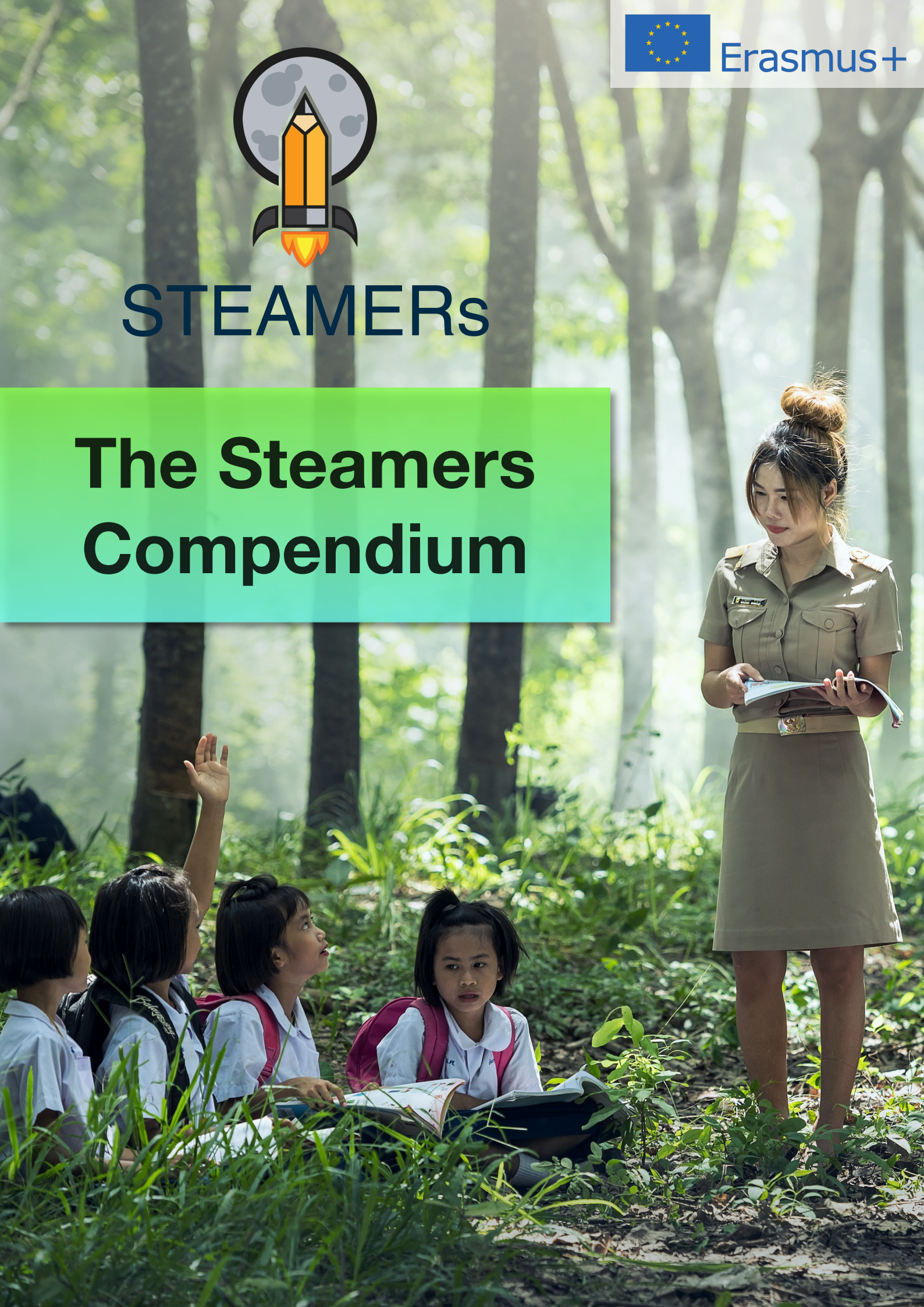
Erasmus+

STEAMERs

The Steamers Compendium



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Welcome to the Steamers Compendium

Steamers is an Erasmus+ Project approved by the French National Agency designed in order to investigate the use of STEAM and Educational Robotics in Pre-Primary Schools. This publication includes desk and on field research operated by partners in 6 European Countries: France, Italy, Poland, Greece, Cyprus and Romania.

The first part of the document is dedicated to the on field research operated on pre-primary schools teachers. The second part includes insights from the 6 countries and practices applied at the national level. We wish you a good reading of the Steamers Compendium.

The Steamers Team

Perceptions of Pre-primary School Teachers about STEAM and Educational Robotics

In order to investigate the perceptions of Pre-primary School teachers about STEAM and Educational Robotics we created a new questionnaire designed to this purpose. The questionnaire was composed by open and closed questions, its original form was created in English and then translated into the National languages of the participating countries for allowing the full understanding of the content among pre-primary school teachers.

Please, if you want to replicate the content in your national language or adapt it to your specific needs, contact us at igorvitaleinternational@gmail.com

The STEAMERS Questionnaire

Dear Teacher, the following questionnaire is a part of the STEAMERS, an Erasmus+ Project designed to support the use of STEAM competences and Robotics in Pre-primary Schools. We kindly ask you to answer to it fully and sincerely. The questionnaire is anonymous and all data will be analyzed in an aggregated way.

STEAM includes all activities connected with Science, Technology, Engineering, Arts and Mathematics. **Educational Robotics** is a discipline designed to introduce students to Robotics and Programming interactively from a very early age.

Information about past training in the field and activities

1. Do you apply STEAM for Pre-primary Schools activities?

(only if yes) Please give a brief description of the activity you do (max 3 lines)

2. Did you ever received a training about STEAM for Pre-Primary School? (yes/no)

(only if yes on 1) Did you improved your lessons/activities after the course attended? (yes/no)

(only if yes on 1) Do you feel the need for further training? (yes/no)

3. Are you using Robotics applied in Pre-primary schools activities?

(only if yes) Please give a brief description of the activities you do (max 3 lines)

4. Did you ever receive training about Robotics applied in Pre-primary schools activities?

(only if yes on 1) Did you improved your lessons/activities after the course attended? (yes/no)

(only if yes on 1) Do you feel the need for further training? (yes/no)

Scales connected with opinions

Please determine your level of agreement with the following statements from 1 (no agreement) to 5 (complete agreement)

1. I consider useful the application of more activities connected with Science and Mathematics in pre-primary schools
2. I consider useful the application of Educational Robotics in Pre-primary schools
3. I think that our University/Training Curricula is non-sufficient to implement STEAM activities in pre-primary schools
4. I think that our University/Training Curricula is non-sufficient to implement Robotics activities in pre-primary schools
5. I think that Educational Robotics is the future of pre-primary education
6. I think that Educational Robotics in pre-primary education have important risks for the pupils
7. I have the competences for the application of STEAM activities in pre-primary schools
8. I have the competences for the application of Educational Robotics in pre-primary schools
9. I think that digitalization of pre-primary schools in my territory should be improved
10. I think that pre-primary schools students are too young to be exposed to STEAM and Robotics lectures

Estimates of teachers in the future

1. I expect a more prominent presence of STEAM activities in pre-primary schools
2. I expect in the future a complete integration of Educational Robotics and teaching in pre-primary schools
3. I expect that STEAM and Robotics Activities in Pre-primary Schools can positively impact careers in this sector.

General open questions

1. What are the strengths of including STEAM and Robotics in pre-primary schools? (open question) - List three
2. What are the weaknesses of including STEAM and Robotics in pre-primary schools? - List three

Methodology for the administration

After the completion of the questionnaire, all partners translated it into national languages and the administration has been done through Google Forms, allowing us to collect data at distance and reaching adequately the national territory. Google Form allowed us to export the data in an excel file. Since the answers to open questions was filled by pre-primary school teachers in national languages, before its analysis, the partners translated the text produced in English, in order to allow the organisation responsible for the data analysis (Igor Vitale International s.r.l.) to correctly perform qualitative research analysis.

The collection of answers included different techniques for sampling including: direct contact, administration in pre-primary school teachers, involvement of Pre-Primary School Directors or Heads of Association of Teachers, and snow-ball sampling. Considering the variety of techniques used, it's difficult to state a representativeness of the sample at the national levels. At the same time, the moderate number of participants which is over 294 Pre-Primary School teachers across Europe, reveals an adequate statistical power.

Methodology for the scoring

After having merged all data in one single data matrix, the scoring procedure has been performed according to the following rules

CODING FOR BINARY ITEMS

The binary items has been recoded with the following codes

Yes = 1

No = 2

In this way we will be able to create subgroups of the sample and compare their results through t-test statistics.

CODING FOR SCALED ITEMS

The scoring for scaled items from 1 to 5 was used without any substitution. The items have been not modified for possible reverse items when analyzed individually.

CODING FOR OPEN QUESTIONS

All open questions has been translated in English and analyzed at qualitative level and studied one by one. Coding for categorization is proposed in case of possibility to group answer in major groups and further discussed in the qualitative analysis section

COMPOSITE MEASURES

In order to have a more comprehensive understanding of items having a similar purpose with created 4 composite measures which can be summarized as follows

NEGATIVE PERCEPTIONS ABOUT EDUCATIONAL ROBOTICS

This measure is the sum of the values of the following items

1. I think that Educational Robotics in pre-primary education have important risks for the pupils
2. I think that pre-primary schools students are too young to be exposed to STEAM and Robotics lectures

POSITIVE PERCEPTIONS ABOUT EDUCATIONAL ROBOTICS

This measure is the sum of the values of the following items

1. I think that Educational Robotics is the future of pre-primary education
2. I consider useful the application of Educational Robotics in Pre-primary education

NEEDS FOR STEAM COMPETENCES

This measure is composed by the sum of 2 items,

1. I think that our University/Training Curricula is non-sufficient to implement STEAM Activities in Pre-primary Schools
2. I have the competences for the application of STEAM activities in pre-primary schools

The 1st item is analyzed with the normal scoring from 1 to 5; the 2nd item is analyzed with a reverse scoring with the following re-coding

5 = 1

4 = 2

3 = 3

2 = 4

1 = 5

In this way, the resulting scale will range from 2 to 10, where 10 represent at the maximum level the perception that University/Training Curricula are non-sufficient for STEAM and the respondent perceive to have low competences in STEAM for pre-primary schools.

NEEDS FOR EDUCATIONAL ROBOTICS COMPETENCES

This measure is composed by the sum of 2 items,

1. I think that our University/Training Curricula is non-sufficient to implement Educational Robotics Activities in Pre-primary Schools
2. I have the competences for the application of Educational Robotics activities in pre-primary schools

The 1st item is analyzed with the normal scoring from 1 to 5; the 2nd item is analyzed with a reverse scoring with the following re-coding

5 = 1

4 = 2

3 = 3

2 = 4

1 = 5

In this way, the resulting scale will range from 2 to 10, where 10 represent at the maximum level the perception that University/Training Curricula are non-sufficient for Educational Robotics and the respondent perceive to have low competences in Educational Robotics for pre-primary schools.

CODING FOR THE NATIONALITY

In order to allow the transnational comparisons of the 6 participating countries at this project, we coded the data as follows

1 = Romania

2 = Italy

3 = France

4 = Poland

5 = Cyprus

6 = Greece

Demographics Statistics of the Sample

The statistics has been performed through JASP software a free software compatible with IoS and Windows and which allow to perform a broad range of statistics both for quantitative and qualitative data.

In this section we will describe the demographics of the participants in order to have more information about the general sample of participants

TABLE 1. FREQUENCY TABLE FOR THE NATIONALITY

Nationality	Frequency
Romania	69
Italy	50
France	22
Poland	50
Cyprus	52
Greece	51
Total	294

TABLE 2. FREQUENCY TABLE FOR GENDER

Gender	Frequency
Male	21
Female	268
Prefer not to say	5
Total	294

TABLE 3. DESCRIPTIVE STATISTICS FOR THE AGE

	Age
Average	38,58
Standard Deviation	10,16
Minimum	20
Maximum	61
25th Percentile	31
50th Percentile	38
75th Percentile	46

Prevalence of the application of STEAM and Educational Robotics in European Pre-Primary Schools

This section includes the descriptive statistics for the binary items included in the matrix of data in order to describe the frequencies of STEAM and Robotics activities in the participating countries

TABLE 4. DO YOU APPLY STEAM IN YOUR PRE-PRIMARY SCHOOLS ACTIVITIES?

	Frequency	Percentage
Yes	98	33,33%
No	166	66,67%

The table shows that STEAM activities are not predominant in the analyzed sample since it involves only 1 out of 3 teachers.

