers are ready for the implementation of STEAM approach. Experienced teachers think they have got enough knowledge to teach STEAM effectively. However, there is a part of teachers who need more training. Teachers need lesson plans, methodologic materials. There is also a need in practical seminars where teachers could share their experience. Some would like more international projects and activities where they could share their experience with teachers from other countries.

Most of the teachers expect to have an environment in and outside the classroom suitable for teaching STEAM. As there is a lack of laboratories, botanic gardens and other places for experiments and research work, the teachers would like to have more free opportunities to work in similar organizations in other cities using environments of universities or other institutions.

Also teachers expect to be provided with the newest methodologies, literature and integrated lesson plans.

Implementation of STEAM in teaching inspires children's imagination and creativity. It is necessary to make the lessons into learning-by-doing lessons in order to motivate students. Research, experiments, experience playing, learning-



by-doing have a positive overall impact on children's knowledge and understanding of everyday life.

According to the teachers STEAM approach is based on encouragement of children's creativity. Pupils develop their thinking skills, speak argumentative, give reasons and discuss, solve problems, separate fake and real information, concentrate their attention and develop their main senses such as sight, tactile, hearing, smell, taste and reinforce their self confidence. STEAM activities help students put their theoretical knowledge into practice. The impact of STEAM is positive as their achievements are better and motivation improves.

The teachers do not think that there is a difference between genders while teaching STEM/STEAM. There are no separate classes for girls, the lessons are in mixed groups. The main way is to allow students explore and invent themselves, allow them to prove or reject certain hypothesis.

To make STEM/STEAM more attractive to girls STEAM professionals choose topics which are interesting for girls, which will be useful in their future life and areas where every girl would experience success. In the beginning individual tasks are chosen, later, when particular features become clear, team work is used to allow every girl use her individual personal characteristics to implement certain part of the project. It is necessary to show the girls that natural sciences are not theoretical and analytical subject but there is an opportunity to improvise and create.

To make STEM/STEAM more attractive to disadvantaged students such tasks are used where experiments could be done using minimum materials which could be easily found at home. Such students are usually creative therefore they like creative tasks.

All the teachers take the pupils' social and emotional learning process into account, while teaching STEAM or science lesson. Teachers think that social emotional learning process is very important therefore they always choose activities which are attractive to students and would motivate them. It is thought that to make students motivated teacher herself has to be interested and devoted to the subject willing to try something new.

STEM+Arts motivate girls to study STEM field. It is attractive and interesting to young girls. Therefore, more and more girls become interested in STEM field and choose their career connected to this area.

Some parents say that there are gender differences in the use of toys, programs and activities specific to their children's age. The girls are more emotional, they like art

more, they are more thorough. The boys are more interested in computer games, more active. But children of both genders are equally interested in STEM field as it is interesting to explore and feel self-confident.

Parents state that they talk to their children about the value of education, their future career. Parents say they help children understand the value of Science and Art by their own example, they share their experience with their children, visit museums, exhibitions, spend time in the nature together teaching everyday skills. Most parents understand the difference between STEM and STEAM as it is a popular topic in nowadays Lithuania. They say that Art helps their children express themselves better and natural sciences are useful for the future career of their children.

3.1.2 The conclusions of the Focus Groups Interviews

Teachers and parents in Lithuania have a clear vision what STEM/STEAM is and what are their differences. Most teachers are prepared to teach STEM/STEAM but some lack of experience. There are a lot of courses prepared for teacher training and the teachers are ready to learn and are open to new ideas. The main difficulty for Lithuanian teachers is lack of financial opportunities and materials.

3.2. Desk research results

a) The framework provided by the national curriculum for science education:

Both in pre-school and primary education STEAM education is an integral and complex cognition, application and problem solving of reality phenomenon, oriented to the recognition of the world, ICT, engineering, Arts and Maths. STEAM education is based on development of the main competences of students which are cognitive, social and emotional, healthy living, creativity, citizenship, cultural and communication. Participating in STEAM activities students learn in attractive environments and through individual and team tasks develop their critical thinking and creativity both communicating and collaborating and solving problems.

