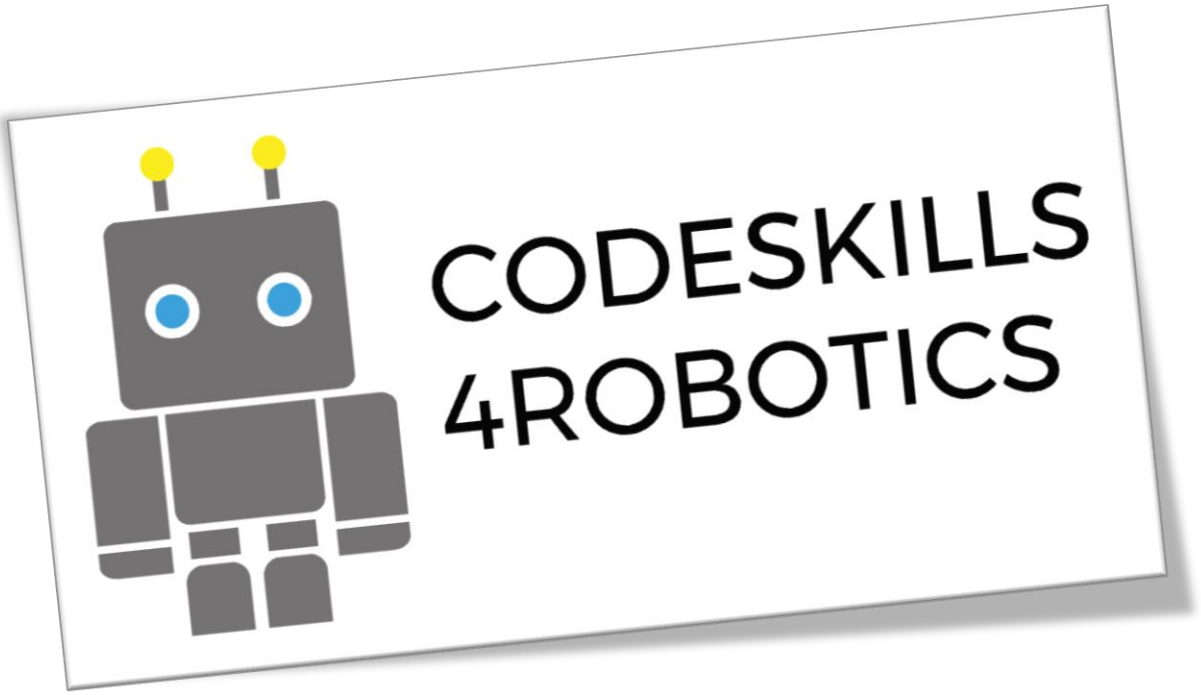


POLICY RECOMMENDATION STRATEGY

CODESKILLS4ROBOTICS: Promoting Coding & STEM Skills through Robotics: Supporting Primary Schools to Develop Inclusive Digital Strategies for All

IO6: The DIGITALSKILLS@SCHOOLS Policy Recommendation Strategy for Sustainability & Upscaling: From the Primary School Level to the National & EU Levels

Partner: Lifelong Learning Platform (Belgium), Regional Directorate of Primary and Secondary School Education in Crete (Greece)

Grant Agreement No: 2018-1-EL01-KA201-047823

Website: http://codeskills4robotics.eu/

March 2021

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

ΙΔΡΥΜΑ ΚΡΑΤΙΚΩΝ ΥΠΟΤΡΟΦΙΩΝ ΙΚΥ

This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein." "Funded by the Erasmus+ Programme of the European Union"

CODESKILLS 4ROBOTICS

Table of Contents

1. Introduction

Based on the IO5, which aimed to design, develop, produce and pilot-test the TOOL KIT and the Digital School Strategy necessary for the implementation of the CODESKILLS4ROBOTICS Program, following the Tool Kit piloting successful implementation at schools and in-house, **the evaluation** of the Tool Kit **Pilots** and the Tool Kit **overall impact** constitute the next step before proceeding with the development of relevant policy recommendations as means to develop the project Sustainability Strategy Plan that is the focal point of IO6.