TABLE 5. DO YOU APPLY EDUCATIONAL ROBOTICS IN YOUR PRE-PRIMARY SCHOOLS ACTIVITIES?

	Frequency	Percentage
Yes	66	22,44%
No	228	77,55%

The table shows that Educational Robotics activities are not predominant in the analyzed sample since it involves approximately 1 out of 5 teachers.

Prevalence of trainings in STEAM and Educational Robotics in European Pre-Primary Schools and its level of satisfaction

In order to understand why STEAM and Educational Robotics are rarely applied in the European Pre-primary schools we asked to teachers:

1. if they ever received a training in STEAM and Educational Robotics
2. In case they received a training, if this changed on the practices
3. In case they received a training, if they feel the need for further trainings in the same area

TABLE 6. DID YOU EVER RECEIVED A TRAINING ABOUT STEAM FOR PREPRIMARY SCHOOLS?

	Frequency	Percentage
Yes	51	17,35%
No	243	82,65%

TABLE 7. DID YOU IMPROVED YOUR LESSON/ACTIVITIES AFTER THE COURSE ATTENDED IN STEAM

	Frequency	Percentage
Yes	47	69,18%
No	21	30,82%

TABLE 8. DO YOU FEEL THE NEED FOR FURTHER TRAINING IN STEAM?

	Frequency	Percentage
Yes	66	84,61%
No	12	15,39%

The tables regarding the training performed about STEAM reveals that pre-primary teachers having had a training in this field (17,35%) are less than those putting into practice STEAM activities (33,33%).

The training seems to improve significantly the quality of the lectures since the 69,18% of those having had a training say to have changed the lecture and activities after the course. At the same time, there is a margin for improvement since the vast majority (84,61%) of participants states to feel the need for further trainings in STEAM.

TABLE 9. DID YOU EVER RECEIVED A TRAINING ABOUT EDUCATIONAL ROBOTICS FOR PREPRIMARY SCHOOLS?

	Frequency	Percentage
Yes	48	16,32%
No	246	83,67%

TABLE 10. DID YOU IMPROVED YOUR LESSON/ACTIVITIES AFTER THE COURSE ATTENDED IN EDUCATIONAL ROBOTICS

	Frequency	Percentage
Yes	46	61,33%

	Frequency	Percentage
No	29	38,67%

TABLE 11. DO YOU FEEL THE NEED FOR FURTHER TRAINING IN EDUCATIONAL ROBOTICS?

	Frequency	Percentage
Yes	62	80,51%
No	15	19,48%

Trainings in Educational Robotics are less frequent as expected, in fact the pre-primary teachers having had a training in this field (16,32%) are less than those putting into practice Educational Activities activities (22,44%).
The training seems to improve significantly the quality of the lectures since the 61,33%, less if compared to training courses connected to STEAM. Anyhow, a majority of participants showed to have changed their activities after the course, which is a quite satisfactory result.

Still there is a broad margin of improvement according to pre-school teachers, since the 80,51% of respondents need for further trainings.

The future of Educational Robotics in the European Pre-primary schools

In our Questionnaire we asked to pre-primary school teachers the opinions about the educational robotics with 3 specific binary questions, showing the following results

TABLE 12. I EXPECT A MORE PROMINENT PRESENCE OF STEAM ACTIVITIES IN PRE-PRIMARY SCHOOLS

	Frequency	Percentage
Yes	255	86,73%
No	39	13,27%

TABLE 13. I EXPECT IN FUTURE A COMPLETE INTEGRATION OF EDUCATIONAL ROBOTICS AND TEACHING IN PRE-PRIMARY SCHOOLS

	Frequency	Percentage
Yes	214	72,78%
No	80	27,21%

TABLE 14. I EXPECT THAT STEAM AND ROBOTICS ACTIVITIES IN PRE-PRIMARY SCHOOLS CAN POSITIVELY IMPACT ON THE CAREER IN THIS SECTOR

	Frequency	Percentage
Yes	258	87,75%
No	36	12,24%

The expectation of pre-primary school teachers is quite clear since the wide majority of respondents believe that there will be more presence to steam activities (86,73%), educational robotics (72,78%) and also that teachers having this type of competences will have a positive impact on the career (87,75%).

In summary, despite the application of STEAM (33,33%) and Educational Robotics (20,24%) are not rare in the European Pre-Primary Schools, there is a need of training among the pre-primary school teachers since there are more teachers applying STEAM or Educational Robotics than those having had a training in the aforementioned fields. Moreover, trainings leads to an improvement of practices in the majority of case, but over the 80% of the pre-primary school teachers feel the need for further training.

General opinions about the integration of STEAM and Educational Robotics is positive and teachers believes that competences in this field will also impact positively on their career.

Therefore, we can state that the needs of trainings is perceived and its creation and implementation is priorital according to opinions of the respondents.

Pre-Primary School Teachers Opinions about STEAM and Educational robotics

Our study, moreover, investigated pre-primary school teachers opinions about STEAM and Educational Robotics on a scale from 1 (minimum agreement) to 5 (maximum agreement). Descriptive statistics can be summarized as follows.

TABLE 15. AVERAGE OF THE OPINION STATEMENTS IN THE 6 PARTICIPATING COUNTRIES

Opinion statements	Average	Standard deviation
I consider useful the application of more activities connected with Science and Mathematics in pre-primary schools	4,46	0,88
I consider useful the application of Educational Robotics in Pre-primary Schools	4,30	3,89
I think that our University/Training Curricula is non-sufficient to implement STEAM activities in pre-primary schools	3,87	1,22
I think that our Unviersity/Training Curricula is non-sufficient to implement Robotics activities in pre-primary schools	3,81	1,14
I think that Educational Robotics is the future of pre-primary education	1,87	1,14
I think that Educational Robotics in pre-primary education have important risks for the pupils	2,74	1,32
I have the competences for the application of STEAM Activities in pre-primary schools	2,28	1,33
I think that digitalization of pre-primary schools in my territory should be improved	4,22	1,01
I think that pre-primary schools students are too young to be exposed to STEAM and Robotics lectures	2,03	1,21

At a general level, the statistics shows that there is a general positive perception about STEAM and Educational Robotics in the Pre-primary Schools. The perception of utility for STEAM (4,46) and Robotics (4,30) is near to the maximum (5).

The participants are convinced that Educational Robotics will be not the future of pre-primary education, in other words they believe that human component in education will be predominant, since the average of this scale is the lowest (1,87).

There is a general perception that University /Training activities are non completely sufficient to ensure proper activities in STEAM (3,87) and Educational Robotics (3,81) fields.

2-sample t-tests comparisons

GENDER COMPARISONS

The sample analyzed is predominantly composed by female participants (268 teachers) rather than male participants (21 teachers). We investigated if there were differences in perceptions and variables analyzed through a dedicated 2-sample t-test which revealed no statistical differences among the 2 samples. It seems there are no differences between genders.

COMPARISONS REGARDING THE IMPLEMENTATION OF STEAM ACTIVITIES

We subdivided the sample in 2 groups, one composed by the teachers already performing STEAM activities and the other not performing currently STEAM activities in order to check the effect on the other variables of the study. The majority of variables do not show significant differences.

TABLE 16. AVERAGE OF RESULTS IN THE TEACHERS PERFORMING OR NOT STEAM ACTIVITIES

	Average of performing steam	Average of non performing steam
Need of STEAM	6,38	7,52
Need of Robotics	0,93	-0,23
Perception of utility of STEAM in preprimary schools	4,61	4,39
Competences in STEAM	3,59	2,32
Competences in Educational robotics	3,06	1,89

COMPARISONS REGARDING THE IMPLEMENTATION OF EDUCATIONAL ROBOTICS ACTIVITIES

We subdivided the sample in 2 groups, one composed by the teachers already performing Educational Robotics activities and the other not performing currently Educational Robotics activities activities in order to check the effect on the other variables of the study. The majority of variables do not show significant differences.

TABLE 17. AVERAGE OF RESULTS IN THE TEACHERS PERFORMING OR NOT EDUCATIONAL ROBOTICS ACTIVITIES

	Average of performing Educational Robotics	Average of non performing Educational Robotics
Need of STEAM	6,72	7,26
Need of Robotics	1,71	-0,28
Perception of utility of STEAM in preprimary schools	4,72	4,39
Perception of utility of Educational Robotics in preprimary schools	4,56	4,23
Competences in STEAM	3,63	2,48
Perception of non-sufficient curricula in STEAM for pre-primary school teachers	3,63	2,48
Competences in Educational Robotics	3,62	1,89

COMPARISONS REGARDING THE PAST PARTICIPATION TO A STEAM TRAINING COURSE

In this paragraph we will see the different perception of the pre-school teachers according to the previous participation at a training course in STEAM. We separated the sample in 2 groups one of teachers having had a training course in STEAM with those who didn’t.

TABLE 18. DIFFERENCES AMONG TEACHERS HAVING OR NOT A TRAINING IN STEAM

	Average of teachers with a training in STEAM	Average of teachers without a training in STEAM
Need of STEAM	6,45	7,29
Need of Robotics	0,80	0,02
Perception of utility of STEAM	4,70	4,41
STEAM Competences	3,62	2,56

	Average of teachers with a training in STEAM	Average of teachers without a training in STEAM
Robotics compétences	2,86	2,16

COMPARISONS REGARDING THE PAST PARTICIPATION TO AN EDUCATIONAL ROBOTICS TRAINING COURSE

In this paragraph we will see the different perception of the pre-school teachers according to the previous participation at a training course in Educational Robotics. We separated the sample in 2 groups one of teachers having had a training course in Educational Robotics with those who didn't.

TABLE 19. DIFFERENCES AMONG TEACHERS HAVING OR NOT A TRAINING IN EDUCATIONAL ROBOTICS

	Average of teachers with a training in Educational Robotics	Average of teachers without a training in Educational Robotics
Positive perceptions about robotics	8,81	7,99
Need of robotics	1,49	-0,09
Perception of utility of STEAM	4,70	4,41
Perception of Educational Robotics	4,67	4,23
Perception of non-sufficient curricula in STEAM	4,39	3,79
Educational Robotics is the future of pre-primary education	4,14	3,75
STEAM Competences	3,29	2,63
Educational Robotics competences	3,29	2,08
I think that digitalization of pre-primary schools in my territory should be improved	4,58	4,16

Transnational Comparisons

In order to determine the transnational differences among the participating countries we applied the Analysis of Variance for the different scaled items included in this research. This paragraph shows the differences among countries in specific items analyzed. Significant differences will be commented.

In order to determine if average are significantly different each other, we used the indicator F, described below the table and the p-value, which indicates significant differences when lower than 0.05.

TABLE 20. I CONSIDER USEFUL THE APPLICATION OF MORE ACTIVITIES CONNECTED WITH SCIENCE AND MATHEMATICS IN PRE-PRIMARY SCHOOLS

	Average
Romania	4,42
Italy	4,32
France	3,90
Poland	4,38
Cyprus	4,90
Greece	4,50

F = 5,057; p <.001

The Table 20 shows clear and significant differences in the analyzed samples. Cyprus showed very uniform and high perception utility of Science and mathematics in pre-primary schools (4,90). The lowest score has been obtained by France (3,90).

TABLE 21. I CONSIDER USEFUL THE APPLICATION OF EDUCATIONAL ROBOTICS IN PRE-PRIMARY SCHOOLS

	Average
Romania	4,15
Italy	4,20
France	3,80
Poland	4,25
Cyprus	4,84

	Average
Greece	4,35

F = 5,057; p <.001

The table 21 shows similar tendencies also for this question regarding. Cyprus showed very uniform and high perception utility of Educational robotics in pre-primary schools (4,84). The lowest score has been obtained by France (3,80).

TABLE 22. I THINK THAT OUR UNIVERSITY/TRAINING CURRICULA IS NON-SUFFICIENT TO IMPLEMENT STEAM ACTIVITIES IN PRE-PRIMARY SCHOOLS

	Average
Romania	3,20
Italy	3,46
France	4,09
Poland	4,07
Cyprus	4,78
Greece	4,09

F = 15,062; p <.001

The perception that formal trainings for teachers in non sufficient for STEAM is perceived very high in Cyprus (4,78), lower scores are Romania (3,20). This item indicates us on one side the perception that something is missing, but also indirectly somehow the satisfaction towards the existing training systems.