Suggested topics:

1. Stories of the Items.
2. Painting and Creation.
3. Technics, Construction, Modelling.

4. Astronomy. Architecture. Design.
5. Experience in the Nature and Forest.
6. Construction, Sculpture and Creation.

Suggested teaching strategies:

1. Learning to learn, learning by doing.
 2. Practical, research activities and lessons outside.
 3. Research based learning, interest in scientific discoveries.
 4. Experiments, observations.
 5. Practical tasks in laboratories.
 6. Educational programs.
 7. Practical lessons connected to life experience.
 8. Integral learning.
 9. Critical thinking.
 10. Practical activities with scientists.
 11. Stimulation of imagination and creativity.
 12. Project work.
 13. Educational excursions.
 14. Mobile technologies, programs.
 15. Thinking maps.
 16. Roleplays.
 17. STEAM educations.
 18. Taks in groups, pairs.
 19. Creation of diagrams, schemes and thinking maps.
 20. Robotics.
- b) **The previous use (if any) of STEM or STEAM approach in national or regional pre-primary and primary education:**

General Curriculum Framework for Primary and Lower Secondary Education (2008), Lithuanian Innovation Strategy for 2010-2020 (2010), Pre-school and Pre-primary Education Development Programme for 2011-2013 (2011), The State Progress Strategy “Lithuania Progress Strategy “Lithuania 2014-2020“ (2012), The State Progress Strategy “Lithuania Progress Strategy “Lithuania 2030“ (2012) and documents ratified in 2013 (Guidance for Diversity of models of Pre-school Education (2013); Guidance for Providers of Non-state Pre-school and Pre-primary Education (2013); The National Education Strategy for 2013–2022 (2013)) aim to emphasize that educational institution has to adapt to fast changing needs of society and educate children capable to live in nowadays conditions.

The State Progress Strategy “Lithuania Progress Strategy “Lithuania 2030“ (2012) claims that „in long term perspective it will be aimed to stimulate creativity of all the society and its every member, to concentrate on the ideas which would help Lithuania to become modern, open to the world but cherishing its own national identity country.“ The strategy emphasizes that STEAM helps to solve problem of lack of specially important skills and encourages to develop versatile skills which encourage entrepreneurship, innovation and creativity. The document aims to intelligent society where creative and free individuals easily adapt to fast changing environment, creates fresh impetus to new ideas and works, able to not only survive but also satisfy all the necessary needs.

The Description of the Achievements of Pre-school Age Children (2014), The General Curriculum Framework for Pre-Primary Education (2014) Guidance of Pre-school Education (2015) provide modern approach to quality of pre-school and pre-primary education which aims to ensure successful development of children and use the most attractive and most effective methods and ways of teaching. Teachers are suggested to implement innovations, create not traditional educational environments, activate children’s curiosity demonstrating the way items work, use all the senses (smell, tactile, hearing, sight, taste) while exploring the environment. National General Curriculum Framework for Pre-Primary Education (2014) presents guidelines for development of STEAM education using learning by doing and experimenting; also foundation of laboratories, experimental areas and creative areas, where it would be possible to organize different activities to develop children’s cognitive and communication competences, is encouraged. The Good School Concepts’s (2015) main position is to learn discovering and inventing, creating and collaborating. The concept emphasizes education (development) based on dialogue, making assumptions for implementation of new, innovative models both in state and non-state education.

The article “STE(A)M Non-formal Children’s Education: Problems and Opportunities” in the series of publications “Analysis of Educational Problem” by Ministry of Education, Science and Sport of the Republic of Lithuania (2015) new educational method introduces a new educational method and provides recommendations how to implement it in Lithuania. Also a project “Scientix“ was introduced; it aims to encourage and support cooperation of science, technology, engineering and mathematics (STE(A)M) teachers, educators, politicians and other

professionals of the field across Europe. This project had three stages: in 2009–2012 web portal for European STE(A)M projects and their results was created; in 2013–2015 the project served while creating national strategies intended to encourage wider use of inquiry based learning and other innovative methods for STE(A)M teaching; in 2016–2019 it is funded by EU Research and Innovation program “Horizon 2020”.

Publication “STEAM education in Lithuania: establishment of open access centres and cooperation” (2020) emphasizes essential changes in the field of modernization of curricula of STEM and development of teachers’ competences. In order to assure development of children’s STEAM competences in Lithuania, STEAM open access centres (future classrooms) are being established since 2016 in Vilnius, Kaunas and Klaipėda cities and Alytus, Marijampolė, Panevėžys, Šiauliai, Tauragė, Telšiai, Utena regions. EU projects “Design and Installment of Digital Curriculum“ (No. 09.2.1-ESFA-V-726-03-0001), „Development of Research, Evaluation and Monitoring System for General Education: Evaluation of Students’ Achievements“ (No. 09.2.1-ESFA-V-706-02-0001), “Professional Development of Teachers’ and Specialists’ Providing Assistance to Pupils” (No. 09.2.2-ESFA-V-707-02-0001), “Continue” (No. 09.2.1-ESFA-V-727-01-0001) and “Maintenance of Schools with Means for Natural Sciences and Technologies” (No. 09.1.3-CPVA-V-704-02-0001) together with its activities “Foundation of STEAM open access centres”, “Purchase of Special Education Supply and Means for Technical Support” (No. 09.1.3-CPVA-V-704-04-0001) are intended to improve quality of education system, to develop teachers’ competence and to establish STEAM centres.