In particular, IO6 focuses on the design of the policy strategy which will ensure sustainability of the products, further exploitation and expansion and utilizing the opportunities provided as part of the **EU DIGITAL AGENDA FOR EUROPE and all related initiatives such as the EU CODE WEEK, EU ROBOTICS WEEK, EU DIGITAL CITIZENSHIP DAY etc.**

What are the IO6 aims?

More specifically its aims:

- to design and produce the **DIGITALSKILLS@SCHOOLS POLICY RECOMMENDATION STRATEGY PACK** for upscaling, transferability and sustainability of the projects' products at the local, regional, national land EU level for further exploitation.

- to investigate the potential sustainability and management of the program, its process and products through the setting up of the **DIGITALSKILLS@SCHOOLS**.

- to initiate the **POLICY MOVEMENT** as part of the **EU CODE/ROBOTICS WEEK** (or any other relevant week) with the organization of various events based on the products and achievements of the project: students' coding exhibition, campaign, awards, petition and a declaration for the EU

Hence, the following sections center around:

- A comprehensive evaluation of the Tool Kit Implementation**,** focusing on the **evaluation of piloting results** and an **overall** Tool kit **impact** on the basis of the CODESKILLS4ROBOTICS piloting case study per each partner organization (2)

- A Design of the DIGITALSKILLS@SCHOOLS Policy Recommendation Pack for Upscaling -Sustainability Strategy, including ideas and proposal to ensure the sustainability and mainstreaming of project results and to disseminate the policy recommendations at local and national level (3).
- Setting Up the DIGITALSKILLS@SCHOOLS Policy Community (4)
- Digital Policy Recommendation Movement (EU Digital Week), including a set of policy recommendations in support for the importance of digital skills upscaling (5)

2. Evaluation of TOOL KIT

The CODESKILLS4ROBOTICS Tool Kit was designed and pilot-tested as part of IO5, a process analytically described by each partner country in the aforementioned intellectual output.

Following IO5 completion, an effort is made to evaluate the Tool Kit placing particular emphasis on **the evaluation of the** Tool Kit **piloting implementation**, by reporting the evaluation results obtained by each partner's case study and the **Overall** Tool Kit **impact**, shedding light into the insight gained in all countries for future application and transferability and as an opportunity for potential improvement.

2.1. Case Study

The Tool Kit Piloting implementation, as analytically presented in IO5, took place in the context of each partner country and was conditioned by the relevant diverse contextual parameters in operation and the dominant pandemic conditions in effect as well.

Regarding the implementation form adopted, in all countries with the exception of Cyprus, where Emphasys Center held pilot testing **in-house**, piloting implementation in Greece and Sweden was held in the **associated schools** either **within school time** (morning zone), or **after school time (oloimero zone)**. Overall, the Piloting implementation schemes adopted fall in two categories, i.e. **Face to Face implementation and blended one** in accordance with the pandemic restrictions imposed in each partner country at the time. In Cyprus and Sweden, the actual piloting implementation took place **in the physical presence of students**, while in Greece, for **Regional Directorate of Education of Crete** and the **Hellenic Mediterranean University** schools, pilot testing teaching classes were materialized **face to face** in their entirety and for **Demokritos** Schools, **a considerable part was materialized f2f**, while the rest teaching was conducted **online** due to the lockdown enforced in Athens at the period.

Nonetheless, apart from actual piloting robotics teaching classes, **students in all countries** overall were engaged in several hours of **blended learning**, as prescribed by the Program guidelines, fully availing of the opportunities offered for self-studying and utilization of the educational material in the e-platform

and the communication tools available to have direct and instant contact with their teachers for clarifications and support.

Regarding the time period that Tool Kit Piloting implementation took place, the time schedule followed in each country was conditioned by the pandemic restrictions affecting the opening and closure of schools, as with the exception of Cyprus**,** where the piloting was held in-house, allowing it the opportunity to start earlier, for all other partners in Greece and Sweden, schools were the key piloting locations for Tool Kit implementation. Within this framework, Emphasys Center, it being a Training Center, had started piloting with some groups even earlier than C1 training, having a more extended period of classes on a normal pace, with a view to using the insight gained from this experience for making any improvements on the overall educational material of the Tool Kit and avoiding potential perilous issues. In the case of the other consortium partners, more intensive piloting courses were opted for, the choice being always contingent on the pandemic conditions affecting school functioning in each case.