TABLE 23. I THINK THAT OUR UNIVERSITY/TRAINING CURRICULA IS NON-SUFFICIENT TO IMPLEMENT ROBOTICS ACTIVITIES IN PRE-PRIMARY SCHOOLS

	Average
Romania	3,24
Italy	3,42
France	3,86
Poland	4,19
Cyprus	4,60

	Average
Greece	4,13

F = 11,318; p <.001

Similar results has been obtained for educational robotics. The perception that formal trainings for teachers in non sufficient for Educational Robotics is perceived very high in Cyprus (4,60), the lowest scores are in Romania with an average of 3,24.

TABLE 24. I THINK THAT EDUCATIONAL ROBOTICS IS THE FUTURE OF PRE-PRIMARY EDUCATION

	Average
Romania	3,78
Italy	3,68
France	2,54
Poland	3,73
Cyprus	4,88
Greece	3,58

F = 19,100; p <.001

We asked to the participants to determine if the educational robotics can be considered the future in this sector. Among the participating countries, is France the country that believe more in a less robotic and more human future for pre-primary education with the lowest score (2,54), Cyprus have the highest score and believe in a strong integration of robotics in the future (4,88).

TABLE 25. I THINK THAT EDUCATIONAL ROBOTICS IN PRE-PRIMARY EDUCATION HAVE IMPORTANT RISKS FOR THE PUPILS

	Average
Romania	2,21
Italy	2,54
France	1,68
Poland	1,48
Cyprus	1,08

	Average
Greece	2,03

F = 13,32; p <.001

In order to determine the perceptions of the pre-primary school teachers we also asked them if they believe that educational robotics could imply some risks. In this, Italy showed the highest results among the participating countries, with an average of 2,54, whereas the lowest is in Cyprus (1,08).

TABLE 26. I HAVE THE COMPETENCES FOR THE APPLICATION OF STEAM ACTIVITIES IN PRE-PRIMARY SCHOOLS

	Average
Romania	2,82
Italy	2,36
France	3,22
Poland	1,94
Cyprus	3,28
Greece	3,09

F = 8,620; p <.001

An important aspect to be considered is also the perception of competence in the STEAM field in the participating countries. Also this aspect can't be considered uniform. Poland has the lowest perception in this study (1,94) and Cyprus the highest (3,28).

TABLE 27. I HAVE THE COMPETENCES FOR THE APPLICATION OF EDUCATIONAL ROBOTICS ACTIVITIES IN PRE-PRIMARY SCHOOLS

	Average
Romania	2,34
Italy	2,26
France	3,36
Poland	1,86

	Average
Cyprus	1,48
Greece	2,98

F = 12,401; p <.001

In Table 27, the participant declared their perceptions of competence in the field of educational robotics. In this case, situations are different, Cyprus showed the lowest results (1,48) and France the highest (3,36).

TABLE 28. I THINK THAT DIGITALIZATION OF PRE-PRIMARY SCHOOLS IN MY TERRITORY SHOULD BE IMPROVED

	Average
Romania	3,85
Italy	4,32
France	3,63
Poland	3,36
Cyprus	4,88
Greece	4,02

F = 9,917; p <.001

We asked to the pre-primary school teachers if they believe that digitalization in schools have to be improved in their territory. This perceptions very strong in Cyprus (4,88) and lowest in Poland (3,36), country which declares the highest satisfaction in terms of digitalization processes.

TABLE 29. I THINK THAT PRE-PRIMARY SCHOOLS STUDENTS ARE TOO YOUNG TO BE EXPOSED TO STEAM AND ROBOTICS LECTURES

	Average
Romania	2,29
Italy	2,44
France	2,54
Poland	1,53
Cyprus	1,34

	Average
Greece	2,23

F = 8,890; p <.001

Another possible “objection” we identified in this study was the belief that robotics should not consider very early ages as a target and measured by the item “I think that pre-primary school students are too young to be exposed to STEAM and Robotics lectures”. This perception given moderate to low results, and is very low in Cyprus (1,34) and moderate in France (2,54).

Correlations

The linear correlation is a statistics indicator designed to measures relations between variables through an indicator called *r*.

This indicator can range from -1 to + 1 and can interpreted as follows:

- Negative correlations are correlations including all negative numbers ($r < 0$) and can be interpreted as opposite relations. The more is present one variable the less will be the other. For example job satisfaction and work related stress are opposite concepts and we expect they have negative correlations.
- Positive correlations are those with positive numbers ($r > 0$) indicates concurrent relations, so the more the first variable is present, the more will be also the second variable. Job satisfaction and psychological wellbeing, for example, are positively related since when we feel satisfied of our job we also feel better.
- Correlation equal to 0 is a null correlation, since there may be no relation between the 2 variables analyzed
- The strength of a correlation is measured by r in absolute value, so the more the value is near to +1 or -1, the stronger will be the relation

Therefore, correlation which are positive or negative but anyhow near to 0 can be considered weak, and even if significant, could have a minimal real impact.

TABLE 30. CORRELATIONS BETWEEN THE PERCEPTION OF UTILITY OF STEAM IN PRE-PRIMARY SCHOOLS AND OTHER VARIABLES

	I consider useful the application of more activities connected with Sciences and Mathematics in preprimary schools
I consider useful the application of Educational Robotics in pre-primary schools	0,702***
I think that our University/training curriculum is non-sufficient to implement STEAM activities in pre-primary schools	0,250***
I think that our University/training curriculum is non-sufficient to implement Education Robotics activities in pre-primary schools	0,256***
I think that educational robotics is the future of pre-primary education	0,521***
I think that educational robotics in pre-primary education have important risks for the pupils	-0,241***
I have the competences for the application of STEAM activities in pre-primary schools	0,193***
I have the competences for the application of Educational Robotics in pre-primary schools	0,081 n.s.
I think that digitalization of pre-primary schools in my territory should be improved	0,540***
I think that pre-primary schools students are too young to be exposed to STEAM and Robotics lectures	-0,420***

The perception of utility of STEAM is correlated positively with perceived utility in Educational robotics and negatively with the perceived risks of robotics and belief that pre-primary school students are too young to be exposed in STEAM. The teachers with high perception of utility of Science and Mathematics seems more sensitive to the need of improving digitalization.

TABLE 31. CORRELATIONS BETWEEN THE PERCEPTION OF UTILITY OF EDUCATIONAL ROBOTICS IN PRE-PRIMARY SCHOOLS AND OTHER VARIABLES

	I consider useful the application of Educational Robotics in Pre-primary schools
I think that our University/training curriculum is non-sufficient to implement STEAM activities in pre-primary schools	0,243***
I think that our University/training curriculum is non-sufficient to implement Education Robotics activities in pre-primary schools	0,267***
I think that educational robotics is the future of pre-primary education	0,698***

	I consider useful the application of Educational Robotics in Pre-primary schools
I think that educational robotics in pre-primary education have important risks for the pupils	-0,273***
I have the competences for the application of STEAM activities in pre-primary schools	0,189***
I have the competences for the application of Educational Robotics in pre-primary schools	0,140***
I think that digitalization of pre-primary schools in my territory should be improved	0,584***
I think that pre-primary schools students are too young to be exposed to STEAM and Robotics lectures	-0,525***

The perception of utility of educational robotics is related also to the perception that this subject will be fully integrated in the future and the perception of need for improving the digitalization. This is also negative related to perceived risks of educational robotics or to the perception that pre-primary school students are too young.

TABLE 32. CORRELATIONS BETWEEN PERCEPTION THAT UNIVERSITY AND TRAINING CURRICULA ARE NON SUFFICIENT FOR THE IMPLEMENTATION OF STEAM AND OTHER VARIABLES

	I think that our university/Training curricula is non sufficient to implement STEAM activities in pre-primary schools
I think that our University/training curriculum is non-sufficient to implement Education Robotics activities in pre-primary schools	0,834***
I think that educational robotics is the future of pre-primary education	0,247***
I think that educational robotics in pre-primary education have important risks for the pupils	-0,13*
I have the competences for the application of STEAM activities in pre-primary schools	0,133*
I have the competences for the application of Educational Robotics in pre-primary schools	0,91 n.s.
I think that digitalization of pre-primary schools in my territory should be improved	0,275***
I think that pre-primary schools students are too young to be exposed to STEAM and Robotics lectures	-0,81 n.s.

The general dissatisfaction towards the University/training curricula for implementing STEAM and Educational Robotics are strongly correlated. Moderate but significant correlation are present also

with the perception that educational robotics will be integrated in pre-primary education in the future and the need to improve the digitalization of pre-primary schools.

TABLE 33. CORRELATIONS BETWEEN PERCEPTION THAT UNIVERSITY AND TRAINING CURRICULA ARE NON-SUFFICIENT FOR THE IMPLEMENTATION OF EDUCATIONAL ROBOTICS AND OTHER VARIABLES

	I think that our university/Training curricula is non sufficient to implement Educational robotics activities in pre-primary schools
I think that educational robotics is the future of pre-primary education	0,279***
I think that educational robotics in pre-primary education have important risks for the pupils	-0,09 n.s.
I have the competences for the application of STEAM activities in pre-primary schools	0,07 n.s.
I have the competences for the application of Educational Robotics in pre-primary schools	0,001 n.s.
I think that digitalization of pre-primary schools in my territory should be improved	0,254***
I think that pre-primary schools students are too young to be exposed to STEAM and Robotics lectures	-0,069 n.s.

Moderate and significant correlation are present between the perception of lacking educational curricula in educational robotics with the expectations that it will be integrated in pre-primary education in the future and the need to improve the digitalization of pre-primary schools.

TABLE 34. CORRELATIONS BETWEEN PERCEPTION THAT EDUCATIONAL ROBOTICS IS THE FUTURE OF PRE-PRIMARY EDUCATION AND OTHER VARIABLES

	I think that Educational Robotics is the future of pre-primary education
I think that educational robotics in pre-primary education have important risks for the pupils	-0,155***
I have the competences for the application of STEAM activities in pre-primary schools	0,180***
I have the competences for the application of Educational Robotics in pre-primary schools	0,21 n.r.

	I think that Educational Robotics is the future of pre-primary education
I think that digitalization of pre-primary schools in my territory should be improved	0,565***
I think that pre-primary schools students are too young to be exposed to STEAM and Robotics lectures	-0,441***

From the analysis of the Table 34 is possible to understand that the beliefs that in the future Educational robotics will be fully integrated in pre-primary education is also linked to the perceive need of improving digitalization in pre-primary schools. This perception also prevent considerations about risks of educational robotics and moderately associated with the though that pre-primary schools are too young to be exposed to STEAM and Robotics.

TABLE 35. CORRELATIONS BETWEEN PERCEPTION OF EDUCATIONAL ROBOTICS RISKS AND OTHER VARIABLES

	I think that educational robotics in pre-primary education have important risks for the pupils
I have the competences for the application of STEAM activities in pre-primary schools	-0,007 n.s.
I have the competences for the application of Educational Robotics in pre-primary schools	0,113 n.s.
I think that digitalization of pre-primary schools in my territory should be improved	-0,262***
I think that pre-primary schools students are too young to be exposed to STEAM and Robotics lectures	0,558***

There is a strong correlation between perception of risks of educational robotics and the belief that pre-primary school students are too young to be exposed. This is also negatively related to the thoughts that digitalization of pre-primary schools should be improved. In other words, previous correlations shows that the perception of importance of STEAM and educational robotics relates with the salience and need to improve digitalization.

TABLE 36. CORRELATIONS BETWEEN STEAM COMPETENCES AND OTHER VARIABLES

	I have the competences for the application of STEAM activities in pre-primary schools
I have the competences for the application of Educational Robotics in pre-primary schools	0,711***
I think that digitalization of pre-primary schools in my territory should be improved	0,102 n.s.

	I have the competences for the application of STEAM activities in pre-primary schools
I think that pre-primary schools students are too young to be exposed to STEAM and Robotics lectures	-0,016 n.s.

STEAM and Educational Robotics competences are directly and strongly correlated as expected.

TABLE 37. CORRELATIONS BETWEEN EDUCATIONAL ROBOTICS COMPETENCES AND OTHER VARIABLES

	I have the competences for the application of Educational Robotics in pre-primary schools
I think that digitalization of pre-primary schools in my territory should be improved	0,012 n.s.
I think that pre-primary schools students are too young to be exposed to STEAM and Robotics lectures	0,094 n.s.

This table do not show any significant correlation, so the competences between educational robotics are fully explained by the previous tables.

TABLE 38. CORRELATIONS BETWEEN NEEDS FOR DIGITALIZATION AND OTHER VARIABLES

	I think that digitalization of pre-primary schools in my territory should be improved
I think that pre-primary schools students are too young to be exposed to STEAM and Robotics lectures	-0,427***

There is a negative correlation between the need for digitalization and the perception that pre-primary school students are too young to be exposed to STEAM and Educational Robotics lecture.