c) Results/outcomes of previous projects on STEM education/ Arts education/ Social and Emotional Learning related to science education :

The report of the research “Innovative Pedagogical Practice and Pedagogical Innovations in Lithuanian kindergartens” (2018) claims that “evaluating the fields of achievements of pupils which require innovative ideas and means at a pre-school age most, it was recognition of environment, research, perception and expression of emotions, counting and measuring, oral and written language”. The report of the research states that innovations are most important for development of cognitive competence at the pre-school age and least important for artistic and health competences. (Monkevičienė, O., 2018, p. 104). The report emphasizes that

mobile laboratories, temporary or permanent research spaces where pupils experiment, observe and research together with their teachers are founded for STEAM education in pre-school establishments. A lot of attention is paid to innovative activities outside (for example, a nap in the tent, outside area as a laboratory for research and experiments), different natural experiments (for example, use of microscope in the lab in the medical room), introduction of innovative educational means (for example, there is a space of toys for STEAM activities). The analysis of the research results showed that STEAM education liberates pupils and teachers. STEAM encourages children to explore real problems playing and with pleasure. Because of STEAM education children develop and gain knowledge sharing their explorations, discoveries, experiences and impressions. They become versatile personalities able to feel joy, improvise, self-confident, open able to act and make decisions.

d) Identifying limitations on or opportunities for the engaging of girls and other economically or geographically disadvantaged groups in science learning in pre-primary and primary education

Primary teachers state they do not exclude girls. The teachers notice that girls become involved into STEAM activities as active and willingly as boys. Primary teachers say that girls are even more interested in STEAM activities than boys therefore they are not separated and “it is very interesting for girls to implement different natural explorations and engineering challenges with different robots”. Primary teachers also claim that “disadvantaged children are even more interested in STEAM activities than more advantaged children who are not able to resist computer games”, “there is no particular experience in involvement only girls or disadvantaged children. They learn STEAM together with all the class”.

STEM professionals claim they “supply students with tools and equipment or implement works and projects in specially equipped classrooms and laboratories”, “it is allowed to do the same work several times”. Analysing STEAM education of girls, STEM professionals emphasize that “topics which are more interesting for girls and both would help them in the everyday life and would allow them to experience success are chosen”, also teachers try “to show the girls that natural science is not only a “dry” analytic science, there is a space for creation and improvisation”. Meanwhile, for disadvantaged students, teachers prepare tasks which are possible to do using simple everyday materials, for example, water, oil,

sticks, etc., as there is always an opportunity to observe or explore something using the simplest materials.

Art professionals “look for volunteers who could help to master different tools”, “create internet access for questions-answers”, look for financial resources to supply tools and equipment”, “look for digital content”, “constantly provide learning material, supplies, methodical help and information”, “organize team work” for girls and disadvantaged students. Art professionals emphasize that “it is interesting both for boys and girls to explore and experience. One of the most important methods is to allow the students to try and find out, to prove or negate a certain hypothesis”.

4. Conclusions and recommendations

<i>Strengths</i>	<i>Weaknesses</i>
<p>Active discussions and work in groups, positive critics provided.</p> <p>Feedback.</p> <p>Research, exploration, experiments implemented.</p> <p>Participation in different events, training activities, seminars, projects.</p> <p>Short videos are used in the lessons.</p> <p>Some schools which have been participatig in the research since 2020 have become valuable members of STEAM network.</p>	<p>Panevėžys does not have laboratories or botanical garden.</p> <p>RoboLabas (non-formal educational institution) does not satisfy all needs.</p> <p>Too poor facility, lack of time, experience, finance.</p> <p>The park is too far, the school yard does not have a piece of natural meadow.</p> <p>Lack of teaching material for STEAM activities.</p>
Opportunities	Threats
<p>Put STEAM lesson plans to one platform and make it public.</p> <p>More help from students of Kaunas Technology University and Panevėžys College.</p> <p>To provide free transportation for students to other cities.</p> <p>To prepare integrated plans,</p>	<p>Lack of support.</p>



<p>methodology.</p> <p>Nature School should organize activities where students are participants, not observers.</p> <p>To implement projects with foreign partners.</p> <p>To improve competences of teachers, quality of teaching, educational content, to create and coordinate educational environment.</p> <p>To develop joint conferences, joint distance learning activities.</p> <p>To share experience, inter-institutional cooperation.</p> <p>To learn from international partners and to know other cultures.</p>	
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