Hence, in their attempt to localize the **Tool Kit implementation** and customize it to the specific local needs and situational aspects, each partner per country embarked on a series of actions, analytically reported in IO5, constituting their specific portfolios of work and overall organization arrangements, as briefly described below:

Portfolios of Work

The steps taken by each partner organization during the process of the preparation of the implementation of the TOOL KIT pertaining to preparatory actions and meetings, consultation with experts, familiarization with the tool kit sessions etc. are briefly delineated below:

Regional Directorate of Primary and Secondary Education of Crete

As IO5 leader, the Regional Directorate of Education of Crete has taken on the responsibility to monitor the process for the design of the Tool Kit to be produced and pilot tested in all partner schools as part of IO5. Hence, it held some preparatory online meetings with P1, as Project Coordinator and P4 as IO5 co-leader, in order to have an agreement on the roadmap to be followed.

Within the framework set, it has developed the content of the IO5, providing the guidelines for Tool Kit **implementation**, **monitoring** and **evaluation** to be followed by partner organizations in each country pilot implementation and generally by any school/education institution that would be interested to implement the Tool Kit in the future as point of reference for successful implementation. Moreover, it has come up with the necessary templates that the rest of the consortium partners would have to fill in, so as to describe both the various preparatory actions taken prior to the pilot testing and all the analytical information of the actual piloting implementation. In addition, it has modified and supplemented, where necessary, all the documents required for the piloting implementation to be sent to schools, which had originally been prepared by P4. The documents, having been localized, were translated to Greek to be used by the two other partners in Greece. The final documents in their entirety are an integral part of IO5 **Annex** and readily available for use.

As IO6 co-leader, RDPSEC was responsible for preparing the document template for Tool Kit **Evaluation**, having designed the evaluation framework and the supplementary evaluation forms along with an evaluation guide for the other partners to help them offer their input regarding the Tool Kit Piloting results and the overall Tool Kit impact reported in the current IO. On the whole, RDPSEC has been in close cooperation, providing support and exchanging constructive feedback with all consortium partners throughout the Tool Kit Implementation and the evaluation process.

Regarding actions as part of the Tool Kit implementation in schools in Crete, analytically presented in IO5, in short, RDPSEC had a remarkably close collaboration with the involved stakeholders prior to commencing the piloting

process by means of online meetings for designing the digital strategy and time schedule to be followed, to decide on the content of the piloting classes, providing also the necessary technical equipment (Lego Boost Kits and tablets) to the schools and supplementary training to teachers on the e-platform and technical support where needed, being in close contact with the piloting schools, ensuring the safety conditions of the students.

Throughout the piloting process ample support and guidance was provided by the RDPSEC Piloting Coordinator, via frequent email or telephone communication regarding the piloting documents, detailed clarifications on their completion and solving problems encountered. Finally, besides the various face to face Info events preceding the Tool Kit Implementation, during the pilot period an additional online Info-Day was organized within the Framework of Women and Girls in Science Celebration Day, whereby the project aims and outcomes were disseminated to the teacher population.

Demokritos

In brief, Demokritos has provided the necessary equipment to the piloting school (Lego boost kits, tablets, laptop, etc.) in order to successfully implement the pilot training along with its guidance on technical issues as an I.T. expert center by means of supplementary training meeting with the teachers. At the beginning of the pilot implementation there was an introductory lesson in order for the students to familiarize themselves with the e-learning platform.

Furthermore, Demokritos organized an info day which took place online due to covid-19 limitations, where parents and teachers were informed about the aims of the project, the educational material produced and the use of the project online tools (e-platform, mobile app, open badges).