Educational Robotics in France

INTRODUCTION

The desk research for the STEAMERS project represents the first step in the developement of the STEAMER Compendium, a document aiming at describing the current situation of STEAM/ER in early childhood education.
The data gathered through this desk research will be supported by primary data, which will be collected via a field research.

When conducting this desk research, we have focused on French/European data, on primary/pre-primary education resources.

Before moving on to the results of our research, it is worth defining what a robot is and what "educational robotics" stands for.
A robot is a device that can execute different tasks if connected to a program. It can be controlled and programmed. Educational Robotics refers to an interdisciplinary learning environment based on the use of robots. Children and teenagers can benefit from the use of these tools as they enhance the development of skills suck as teamwork, creativity, critical thinking, and develop interest in programming activities. Educational Robotics can be used either during class or as an extracurricular activity (OCEAN, 2017).

TABLE 38. RELEVANT PROJECTS FOR EDUCATIONAL ROBOTICS

PROJECT	*"Robots en classe"*	*"Flowers"*
LINK	click here	click here
OBJECTIVES	Motivating and training teachers to introduce technology in schools.	Creation of a platform of open source robots with different shapes, to model the mechanisms of learning in children and understand the role of the body in learning.
DURATION	Since 2013	Since 2012
FREQUENCY	Occasionally	Continuously

RESULTS	Development of the following skills in children: - Observation skills - Ability to order information - Analysis (level of analysis) - Languages - Multidisciplinary work in a group - Stimulation of creativity - Developing a sense of direction - Knowing how to define instructions - Practical sense < > theoretical approach	- Creation of "Poppy project", a website dedicated to the project. - Creation of "Poppy Education", a space dedicated to the use of Poppy in education. - Creation of "Poppy Station", a platform for the collection of Poppy educational robotics kits. - Provision of workshops and training.
LOCAL AREA	Switzerland	Bordeaux
STRENGTHS	- Addressing the theme of robotics through several axes. - Providing educational material. - Addressing the needs of teachers.	- Developing mediation tools for children. - Facilitating the teaching of digital sciences in schools. - The *Flowers* team is part of an ecosystem that extends beyond France. - Supported by several French institutions.
WEAKNESSES	- Even though the site exists in several languages, the projects have been implemented in Switzerland only.	/

PROJECT	*“ITER”*	*“DALIE”*
LINK	click here	click here

OBJECTIVES	Participation into a contest aiming at creating a fully autonomous robot.	What computer science concepts can be taught in primary school classes? What are the conditions for learning computer science at school? And what are the difficulties that pupils may encounter in class in this area?
DURATION	2013	From January 2015 to January 2017
FREQUENCY	Occasionally	Continuously
RESULTS	Development of the following skills: - Use of a software to program robots; - Making diagnosis and have a critical look; - Team work; - There is no thing such as “unique” solution, but problems can be addressed under different points of view.	- Introducing robotics into primary school; - Introducing TIC learning through robotics in primary and pre-primary education; - Developing technological and computer skills.
LOCAL AREA	Marseille	Limoges
STRENGTHS	The project allows students to explore robotics while having fun. At the end of the contest, all students will have developed a functioning robot and acquired important skills. Also, this project allows final year students to explore their appetite for STEM subjects and better understand what university to apply to.	The project is multidisciplinary. Also, pupils were always guided through game boards or algorithm rules. The project highlights the fact that teachers might not need a training for using robots. However, a training on computer science and on understanding how robots work through functional analysis might be useful.

WEAKNESSES	The project is only addressed to students of high school.	Pupils encounter conceptual difficulties in the construction of IT concepts, especially programming sequences and overwriting, if they are not guided by a teacher. This has not been deeply addressed by the project.

PROJECT	*“Fibonacci”*
LINK	click here
OBJECTIVES	Explore the use of Logo programmable toys to introduce some preliminary concepts of programming in the kindergarten context.
DURATION	From January 2010 to February 2013
FREQUENCY	Continuously
RESULTS	- The project has demonstrated that programmable toys can help develop skills related to mathematical concepts, algorithmic thinking and problem solving strategies; - The use of appropriate strategies and teaching aids leads to a rapid evolution of children's representations of basic commands; - Lateralisation is more complex: a good percentage of children do not manage to master the pivoting commands; - The construction of the notion of robot memory also appears to be a difficult process.
LOCAL AREA	France
STRENGTHS	The exercises proposed fall within a pedagogical scripting, based on the children's initial ideas and cognitive difficulties. Those have to be overcome through a discovery approach, in a collaborative work context.
WEAKNESSES	The project has only been implemented in 7 schools and would need further research and experiences to confirm its results.

TEACHERS

During the experimentation of robotics projects in pre-primary classes, the attitude and competences of teachers have also been observed.
In particular, we can mention the work of Bellegarde and Boyaval, who identified six professional gestures in the context of an initiation to robotics in the GSM class.

Debriefing

First, teachers would debrief with children on instructions, rules and principles specific to the programming activity. They would also remind them what has been done during the previous sessions. This action allows for teachers to explicit the actions that the kids will have to perform and to remind pupils what previous knowledge they will have to mobilise during the activity.

Reformulating

Second, teachers would reformulate instructions, emphasise time connectors to work on the chronology of programming or repeat what one kid said to advance the reasoning of the whole group.

Questioning

Third, teachers would ask questions to encourage students to verbalise their strategies, to use previous knowledge in a given exercise or to make them go through procedures orally before applying them to the robots.

Helping through the process

Fourth, in order to help children carrying out tasks, teachers would simplifying it or taking care of part of it. These gestures allows for children to succeed in their project.

Engaging pupils

Fifth, in order to better engage pupils, the teachers would value their success, distributing tasks among team members and making sure that everyone played their part.

Stepping aside

Sixth, teachers would step aside and let children collaborate to find the solution, interfering as little as possible. In fact, it has been proved that working with peers allows pupils to better analyse situations and find solutions.

To conclude, teachers are willing to include tools such as robots and tablets in class to develop technical skills in preschoolers especially due to the playful dimension. However, they have stressed the importance of having clearly defined educational objectives.
Using robots also allows teachers to mobilise skills and knowledge previously learned.

The article does not mention any difficulty found by preschoolers in using technological tools, yet teachers have highlighted the importance of matching the learnings with the age of pupils.

Finally, the article mentions the lack of training on programming felt by teachers, which also had little computer science knowledge.

RESEARCH AT EUROPEAN LEVEL

Robotics in primary and pre-primary education has been an important topic all over Europe in the last few years. Among others, we can name:

- *eMedia*, engaging children into information technology on robotics;
- *EU-RATE*, focusing on giving teachers low cost tools to teach robotics and introducing computer science in pre-primary education;
- *EURLAB*, that has organised several workshops on robotics for high school students;
- *Fibonacci*, exploring the use of Logo programmable toys to introduce some preliminary concepts of programming in the kindergarten context.

BIBLIOGRAPHY

Agnoletti, M., Bianchini, D., Daniela, L., Dreimane, S., Gaudin, A., Groenewolt, P., Lourido, S., Manzani, L., Micheli, E., Pedemonte, G., Stein, J., & Valli, D. (2020, septembre). *La robotique éducative*. https://laligue.org/download/eMedia_Robotic_FR-140920.pdf

Barrué, C., & Vigot, N. (s. d.). *Jouets programmables comme outils cognitifs : pratiques pédagogiques de stagiaires professeurs des écoles*. Researchgate.net.
Consulté le 31 janvier 2022, à l'adresse

https://www.researchgate.net/profile/Catherine-Barrue/publication/299594853_Jouets_programmables_comme_outils_cognitifs_pratiques_pedagogiques_de_stagiaires_professeurs_des_ecoles/links/5701653508aea6b7746a7c96/Jouets-programmables-comme-outils-cognitifs-pratiques-pedagogiques-de-stagiaires-professeurs-des-ecoles.pdf

Bellegarde, K., & Boyaval, J. (s. d.). *Initier des jeunes élèves à la robotique/ informatique : gestes professionnels et agir enseignant*. didapro.org. Consulté le 31 janvier 2022, à l'adresse https://www.didapro.org/8/wp-content/uploads/sites/4/2020/02/Bellegarde_23.pdf

Ebotics. (s. d.). *WHAT IS EDUCATIONAL ROBOTICS?* Consulté le 27 janvier 2022, à l'adresse https://ebotics.com/what-is-educational-robotics/

EU-RATE. (s. d.). *Eu-RATE - European Robotics Access to Everybody, un projet européen de robotique éducative*. ECHOSCIENCES - Nouvelle-Aquitaine. Consulté le 31 janvier 2022, à l'adresse https://echosciences.nouvelle-aquitaine.science/articles/eu-rate-european-robotics-access-to-everybody-un-projet-europeen-de-robotique-educative

EURLAB. (s. d.). *EURLAB*. Consulté le 31 janvier 2022, à l'adresse http://www.eurlab.org/index.php/en/

Institut Français de l'Education & OCEAN. (2017, décembre). *La robotique éducative*. https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fcache.media.eduscol.education.fr%2Ffile%2FGTnum%2F82%2F2%2FOCEAN_Dossier_de_capitalisation_Robotique_educative_Dec2017_2_1070822.docx%23%3A~%3Atext%3DLa%2520robotique%2520p%25C3%25A9dagogique%2520fait%2520r%25C3%25A9f%25C3%25A9rence%2Capprentissage%2520de%2520la%2520robotique%2520comme&wdOrigin=BROWSELINK

Mobsya. (2021, 23 février). *Mobsya | Des robots pour l'éducation | Commercialisation de Thymio*. Consulté le 27 janvier 2022, à l'adresse https://www.mobsya.org/it/

Robotique éducative : enjeux, ressources – Impulsion du numérique éducatif 63. (2021, 3 juin). Académie de Clermont-Ferrand. Consulté le 27 janvier 2022, à l'adresse https://mediascol.ac-clermont.fr/impulsion-numerique-educatif63/2021/06/03/robotique-educative-enjeux-ressources/

Thymio. (2022, 11 janvier). *À propos*. Consulté le 27 janvier 2022, à l'adresse https://www.thymio.org/fr/a-propos-2/

Educational Robotics in Italy

Steam and robotics

In the area of pre-primary education in Italy, some implementation projects in the teaching of courses that use robotics as an educational complement can be found online.

On the other hand, there does not seem to be any trace of systematic and consolidated use of this type of support in the pre-primary school curriculum.

I also interviewed prof. *Stefano Cobello*, a sociologist from Verona, that is the Coordinator of the national network of the *European Pole of Knowledge* and is a very active teacher in the field of training with the use of robotics.

He pointed me to some Erasmus projects he collaborated on: www.roboticavsbullismo.net e https://www.botstem.eu/it/

"The goal of BOTSTEM is to develop new tools through inquiry-based teaching, robotics and coding learning to improve the current teaching of STEM subjects".

Another project is: https://pearl-project.org/it/

"The PEARL project aims to develop, test and validate an innovative and high-quality educational model for the development of an emotional and empathic proximal learning environment in the age group from 1 to 6 years".

Among the projects carried out in Italy, the following seem to be particularly significant:

Where: "Il Laboratorio", a space in Florence equipped for educational robotics, web & coding, printing and 3D modeling located in via dei Serragli 104 in Florence.

When: school year 2018

Who: Equalized Primary School Sister Luisa Martelli - "Maria Child" Equal Kindergarten School Sammontana, Montelupo Fiorentino - Dr. Carlotta Bizzarri

Recipients: pupils of the first, second, third, fourth and fifth grades of Primary School.

Methodology: develop the first basic knowledge of Robotics, building a Robot with the Lego Mindstorm and We-do educational kits.

Website: https://www.scuolasammontana.it/pagine/si-riparte-con-la-robotica

Where: "PONTE AGLI STOLLI" CHILDHOOD SCHOOL

When: School year 2017/2018

Who: Chiara Tognaccini and Angela Fabbricatore

Recipients: pupils of the first, second, third, fourth and fifth grades of Primary School.

Methodology: Allowing the child to approach the world of robotics, and therefore coding, with the game. Orient yourself in space using spatial concepts (eg right and left); use of the *Bee bot robot*, also "disguised" as a *Little Red Riding Hood*.

Website: http://www311.regione.toscana.it/lr04/documents/15427/369604/PROGETTO+ROBOTICA/a98ae132-6f62-4827-93dd-222011944c90?version=1.0

Where: Trento and its province

When: December 2020

Who: ROBOBIMBI is a project born from the collaboration between the Bruno Kessler Foundation (FBK) and the Provincial Federation of Nursery Schools of Trento (FPSM). Circolo di Valsugana

and Primiero, made up of 11 nursery schools Ornella Mich and Alessandra Potrich for FBK, Tiziana Ceol and Camilla Monaco for FPSM

Recipients: children aged 3 to 6

Methodology: BeeBot, Cubetto and Lego WEDO

Website: https://www.fpsm.tn.it/dettaglio/news/un-progetto-per-studiare-l-introduzione-della-robotica-educativa-nelle-scuole-dell-infanzia/

Where: Sesto Fiorentino

When: 3rd year kindergarten a.s. 2016/2017

Who: Third Didactic Circle

Recipients: children of the 3rd year of kindergarten

Methodology: Laboratory teaching through the use of the robot *bee-bot*: neither the pupils nor the teacher had previous knowledge. The goal was to make the robot follow an established path.

Website: http://www311.regione.toscana.it/lr04/documents/15427/315204/fiee56000v_roboticainfanziaprimaria.pdf/f451628f-b8d9-46dd-8783-b6bf3741c9e3?version=1.0

Where: Novara

When: -

Who: *Lucrezia Tangorra Onlus Foundation* - Corso Trieste 60 / b 28100 Novara

Recipients:

- Bottacchi Primary School

- Rigutini Primary School

- Coppino Primary School

- Bazzoni Primary School

- Rodari Primary School

- Levi Primary School

- Institute of Mary Help of Christians

- G. Curioni Primary School

- Duca D'Aosta Middle School

- Pier Lombardo Secondary School

- Bellini Secondary School

- Fornara-Ossola Secondary School

- Gobetti Secondary School

- Salesian Institute

- Castelli Institute

Methodology: workshops with educational didactic paths that lead teachers and children to master the first rudiments of programming and robotics - *Lego We Do 2.0*

Website: https://www.fondazionelucreziatangorra.org/robotica-didattica/uncategorised/robotica-didattica

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Where: Grosseto

When: School year 2019/2020

Who: Comprehensive Institute 4 Viale Einaudi, 6a 58100 - Grosseto (GR)

Recipients: Primary School Via Einaudi - Class 3a Kindergarten Via Papa Giovanni - Section E

Methodology: treasure hunt with *Cubetto*

Website: https://www.comprensivogrossetoquattro.edu.it/wp-content/uploads/2020/09/Coding-e-Robotica-Indire.pdf

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Where: Reggio Emilia Sud (*Marco Polo* Primary School) and Cadelbosco Sopra

When: JUNE 2021

Who: Caritas Foundation of the Archdiocese Pescara-Penne Onlus Progetto Crescere, a social cooperative of educational and health services of Reggio Emilia

Recipients: kindergarten children

Methodology: *Lego WeDo 2.0* kit and software

Website: https://percorsiconibambini.it/ribes/2021/06/23/reggio-emilia-un-progetto-di-robotica-educativa-nelle-scuole/

With the introduction of the PNSD, *National Digital School Plan* (2015), the Miur offers schools new tools, methodologies and proposals that, in recent years, have changed the way many teachers do school. Action n.17 of the Plan states:

"Among the classes of "characterizing" content, that is, which call for specializations, for the application and active use of technological and online dynamics, we expect all students to be offered courses on: ... making, educational robotics, the internet of things".

Robotics, among school activities, is included in the Directive 93 of 30.11.2009 and in decree 851 of 27/10/2015 PNSD (*National Digital School Plan*).

Actions 4 and 6 of the Plan speak of digital skills, coding and computational thinking.https://www.scuolaitaliana.gr/categoria-news/corso-di-formazione-docenti-in-didattica-inclusiva-robotica-educativa-e-coding.html

There are, therefore, numerous proposals for training courses for teachers and operators who want to include the use of these simple robots in traditional teaching. Already in 2011, at the *Marco Polo school* in Rome, as part of the *European Robotics Week*, a week of training and dissemination meetings on the theme of robotics was held where the students of the most advanced path held tutoring lessons on the construction of *WeDo Lego Robots* to children of other classes, illustrating not only how a Robot is built but explaining its structure and purpose.

https://euroweek.scuoladirobotica.it/it/newseu/335/Robotica_educativa_alla_Marco_Polo_di_Roma.html

"In this document, the author SERAFINA D'ANGELICO offers an excellent training course dedicated to teachers of Infancy, Primary School and Lower Secondary School. The course, structured in the form of a 25-hour Training Unit, is divided into 6 phases: Frontal lesson/workshop - research-action - documentation/restitution - planning and aims to disseminate, within the school, good didactic practices inherent to the use of educational robotics as a support to the disciplinary curriculum".

https://codingerobotica.indire.it/index.php?action=vedi_singola_esperienza&id_scheda=13

Training courses for teachers of kindergarten and the first cycle of coding education and educational robotics:

https://www.iccoazze.edu.it/http-www-istruzionepiemonte-it-torino-2021-10-28-corsi-di-formazione-per-docenti-di-scuola-dellinfanzia-e-del-primo-ciclo-di-istruzione-coding-e-robotica-educativa-una-palestra-per-il-pensiero/

http://www.istruzionepiemonte.it/torino/2021/10/28/corsi-di-formazione-per-docenti-di-scuola-dellinfanzia-e-del-primo-ciclo-di-istruzione-coding-e-robotica-educativa-una-palestra-per-il-pensiero/

https://www.scuoladirobotica.it/corsi_ragazzi/

https://www.scuolastore.it/it/conferences/robotica-e-pensiero-computazionale-nella-scuola-d%E2%80%99infanzia-e-nel-biennio-della-primaria

https://www.campustore.it/steam-e-idee-di-lezione-con-di-robotica-educativa-per-la-scuola-d-infanzia.html

Training course on *STEAM and educational robotics* for kindergarten lasting 2 hours for a maximum of 25 participants.

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https://www.sangiuseppepozzuoli.it/scuola-dell-infanzia/75-progetto-2017-2018-a-scuola-con-bee-bot-introduzione-al-coding-e-robotica-nella-scuola-dell%E2%80%99infanzia.html

Project 2017/2018 - At school with BEE-BOT. Introduction to coding and robotics in kindergarten *"SAN GIUSEPPE"* KINDERGARTEN – School year 2017/2018 - Teachers: Cipolletta Anna and Calabrese Veronica

http://www.zeroseiplanet.it/coding-e-progettazione-con-le-bee-bot-alla-scuola-dell-infanzia/

https://www.campustoreacademy.it/visitor_catalog_class/show/22746/Robotica-educativa-per-la-scuola-primaria

https://formazione.orizzontescuola.it/corso/robotica-educativa-nella-scuola-primaria-e-dellinfanzia-la-bee-bot/

I also tracked down courses that seem to be a sort of workshops or presentations of the hypothesis of using robotics in the classroom:

https://valeriacagnina.tech/laboratori-robotica-bambini-museo-asti/

https://www.paleos.it/post/idee-per-il-coding-e-la-robotica-alla-scuola-dell-infanzia-in-attesa-che-il-corso-cominci-il-27-05

It is a proposal for a school laboratory in which BeeBot is used with children aged 5 and over. The training institution proposing the course is *PaLEoS*, based in Florence.

Educational Robotics in Romania

Project Erasmus+: STEAM and Educational Robotics in Preprimary Education

The benefits of using STEAM in education are many: developing problem-solving skills, facilitating cooperation, teamwork and communication, stimulating innovation, reducing student anxiety. However, it has been found at the level of the European Commission that there is a low interest of students in approaching STEAM.

The current situation of digitalization in Romania

Although it has very good results in terms of Connectivity, especially in urban areas, Romania is on the 26 / 28th place in terms of DESI for 2020 (Digital Economy and Society Index).

At the centralized, official level (Ministry of Education and Research, Local School Inspectorates) there is a strategy on the digitization of education that includes the inclusion in the curriculum for primary classes of the study of digital skills (from the school year 2021/2022). The strategy includes mandatory elements of digital skills and elements of digital security. The target is the digital literacy of 90% of the population. (SMARTedu 2021/2027). The strategy also includes kindergarten children, programs and resources for parents and teachers.

Situation of Robotics Education

- Although in Romania the robotics industry is still young, and the degree of robotization is still relatively low, Romania being in 2015 on the 19th place out of 26 countries of the European Union regarding the number of robots per 1000 industrial workers (0.19 robots / 1000 workers), a study by the International Federation of Robotics in 2017 shows, instead, that Romania recorded in 2016 the largest increase in the European Union in terms of the annual growth rate of the number of industrial robots (45% compared to 2015).

The impact of Educational Robotics on STEAM education

- It is acknowledged that Educational Robotics creates a pleasant and attractive educational context which promotes STEAM education and improves the educational process. Educational Robotics, as part of the STEAM education, incorporates a large range of general knowledge and allows the approach of any specific subject in a larger educational context.

- It is very important to mention that, before implementing such an integrated curricula – (Educational Robotics - STEAM education) that efficiently meets the needs of the students, it is very necessary to understand the complex challenges the teachers face. These challenges include limited educational content, inadequate methodology and the lack of infrastructure. The teachers need to keep themselves updated with the new technologies and be trained about the latest forms of educational technology. This way, the teachers will be able to integrate technology in teaching their students issues like problem solving, critical thinking and cooperation, independent of the students' age.

- Education for Robotics and/or for STEAM is mainly extracurricular, non-formal in Romania, for preprimary and primary schools, including private schools and clubs.

-

- The preprimary schools in Romania do not have specialized teachers for STEAM, Robotics, programming – if the families are interested (many of them offer them as optional classes), then an external teacher, club, private school are hired. There are many programming schools, local or national that are franchise of international schools (ex. LOGISCHOOL present in 130+ locations in 21 countries, 10 in Romania)

- Analyzing the Robotics/Programming clubs' offer, I noticed that they suggest the ideal age for starting the classes as 6-8 (**Nextlab TECH**). However, there are clubs that offer classes from age 4+ (**Belsorisso**), age 4-6 Junior Robotics, age 5-7 IT Start, 6-9 Robocoders (**Academia de Robotica).** The local presence of STEAM schools is linked to the well-developed IT industry in our city. (**Logischool, Robbo club, Code Academy, Tech Kids Academy, Code School Academy, Academia Kids, IRIS Robotics, Palatul Copiilor, CSC Code School Clubs (stemdeacasa.ro**). During the pandemics, some programming courses were online.

Successful projects

Coderdojo (Ireland 2011 and, in Romania since 2012, now in over 100 countries, www.coderdojo.com) is free and it is on a voluntary basis (trainers are engineers that teach for free); for ages 7-17 – they have a free online resources platform for pupils, teachers and parents.

SCIENTIX - the science education community in Europe (a network with national contact points; in Romania, there are approx. 50 ambassadors (part of an European project Horizon 2020, Innovation and Research, University of Bucharest is a partner) – they developed a database with implemented projects for preprimary.

For primary schools: **Asociatia Zi de Bine**, sept 2021, Robotics Lab; Arduino Kits, 3D printers, VR glasses, interactive Robodog robots.

Conclusions:

- The preprimary schools in Romania do not have specialized teachers for STEAM; the pupils attend robotics/programming classes with specialized trainers at external clubs or in their schools, usually once a week. The presence of many robotics/programming classes in our town (Iasi, Northeast of Romania) is closely related to the well-developed IT industry; the same situation is for other large cities with a strong IT communities (the largest number being in Bucharest).
- There is no formal STEAM curricula for preprimary, elements of STEAM being introduced by preprimary teachers using

didactic projects, optional cross-curricular courses, the initiatives being individual (Joarză Mihaela-Anca from Grădinița cu program prelungit nr. 28 Sibiu designed a cross-curricular optional for level II (preprimary), one activity per week for one year - http://isjsb.ro/d2019/optional%20Joaca%20de-a%20programarea.pdf

- But, since the benefits of using STEAM in education are many (developing problem-solving skills, facilitating cooperation, teamwork and communication, stimulating innovation), such courses are requested by parents of preprimary children; this is why, the kindergartens (both private or public) hire external teachers, clubs, private schools etc. Only a few offer specific Robotics Education, most of them offer STE(A)M courses.