Hellenic Mediterranean University

Hellenic Mediterranean University started the pilot implementation with introductory instructions to the teachers about the necessary paper work, educational robotics and how they can help students to improve STEM Skills. In addition, the basic idea of the lessons was explained, along with the e-learning

platform, the programming environment and the appropriate tools needed for the pilot implementation. Furthermore, an introductory meeting was made to discuss how the blended learning approach can be implemented. Instructions were also given to students about how they would have the ability to access and implement part of the educational material at home with their parents.

Emphasys Centre

Emphasys Centre, as an ICT and training centre, was the partner responsible for developing the educational material. In addition to that, Emphasys Centre was responsible for preparing all the assessments coupled with the assessment methodology. Thus, its involvement in the preparation of the TOOLKIT was significant. Additionally, Emphasys provided significant support to the leader of the output for the design and production of the TOOLKIT. Concerning the additional material prepared for the IO5 needs, Emphasys designed the templates (registration form, weekly schedule, parental consent form, etc.), which are considered necessary for implementing the pilot testing.

Before the implementation, Mr Nicholas Moudouros, the Head of Training Department of Emphasys Centre, provided a series of internal training sessions to the rest of the trainers involved in the programme and offered them support during the sessions. Miss Andrianna Georgiou and Chrystalla Thrasyvoulou were responsible for contacting schools and other organisations to arrange an event/activity/info day where Emphasys could promote the project results and the upcoming at that time piloting program.

Emphasys Centre participated in various national events where the opportunity for dissemination was given before the pilot testing. Such as events were:

i. its participation at the International Education and Career fair 2020 organised in Nicosia

ii. the organisation of an Info Day at the 40th Scouts Troop of Egkomi as part of the EU Robotics Week
iii. its participation at the INFO DAY organized by the parental association of Ayios Dimitrios Primary School.

During the events, students had the opportunity to get hands-on experience with their involvement in various robotics activities. Their parents were informed about the upcoming training of the CODESKILLS4ROBOTICS program to understand the importance of the acquisition of STEAM skills. During the pilot testing, Emphasys Centre organized another INFO DAY (as part of the EU CODE WEEK), where parents were invited to join various activities designed for the whole family.

Emphasys Centre was the first organization to start the piloting implementation of the project. The piloting organized in-house (face2face) starting from the middle of September 2020. In December 2020, the second wave of the pandemic hit the island, so Emphasys Centre had to interrupt the pilot testing to safeguard students and teachers' health. However, a tremendous amount of the material had been already tested by then. A series of online sessions were organized between January and March 2021 to prepare the students for the C2 activity.

Sweden

Halsingland Education Association

Halsingland Education Association has provided the necessary technical equipment (Lego Boost Kits and tablets) to the school as well as technical support. Prior the implementation online meetings were held with the teachers so as to have a dialogue for preparation of the piloting activities. They started with a review of what to work with, went through the e-platform, what programming means and how to work with the Lego Boost kit.

Overall Organization arrangements

The present section briefly touches upon the issue of the overall organization arrangements, described at length in IO5, that took place in each country, by making special reference to any modifications made as a result of the pandemic restrictions.

Regional Directorate of Primary and Secondary Education of Crete

Regional Directorate of Education of Crete commenced the Tool Kit Piloting implementation on a preparatory stage on 18 December 2020 and completed it on 8 March 2021, with teaching being fully held face to face. Besides the provision for the necessary technical equipment (Lego Boost Kits and tablets), all along the way, RDPSEC was in close collaboration with all involved teachers and principals of piloting schools to monitor the implementation progress and provide support when needed and to safeguard the hygiene conditions and the safety of the participating students.

.

The main concern derived from the uncertainty whether schools would remain open throughout the piloting process. Nonetheless, as no local lockdown was enforced in Crete until the official ending period of piloting, there was no need for modifications and switching to online mode of teaching due to pandemic restrictions and thus piloting implementation in all RDPSEC schools was not hindered whatsoever. The enforcement of a local lockdown in Heraklio on the first week of March, which coincided with the pre-scheduled official ending of piloting anyway, did not have any negative effect on its piloting process. After the ending of piloting process, students had some online preparatory classes so as to take part and present their portfolios of work in the C2 Training held online from 16-19 March 2021.