Bibliography

1. **Educatia digitală în şcolile din Europa**, raport Eurydice, European Commission, 2019
2. Chaudron, S., 2015. **Young Children (0-8) and Digital Technology. A qualitative exploratory study across seven countries**. Luxemburg: Oficiul pentru Publicații al Uniunii Europene.
3. Cadrul European pt Competenta digitala a profesorilor, DigCompEdu
4. Planul European de Actiune pt Educatia digitala 2021/2017
5. Agenda Europeana a Competentelor pt competitivitate sustenabila, echitate sociala si rezilienta
6. **România educată**
7. http://www.romaniaeducata.eu/wpcontent/uploads/2021/07/Raport-Romania-Educata-14-iulie-2021.pdf
8. Strategia privind digitalizarea educatiei in RO **(https://www.smart.edu.ro/),** Ministerul Educatiei si Cercetarii 2021-2027
9. Council of the European Union recommendation of 22 May 2018 on key competences for lifelong learning1 (in particular competence 4 - digital competences). https://eur-lex.europa.eu/legal-content/RO
10. Promoting STEAM education using Educational Robotics), Teodora VASCAN, PhD, Associate Professor, Department of Informatics and Information Technologies, UST
11. https://digitaledu.ro/
12. https://iteach.ro/

Web resources

13. https://edict.ro/categorie/stem/EDICT (Revista educației ”(ISSN 1582 - 909X) is an international magazine, which accepts for publication articles in the field of education and training, in Romanian, English and French.
14. https://teachyourkidscode.com/coding-for-kindergarten-5-basic-coding-concepts-5-yearolds-can-understand/
15. https://scratch.mit.edu/
16. https://preschoolsteam.com/coding-games-for-kids/

17. https://www.edupedu.ro/drone-roboti-si-programare-in-toate-scolile-din-spaniaguvernul-introduce-limbajul-scratch-3-0-inca-din-ciclul-primar-si-tehnologii-creative-lagimnaziu/
18. http://isjsb.ro/d2019/optional%20Joaca%20de-a%20programarea.pdf

Resources for STEAM lesson plans:

1. The 10 Weeks of Afterschool Maker Program

This program is designed for children from kindergarten through 5th grade. It will "increase involvement in practical exploration and STEM / STEAM practice in ways that foster excitement, curiosity, and interest in learning."

2. STEAM + Coding Program

Designed for students in grades III-VIII, this comprehensive year-round program involves students in six creative electronic and programming activities.

3. 10-Week STEAM Program

For 10 weeks, students will be introduced to STEAM through home projects using creative materials. The program is the best from **kindergarten to second grade**.

4. NASA – STEM Lessons From Space

This STEM education program created by NASA is definitely a unique learning resource that demonstrates STEM knowledge in a real setting.

Educational Robotics in Cyprus

Introduction – Emergence of STEAM/ER in National Level

For the first time in 2005, Cyprus's annual Circular of the Cypriot Ministry of Education and Culture (MoEC) emphasized the critical role of education in supplying the market with young people who possess the necessary employability skills, all of which can be taught and learned in school to prepare pupils to face the challenges of the modern world and labor market as citizens. These abilities include initiative/accountability, creativity, critical thinking, problem solving, financial literacy, and financial literacy.1

Additionally, for the first time in 2010, the Ministry of Education's Department of Higher and Tertiary Education emphasized the importance of increasing the number of students enrolled in STEM-related programs and aligning the Cypriot educational policy and vision with that of the EU, which places a premium on research and development as critical components of smart economic growth.2

To address this need, between 2007 and 2018, seminars on critical thinking, creativity, innovation, artificial intelligence, lifelong learning skills, innovative teaching approaches for STEM subjects, and the use of ICT tools in STEM education were announced for teachers and school principals to attend on a voluntary basis.3

Numerous efforts aimed at enhancing digital education in schools are now ongoing. Due to the unpredictable nature of labor market developments and lack of alignment, the Cypriot MoEC is reinforcing its partnership with the Cyprus Employers and Industrialists Federation (OEB) and the Cyprus Chamber of Commerce and Industry to identify the needs of today's labor market in order to modernize school curricula through the inclusion of new subjects that will help to reduce skill mismatches in the labor market. Design and Technology is taught to students of all ages and is built on problem solving, investigation, and application of information from other sciences through experiential learning and practical sessions. The curriculum was altered for
the 2017-2018 academic year to incorporate the topic of Robotics with the goal of cultivating algorithmic thinking and fostering programming abilities.4

In February 2019, a pilot program was established in which roughly 205 robots were sent to secondary schools with the goal of supplementing robotics modules and establishing national robotics contests.5

Cyprus's future ambitions include enhancing the Cypriot national qualifications framework and producing a handbook of rules, criteria, and processes for the inclusion of qualifications in the national registration. Additionally, the formation of a validation agency, the formulation of standards for non-formal and informal learning validation, as well as the analysis and implementation of learning outcomes in various subsystems, are planned for the near future.6

Finally, in order to address the low number of students selecting STEM occupations, the Ministry of Education and Culture is now constructing a STEM curriculum to be integrated into middle and

high school curricula for the 2020 – 2021 academic year. For the first time in year (2019 – 2020), a pilot STEM program was introduced in nine primary schools, led by teachers with a Master's degree in STEM education and teaching methodologies.7

STEAM/ER curriculum programs in various Cyprus schools

1. **The Robotics Academy**, a research and instructional institution of Frederick University Cyprus, performs and promotes educational robotics. They recently developed an Educational Robotics Curriculum, which was piloted in a non-formal educational setting in collaboration with a private summer school for children ages 8 to 12. The examination of data acquired via questionnaires, observations, and focus groups demonstrated that this curriculum had a favorable impact and tremendous potential as a cognitive-learning tool, increasing students' enthusiasm, critical thinking abilities, creativity, invention, and teamwork.8

2. Since 2015, **Grammar School** has included a STEM program in its curriculum. Its mission is to teach students in four distinct fields — Science, Technology, Engineering, and Mathematics – through a collaborative and practical approach. Rather of teaching these areas independently, the curriculum incorporates them into a unified learning paradigm. The STEM curriculum is taught using an applied knowledge method that emphasizes real- world problem solving, organized inquiry-based learning, and students' active and creative participation.9

3. The STEAMers is a program run by the **Cyprus Youth Board** that seeks to foster young people's creative growth, enjoyment, and learning, as well as to improve their creativity, invention, and communication skills, as well as their personal development and well-being. It includes a series of seminars on robotics, coding, filmmaking, photography, graphic design, creative writing, music, drama, and art taught by specialized and expert trainers using STEAM methodologies from across the world.10

4. **The Youth Makerspace** was developed in 2019 by the Cyprus Youth Board in partnership with the Municipality of Larnaca. The Youth Makerspace adheres to the Makerspace standards created by universities and other communities throughout the world. Makerspaces exemplify the decentralization of design, automation, building, and teaching. These spaces serve as centres for project-based learning, innovation, and invention, all of which contribute to the integration of Art and STEM topics.11

5. **The University of Nicosia** hosts an annual competition called "Research by Students" in which students from Middle, High, and Technical schools are invited to propose creative team-based projects in the social sciences, applied sciences, economics, or health sciences.12

6. **The Cyprus Research and Innovation Foundation**, a public organization founded in 1996, hosts an annual competition called "Students in Research" with the goal of cultivating a culture of research and innovation. The purpose of this project is to familiarize elementary and secondary school children with scientific research methods and to foster their creativity and originality. Students are encouraged to participate in several phases of the research and development process through the competition, including hypothesis formation, methodology, data collecting and analysis, experimentation, result interpretation, and presentation of a research process. 13

Robotics Seminars for STEM teachers and trainers

In 2019, the TIME Private Institute in Larnaca, in conjunction with Eduk8 in Greece, began delivering Robotics seminars in Cyprus for the first time. The seminars are taught by LEGO Education Academy-certified Teacher Trainers. The trainers equip instructors with the skills and resources necessary to incorporate the LEGO Education Academy's solutions into their existing STEM curricula and daily lesson preparation. Teachers attend the seminars to get an understanding of teachings from a student's

viewpoint, to learn classroom management, and to examine best practices for classroom application.14

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On 10 March 2018, the Paedagogical Institute co-organized the first national seminar on "STEM and Robotics in Education — State-of-the-Art Approaches and Applications" with the private company ENGINO, under the auspices of the Ministry of Education and Culture. The lecture was designed for instructors at all levels of schooling. Since then, annual seminars on reinforcing STEM education have been held, covering topics such as the use of innovative and interactive technologies in STEM teaching, as well as the use of Go-Lab, an online educational platform that includes online workshops and open educational resources on STEM subjects.

Bibliography

1 Annual Report (2005). Ministry of Education and Culture in Cyprus: http://www.moec.gov.cy/en/annual_reports/Annual-Report-2005-EN.pdf
2 Annual Report (2010). Ministry of Education and Culture in Cyprus.
3 Ενημέρωση Υπουργείου Παιδείας και Πολιτισμού (moec.gov.cy)
4 Annual Report (2018). Ministry of Education and Culture in Cyprus. URL: http://www.moec.gov.cy/etisiaekthesi/index.html
5 Έκθεση παρακολούθησης της εκπαίδευσης και κατάρτισης 2019 – Κύπρος. Ευρωπαϊκή Ένωση 2019.
6 Cedefop, 2019. Cyprus – European Inventory on NQF 2018.
7 http://enimerosi.moec.gov.cy/ypp9188
8 Eteokleous N & Neophytou R. 2019. The case of the Robotics Academy @ Frederick University: 21st Century Skills Developed through a Non-formal Educational Setting. 10th International Conference in Open & Distance Learning
9 http://www.grammarschool.ac.cy/easyconsole.cfm/id/1542
10 https://onek.org.cy/en/home-page/programs-and-service/creative-activeness/youth-multicentres/#toggle-id-1
11 https://onek.org.cy/en/home-page/programs-and-service/creative-activeness/makerspace/
12 https://www.unic.ac.cy/support/research-innovation-office/research-by-students/
13 http://www.research.org.cy/el/news/mera
15
16 http://larnakaonline.com.cy/2019/08/02/time-private-institute-prosferoun-seminaria-rompotikis-gia-ekpaideftikous-kai-gia-enilikes-ekpaideftikis-rompotikis-stem/
15 https://innovativeschools.pi.ac.cy/education-details-2017-2018/kain-sem-2018-engino

Educational Robotics in Poland

STEAM and Educational Robotics in PrePrimary Education in Poland

When analysing the official Polish national core curriculum for pre-primary education (kindergarten), we won't find such terms as "STEAM", "Robotics", "coding" or "programing". According to the current goals of the Polish educational system, teaching such subjects like programming or other information technologies separately should start from the first class of the primary school and continue through the whole teaching process of young people.

So, from the first glance it looks that there's no space for such activities like programming and for developing STEAM skills in the early ages of children. However, following opinions of experts responsible for Polish school programmes, we should notice that "programming" starts much earlier before turning on the computer, that the part of its process is "Understanding, analysing and solving problems based on logical and abstract thinking, algorithmic thinking and ways of representing information."[1]

Official curriculum for preschool education complements these goals with such specific preschool assignments as: "Creating conditions enabling safe, independent exploration of technical elements in the environment, construction, DIY, planning and taking intentional action, presenting the products of child's work."[2] or "Creating conditions enabling safe, independent exploration of the nature surrounding the child, stimulating the development of sensitivity and enabling learning about the values and norms relating to the natural environment, adequate to the stage of the child's development."[3] This opens a space for the basics of STEAM education and robotics in polish kindergartens.

Current curriculum with an enhanced role of programming (including robotics) and STEAM education has been in force since 2017 and since then the problem of a proper teacher's preparation, and their IT and digital competences has emerged. It is most severe in case of preschool and early-school teachers.[4] There are several interesting facts which we can learn from the research carried out between 2016 and 2020. They are shortly outlined below.

Although the analysis of the educational needs emerging from the changes in the job market and in the world in general showed the necessity of increasing the dimension of STEAM education from the early stages, the teachers were rather

resistant towards this idea. Done in 2016 research showed that even 44% of the teachers and future teachers were against this idea, arguing that children at this age are not prepared for managing difficult and stressful situations and learning from mistakes, which is an immanent part of programming. It also requires some other skills like ability to work in teams, openness for new situations and communications skills due to specifics of programming which are diverse programming languages or

environments.[5] These arguments sound reasonable, however there may be some other reasons behind this lack of openness for the changes in teaching programmes in this field. Over half of the teachers admitted that they had low, insufficient programming teaching skills or had no opinion in this case and there was a lack of the verified teacher's handbooks in this subject.[6]

Also less than 20% of kindergarten and early school teachers regard their ability to use computers, other technical equipment and internet in their teaching practice as "very good" and less than 15% in their own professional development. The others defined their levels as "good" or" "everage".[7]

These findings show how important different forms of rising qualifications in the field of STEAM education and robotics are. However, more complex reports show, that the general reform of the school system and change in teaching philosophy are required in order to answer all the challenges related do digital transformation are necessary[8], but let's focus just on this aspect.

Among different forms of rising qualifications among teachers the most important are: postgraduate studies, workshops, conferences, courses, seminars, in-school forms of learning, EU projects, regional projects and government programmes. In the case of forms of professional development related to the elements of robotics in education, most of the teachers have been using workshops (53%) and conferences (42%). The next are in-school forms of development (24,2%) and courses (20,6%). The less popular were government (4,8%) and regional (5%) programmes. In the case of rising digital competences in education, the most popular were in-school forms of learning (27,49%), workshops (28,85%) and courses (20,38%).

When asked about their expectations regarding future forms of training, as the most important they pointed to workshops (over 53% in the case of robotics and 29% in the case of digital competences). The other desired options would be

courses (14%) EU projects (10,3%) in the case of robotics and seminars (16,4%), in-school activities (16,4%) and courses (16%) when it comes to digital competences.[9]

To sum up, STEAM education, programming, coding and digital skills are relatively new in the Polish education system on the lowest levels, like kindergartens or even the lowest primary school levels. The system is still in the phase of transformation and the good practises in this field are still being shaped and improved. And although formally such priorities as STEAM education or robotics don't exist in the preschool curriculum, there are many initiatives towards their

development on this level. Below we present some examples of such activities. They all address the needs and deficiencies revealed by presented research.

First of all, even if there are no official preschool teaching programmes based on STEAM methods and teaching robotics, we can find very good materials provided by the specialists in the field. The most complex, dynamically developing, seems to be LEGO company together with its teaching programmes and ready to use teaching scenarios for almost all the educational levels. Based on that, some other private persons, companies or other organisations prepare further materials. Some examples we can find here:

- https://education.lego.com/pl-pl/lessons?grades=Przedszkole
- https://education.lego.com/pl-pl/lessons?grades=Klasy+1-2,Klasy+2–3,Klasy+1-3
- https://akcesedukacja.pl/baza-wiedzy/scenariusze-zajec
- https://mojebambino.pl/lego-education/steam/

There are also open educational portals and databases of teaching scenarios made by the teachers and for the teachers, where one can find also those in th scope of our interests:

- https://www.edukacja.edux.pl/p-39560-robokody-program-zajec-dodatkowych-z.ph p
- https://www.edukacja.edux.pl/p-46830-glodny-aligator-zajecia-z-robotyki-z-wykorz ystaniem.php
- https://www.edukacja.edux.pl/p-46634-jestesmy-robotami-scenariusz-zajec.php
- https://www.edukacja.edux.pl/p-44388-w-wiejskiej-zagrodzie-utrwalenie-nazw-zwi erzat.php

There's also a growing number of different forms of extracurricular workshops for the children in preschool age. They can be organised by the external companies or training centres, either in the kindergarten (during regular activities) or in the afternoon hours in any location. Here are some of the examples:

- https://mali-naukowcy.pl/warsztaty-dla-przedszkoli/
- http://edukacja.andrychow.eu/placowki/przedszkola/przedszkole-nr-5-w-andrycho wie-104/dokumenty/akademia-mlodego-robotyka-633/
- http://www.robotykadlanajmlodszych.pl/portfolio/robotyka-dla-przedszkolakow/

On the other hand, the offer of different kinds of training for teachers is getting wider. The teachers can develop all the skills necessary to work in today's school. Starting from the improvement of the toolbox important for remote teaching, through the basics of digital tools and methods, up to programming and robotics. An exemplary offer of one of the biggest organisation in Poland looks like this:

- *Tick Tock. Time for interactive technologies in preschool education* (https://cyfrowydialog.pl/training/2-tik-tak-czas-na-technologie-interaktywne-w-edu kacji-przedszkolnej/)
- *In the land of code. Online and offline programming in early childhood education* (https://cyfrowydialog.pl/training/14-w-krainie-kodu-programowanie-online-i-offline- w-edukacji-wczesnoszkolnej/)

- *The preschooler is programming! Coding in preschool education* (https://cyfrowydialog.pl/training/1-przedszkolak-programuje-kodowanie-w-edukacj i-przedszkolnej/)
- *The cat likes code. Scratch Junior in preschool education* (https://cyfrowydialog.pl/training/3-kot-lubi-kod-scratch-junior-w-edukacji-przedszk olnej/)

Except for the short forms of training, there are also other proposals available, both, for the teachers and for the kids. Some of the biggest initiatives in Poland are:

- **"Kindergartens of Tomorrow - Equal Opportunities" Programme** is a unique educational program aimed at preschool institutions, which will allow children to develop the skills and competences of the future from

an early age (https://kidsview.pl/edukacja-z-pasja/przedszkole-jutra-to-rowne-szanse-rozwojow e/). It started on 24.01.2022. Its scope covers 4 main initiatives:

- ➢ #STEAMInTheKindergarten - Creation of a preschool education program based on the dynamically developing STEAM model.
- ➢ #SecialisedSchoolJournal - Providing an electronic journal adapted to the implementation of specialist classes, including revalidation-education and correction-compensation classes, supporting diagnostics and the work of educators, psychologists and other specialists with children in cooperation with parens.
- ➢ "#DigitalAvailability - Development of an application for preschool education, available digitally for parents with disabilities who often have difficulties with full participation in the life of a child.
- ➢ #PreschoolActivitiesOfTheFuture - Organising a competition for kindergarten teachers for the most interesting activities dedicated to children, also with special needs and based on the STEAM model, and the implementation of a series of training in preschool education using modern digital tools, electronic journals and the STEAM model for preschool staff in Poland.

❖ **"STEAM education at school"** - Programme implemented by The Polish Development Found Group Foundation, directed to teachers and educators aimed at supporting and developing competences, emphasising the active use of the STEAM method, creating and designing lessons independently, and building cooperation between teachers and students for effective teaching (https://fundacjapfr.pl/edukacja_steam).

❖ **"Program your future"** is a project aimed at teachers of grades 1-3, who, thanks to their participation in it, have a chance to develop digital competences, in particular related to learning programming in early childhood education and, above all, to apply the acquired knowledge directly in practice by conducting classes with students. It reaches 205 schools, 1210 teachers, 22000 students and 250 educators (https://zaprogramujprzyszlosc2.edu.pl).

❖ **"STEM Kindlothecs"** are specially arranged multimedia corners created in schools, culture centres and libraries. These are ideal places for learning, reading, DIY or acquiring programming and robotic skills. Participation in the

activities organised in STEM Kindlothecs allows children to acquire knowledge and

competences of the future in an accessible and creative way. The plan is to create at least 35 such places in the whole of Poland. It also covers 136 online courses for 35000 participants (https://cyfrowydialog.pl/project/stem-kindloteka/).

- **"The Academy of Good Competences"** is a project run by the Association "Dobra Edukacja", addressed to teachers and students in Warsaw and Jabłonna. It supports 50 teachers and 130 students (https://cyfrowydialog.pl/project/akademia-dobrych-kompetencji/).

- **"School Leaders for Remote Education"** is a project that aims to create 60 leadership teams (120 teachers in total) in primary schools from the cities and villages below 50 thousend inhabitants, that support all teaching staff in implementing ICT tools in remote and hybrid education (https://cyfrowydialog.pl/project/szkolni-liderzy-edukacji-zdalnej).

Although the above mentioned examples prove that the situation in Poland in the field of STEAM education, robotics and related support for teachers in this field has improved over recent years, since the new school system reform has been announced, there's still a long way to go to create a fully functional environment for teachers and their pupils.

Bibliography in Polish (all links active on 06.02.2022):

1. Polish school core curriculum for kindergartens and early school education: https://www.ore.edu.pl/wp-content/uploads/2017/05/wychowanie-przedszkoln e-i-edukacja-wczesnoszkolna.-pp-z-komentarzem.pdf
2. Polish school core curriculum, informatics subject: https://www.ore.edu.pl/wp-content/uploads/2017/05/informatyka.-pp-z-koment arzem.-szkola-podstawowa-1.pdf

3. Kordylewski M., *A new core curriculum in informatics,* *https://cdnkonin.pl/materialy/konferencje_04_2017/informatyka.pdf*
4. Kuźmińska-Sołśnia B., *Teaching programming/coding in children's education* http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-67352be3-4f 9a-4109-9d78-4c9a009b73ea/c/DOI_15.pdf
5. Kuźmińska-Sołśnia B., Ziębakowska-Cecot K., *Preparation of Teacher Trainees to Implementation of Programming Learning in Elementary Education* http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-4532f4e3-8e 0c-4c2a-8253-c2af3ca99019/c/025_ETI_nr_Vol_8_3_Przygotowanie_przyszly ch.pdf
6. Kwiatkowska U. B. dr, *IT / programming in the core curriculum*, https://2014-2020.erasmusplus.org.pl/wp-content/uploads/2019/03/1.-Informat yka_programowanie-w-Podstawie-programowej.-dr-Anna-B.-Kwiatkowska.pdf
7. Ordon U., Serwatko K., *Evaluation of kindergarten and early school teachers concern- ing their Information Technology skills* http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-46a1301b-58f3-4214-b00d-48521e076567/c/027_ETI_nr_Vol_7_3_Kompetencje_informat yczne.pdf
8. Głąb K. red., *Future competencies in times of digital disruption* https://mwi.pl/uploads/filemanager/publikacje/Kompetencje--przyszłości--w--czasach--cyfrowej--dysrupcji--studium--2019%2C%20final%2C%207.02.2018.p df
9. Mikołajczyk J., Królikowski T., Mikulski K., *Research in the area of educating teachers' skills in the field of robotics and digital competences in education* https://depot.ceon.pl/bitstream/handle/123456789/20662/Strony%20od%20Z N%20ERS%20tom%205%202020-8.pdf?sequence=1&isAllowed=y
10. Plebańska M. dr hab., *STEAM - education of the future*, https://mscdn.home.pl/mscdn2018/images/pdf/Dobre_praktyki/1058_art.pdf
11. Raczykowska A., *Programming and robotics in the new core curriculum in the face of (non) competences of IT teachers, https://www.ceeol.com/search/article-detail?id=923700*

12. Sowa J. *Competences and professional requirements of a kindergarten teacher*, https://pcud.edu.pl/blog-post/kompetencje-i-wymagania-zawodowe-nauczyciel a-przedszkola
13. *What changes are needed in a Polish school? Report from meetings organized by the Children's University.* *https://www.scdn.pl/images/stories/raporty2020/Uniwersytet%20Dzieci2019-2 020.pdf*

Additional bibliography in Polish (blog posts, all links active on 06.02.2022):

1. *STEAM in the kindergarten of the 21st century*, https://kidsview.pl/edukacja-z-pasja/steam-w-przedszkolu-21-wieku/
2. *Steam - an alternative to traditional teaching methods,* https://kidsview.pl/edukacja-z-pasja/steam-alternatywa-dla-tradycyjnych-meto d-nauczania/
3. *The kindergarten of tomorrow means equal development opportunities*, https://kidsview.pl/edukacja-z-pasja/przedszkole-jutra-to-rowne-szanse-rozwoj owe/
4. *STEAM education (science, technology, engineering, art, maths)*, https://www.mentorpolska.pl/steam
5. *STEAM - I learn by design, I develop myself and the world,* https://portal.librus.pl/szkola/artykuly/steam-ucze-sie-projektowo-rozwijam-sie bie-i-swiat
6. *Robotics in early childhood education, is it even possible?* https://www.edunews.pl/nowoczesna-edukacja/programowanie/3750-robotyka-w-nauczaniu-wczesnoszkolnym-czy-to-w-ogole-mozliwe

Notes

[1] Polish school core curriculum, informatics subject: https://www.ore.edu.pl/wp-content/uploads/2017/05/informatyka.-pp-z-komentarzem.-szkola-podstawo wa-1.pdf, p. 20.

[2] Polish school core curriculum for kindergartens and early school education: https://www.ore.edu.pl/wp-content/uploads/2017/05/wychowanie-przedszkolne-i-edukacja-wczesnosz kolna.-pp-z-komentarzem.pdf, pp. 5-6.

[3] Ibidem, p. 6.

[4] In fact most of the research concerns early school teachers and less preschool teachers, which results from the fact that they especially had to switch into a new teaching paradigm. However even in this group there is a significant number of teachers who teach on both levels, especially where the preschool levels are formally incorporated in primary schools environments.

[5] A. Raczykowska, *Programming and robotics in the new core curriculum in the face of (non) competences of IT teachers, https://www.ceeol.com/search/article-detail?id=923700*, p. 65.

[6] B. Kuźmińska-Sołśnia, *Teaching programming/coding in children's education* http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-67352be3-4f9a-4109-9d78-4c9a009 b73ea/c/DOI_15.pdf

[7] U. Ordon, K. Serwatko, *Evaluation of kindergarten and early school teachers concern- ing their Information Technology skills* http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-46a1301b-58f3-4214-b00d-48521e0 76567/c/027_ETI_nr_Vol_7_3_Kompetencje_informatyczne.pdf, p. 155.

[8] K. Głąb red., *Future competencies in times of digital disruption* https://mwi.pl/uploads/filemanager/publikacje/Kompetencje--przyszłości--w--czasach--cyfrowej--dysru pcji--studium--2019%2C%20final%2C%207.02.2018.pdf

[9] J. Mikołajczyk, T. Królikowski, K. Mikulski, *Research in the area of educating teachers' skills in the field of robotics and digital competences in education* https://depot.ceon.pl/bitstream/handle/123456789/20662/Strony%20od%20ZN%20ERS%20tom%205%202020-8.pdf?sequence=1&isAllowed=y

Educational Robotics in Greece

The past years there has been a tendency to integrate the Arts into STEM education and finally make it STEAM. STEAM is important according to Colker & Simon (2014) it helps teachers incorporate multidiscipline learning and promotes experiences for children to question, explore, research, discover, and exercise innovative building skills. STEAM education in preschool seems to be possible in the Greek Preschool as well. The objectives of the curriculum of 2003 (Greek Pedagogical Institute, 2003) of the preschool are in line with the objectives and the possible benefits offered by the STEAM education. In addition, the Preschool emphasizes their interdisciplinarity, skills and practice. Also, in the New Curriculum (Greek Pedagogical Institute, 2011) for the preschool reference is made to the "basic skills" promoted through it: a) communication, b) creative thinking, c) personal identity and autonomy, and d) social skills and abilities that related to citizenship. Moreover, while separate learning areas are presented in the Curriculum, there are links between all learning areas and the core competencies remain the same. It seems that the curricula for Preschool in Greece do not differ much in philosophy with STEAM education, although they do not refer to these areas directly. However, there is freedom for preschool teachers, and they can implement STEAM programs in Preschool.

STEAM approaches that utilize school-based material (Torres-Crespo et al., 2014; Christenson & James, 2015; Bagiati & Evangelou, 2016) could be directly integrated into the Greek preschool. Building materials, for example, are one of the areas that exist in Greek preschools and these approaches could be the beginning for the adoption of such practices. Also, lately, robotics seems to be used more and more in the educational process, observing an increased number of scientific publications and national competitions. This makes the integration of robotics in preschool easier.

The literature though, lacks research on STEAM education in Greece. The STEAM movement in Greece is very recent and has occurred over the last seven years according to Spyropoulou, Wallace, Vassilakis and Poulopoulos (2020). Review of existing studies and exploratory research, especially for preschool needs to be done on STEAM-based institutions or programs in a Greek context.

STEAM programs are not widely implemented in Greece. There are several factors for the absence of the variety of STEAM programs in preschools. According to Karapanou and Tzirou (2018) the lack of adequacy and training of teachers by the state body for the STEAM approach, makes teachers feel insufficient to

undertake such efforts. Furthermore, the difficult economic conditions are a deterrent to equipping a classroom with STEAM material and to organizing training seminars, upgrading curricula, etc. The training of teachers in the STEAM approach or in other innovative approaches is usually an initiative of the teacher himself/herself and part of his/her professional development.

According to the research of Karapanou and Tzirou, an online questionnaire was created and posted on an educational networking platform in order to explore the views and perceptions of preschool teachers about the STEAM methodology, to what extent they know it, are trained or want to be trained and how this could happen. In total, the form was answered by 120 participants during a month in February 2019, more specifically the participants are 74 preschool teachers and 46 pre-school teachers (2018). To sum up, we understand that the STEAM approach is not so well known to preschool teachers, but they

want to be trained on it. The way of approaching the issues in the preschool is close to the STEAM approach and this is noted at the beginning of the curriculum for the preschool where the interdisciplinary character of learning is emphasized.

In Greece there is no direct reference to STEAM at the latest curriculum (Greek Pedagogical Institute, 2011) but the curriculum's philosophy is very close to the STEAM approach. Also, the flexibility of the daily program in preschools supports the engagement with similar activities on the field. Many studies emphasize that the construction area/ corner has a lot of material that can be used directly in the field of engineering, as it exists in every preschool, without effort and cost (Torres-Crespo et al., 2014; Christenson & James, 2015, Bagiati & Evangelou, 2016).

Moreover, there are examples of Preschools that use STEAM approach, there are national or European projects that are implemented (such as e-twinning projects, Erasmus projects, etc.). The latest increase of after school programmes has shown that STEAM projects are put into practise. Additionally, various Institutes, Profit and Non-Profit Organizations run STEAM programmes. In Higher Education, many Universities that train preschool teachers, use the term STEAM instead of STEM and run educational projects and studies.

According to one of these studies, a rearch study was held by Chaldi & Mantzanidou in 2021, about educational robotics in kindergarten. Students had to engage with STEAM education, using the programmable robot Bee-Bot®. A sample of 12 children (5–6 years old) took part in an intensive educational robotics lab for 16 sessions (4 weeks) by using a bee-shaped robot called Bee-Bot®. The young students developed and mastered knowledge in programming and computerizing, and algorithmic thinking with playful mod using educational robots, and they also built their vocabulary and develop communication skills.

WRO (World Robot Olympiad) HELLAS is a non-profit Educational Robotics & Science Organization that organizes the World Robot Olympiad (W.R.O.) in

Greece. WRO Hellas is the main body conducting educational robotics competitions in Greece and in the wider region of South-eastern Europe. With their competitions, they seek the introduction of educational robotics, as well as the broader methodology STEM (Science
- Technology - Engineering-Mathematics), in the official educational system of Greece. The competitions are used as an incentive for the creation and operation of a comprehensive program, in order to increase the active interest of the school community towards educational robotics, as well as the wider modernization of Greek schools, through their supply of educational equipment. robotics. In addition, with the help of the competitions, WRO Hellas creates and maintains an active community of Pan-Hellenic scope, which works voluntarily and takes care of the continuous training and support of teachers, through free training seminars (online and offline), integrated printed guides and lesson plans.
The Panhellenic Educational Robotics Competition is organized for the 8th consecutive year by WRO Hellas and is under the auspices of the Ministry of Education and Religions. The Panhellenic Educational Robotics Competition is a unique way for students to understand science, programming and automation, to learn to think like engineers, to develop their problem-solving skills and to expand their creativity. By exploring these skills

in a practical and participatory way, children develop the supplies they need today and for the future, whatever career choice they follow. During their preparation for the competition, the students, under the guidance of their teacher-coaches: They form groups (teamwork), they study the relevant literature and experiment (critical thinking), they explore the science of engineering (engineer thinking), they will identify challenges and suggest solutions (problem solving). At the same time, within the framework of the Panhellenic Educational Robotics Competition, free training seminars will be held for the coaches of the teams that will participate in the competition. The training seminars will be held remotely. The last years, the Competition has shifted towards the STEAM approach by using the word STEAM instead of STEM into the title of the Competition. This year's Competition for the preschool level is called 'STEAM Preschool Educational Action: "The Wealth of my place"'. The addition of the A (Arts) on the title of the Competition probably shows the importance of the Arts into STEM field.
Paraskevi Efstratiou Foti (2021) on her article 'Exploring kindergarten teachers' views on STEAM education and educational robotics: Dilemmas, possibilities, limitations' included a survey conducted in kindergartens of Primary Education in the Third District of Athens. The research aimed to explore perceptions, possibilities, and limitations expressed by preschool teachers regarding STEAM methodology and the introduction of Educational Robotics in kindergarten. According to the study, the need has appeared for the State to give proper

attention to education, considering the approach and designing a framework for its integration at optional or compulsory level, training teachers, providing appropriate STEAM and Educational Robotics materials for activities or workshops.

This year the Greek Institute of Educational Policy (IEP) [1] started a training for the educators of all levels (including preschool teachers) called '21st Century Skills Labs'. In this training there is a huge educational material about how to teach children the 21st century skills. In a section called 'Create and Innovate - Creative Thinking and Initiative' there was a lot of material related to STEAM and robotics. Among others, the goals of the programs have been determined based on the so-called Skills of the 21st century: life skills, soft skills and technology and science skills, including the digital and technological literacy mentioned in. There are also some examples and STEAM projects that have been piloted in preschools and considered as good practices. The training was mandatory for all educators in Greece. Moreover, the educational material for preschool teachers was covering the STEAM aspect there was not enough material for the educators or any toolkit.

There are some examples of programs with educational material and toolkit for preschool educators. In the school year 2019-2020 the National Agency implemented the STEM 2.0 action with the STEM Education Organization (https://stem.edu.gr) to train eTwinners educators for the needs of eTwinning. This organisation was selected for the needs of the training coverage of 280 responsible preschool, primary and secondary teachers and upon delivery of robotics kits in the largest percentage of school units. The majority of the material in this training focused on STEM and not STEAM.

[1] The Institute of Educational Policy (IEP), a scientific body supports the Ministry of Education and Religions and its supervised bodies, among other issues, for issues related to primary and secondary education, post-secondary education, as well as the transition from secondary to tertiary education.

Resulting, STEAM education in preschool in Greece exists to an extent, but it is not widely known to educators and there is not enough material produced to help them expand their knowledge. There have been some initiatives form individual educators, organisations and the Ministry towards this direction but there is still a gap between teachers' skills, competences and attitudes towards STEAM and the actual STEAM education.

References:

Bagiati, A., & Evangelou, D. (2015). Engineering curriculum in the preschool classroom: the teacher's experience. European Early Childhood Education Research Journal, 23(1), 112-128.
Chaldi, D., & Mantzanidou, G. (2021). Educational robotics and STEAM in early childhood education. Advances in Mobile Learning Educational Research, 1(2), 72-81.
Christenson, L. A., & James, J. (2015). Building bridges to understanding in a pre-school classroom: A morning in the block center. YC Young Children, 70(1), 26.
Colker, L. J., & Simon, F. (2014). Cooking with STEAM. Teaching Young Children, 8(1), 10-13.

Foti, P. E. (2021). Exploring kindergarten teachers' views on STEAM education and educational robotics: Dilemmas, possibilities, limitations. Advances in Mobile Learning Educational Research, 1(2), 82-95.

Greek Pedagogical Institute. (2003) Unified Cross-Curricular Framework for the Curriculum of Pre-School Education. Greek Ministry of Education and Religious Affairs-Greek Pedagogical Institute: Athens, Greece.

Greek Pedagogical Institute. (2011) The New School: Curriculum of Pre-School Education. Greek Ministry of Education and Religious Affairs-Greek Pedagogical Institute: Athens, Greece.

Karapanou H. & Tzirou I. (2018). STEAM approach in Preschool Education-Designing, implementing and evaluating an educational program. University of West Attica.
Spyropoulou, C., Wallace, M., Vassilakis, C., & Poulopoulos, V. (2020). Examining the use of STEAM Education in Preschool Education. European Journal of Engineering and Technology Research.
Torres-Crespo, N. M., Kraatz, E. & Pallarsch, L. (2014). From fearing STEM to playing with it: The natural integration of STEM into the preschool classroom. SRATE Journal, 23(2), 8-16.

'21st Century Skills Labs' Retrieved from: http://iep.edu.gr/en/psifiako- apothetirio/skill-labs

'Αναφορά STEM Education Δράση STEM 2.0 eTwinning – Επιμόρφωση Kids First Coding and Robotics'
Retrieved from: https://stem.edu.gr/%ce%b5%ce%ba%cf%80%ce%b1%ce%b9%ce%b4%ce%b5%cf%85

%cf%84%ce%b9%ce%ba%cf%8c-
%cf%80%ce%b5%cf%81%ce%b9%ce%b5%cf%87%cf%8c%ce%bc%ce%b5%ce
%bd%ce% bf/
%ce%b5%cf%80%ce%b9%ce%bc%cf%8c%cf%81%cf%86%cf%89%cf%83%ce
%b7- kids-first-coding-and-robotics/