Demokritos

Demokritos started the pilot testing at the beginning of February till the 30th of March. The pilot testing took place directly after school hours (extended zone/ oloimero) for 1,5 to 2 hours per day on a 3 to 4 days per week basis. The principal of the 3rd primary of Marousi made all the necessary practical arrangements for the required infrastructure and provisions (Internet connection, projector, classroom availability) as well as all the hygienic arrangements (antiseptic, open door and windows during the training) to ensure that the pilot trainings will be carried out safely for everyone involved.

Since 11/2 primary schools were closed by the government due to pandemic restrictions. The training however, continued online using Webex platform (the official platform of primary schools). In the distance learning phase, technical support was provided so that the teaching process became as **interactive** as possible. The teacher had the appropriate equipment at his disposal so that the students could see in real time the programming process and the subsequent actions of the robot.

Hellenic Mediterranean University

The piloting implementation started on the 18th of December 2020 and was completed on the 28th of February 2021. All the appropriate piloting lessons were implemented face-to-face at school, but further cooperation was possible through the Webex platform between the teachers and the students. During face-to-face sessions all the hygienic arrangements like antiseptics, open doors, and windows during the training have been taken in order to ensure that the pilot training would be carried out safely for everyone involved.

The lessons included, among others, topics like construction of the robotic vehicle REA, dealing with the Lego Boost software, the various color and sound sensors, etc. Moreover, several applications were implemented by the students concerning the path following problem in robots and the creative scenarios as described in the educational material.

The students during the lessons were divided into two pilot groups and had the opportunity to use paper materials, make drawings and construct artifacts to

enrich the scene of the creative scenarios. They were impressed and successfully completed the entire Modules 1 and 2 by the end of the pilot implementation.

Emphasys Centre

Emphasys Centre had started the piloting session face-to-face in the class and continued it online, as the second wave of the pandemic hit the island in December 2020. Thus, the piloting implementation started in September 2020 and was completed in March 2021. The online sessions were a great opportunity to explore and exploit the eLearning platform environment and test how the platform works in an online context. Students have been encouraged to familiarize themselves with the eLearning platform, interact and collaborate with their teacher and classmates online.

Halsingland Education Association

Prior to the implementation information on the aims of the CODESKILLS4ROBOTICS project was delivered to parents by the teacher and the children had to apply to participate in the pilot testing. There were about 20 applications and it was decided to divide the students into two pilot groups, as the space in Komtech, the science laboratory in the municipality of Söderhamn, where the piloting was held, did not allow for many students for ventilation reasons and pandemic safety as well.

The first group started the Tool KIT piloting activities on 03 February 2020 and finished on 10 March 2020. The Covid-19 conditions in Sweden did not affect the school functioning in Sweden and as a result, since schools were open during the period piloting, all piloting sessions were held face to face and there was no need to make any changes and have online teaching. As part of the project sustainability the other group starts after Easter holidays., on 14 April 2021.

Besides organizational arrangements outlined above, reference is to be made in the following section to the Campaign run along in the process of the Tool Kit implementation.

Campaign

A core constituent of the overall implementation process of the project, being highly conducive to the dissemination and sustainability of the results obtained, is the Campaign launched by each partner organization throughout the Tool Kit implementation process, the particular aspects of which are delineated below:

Regional Directorate of Primary and Secondary Education of Crete

The strong network of primary schools being under Regional Directorate of Crete supervision facilitates the seeking piloting schools process, while at the same time strengthens the possibilities for project dissemination and exploitation.

As analytically described in Io5, following the initial informative and awareness raising campaign for school selection purposes, a **systematic communication** and **dissemination online Campaign** took place on **social media (**RDPSEC EU Programmes Facebook page**)** during the implementation phase of the project, by means of robotics articles, visual material for raising awareness and informing on various events and trainings, brochures and invitations for

webinars and Info-days, special visual posts directing the audience to the Project intellectual outcomes (IOS) with the use of witty slogans, emojis, videos, with the Project Logo always featuring prominently, so as to establish its identity in the eyes of the audience. Links of the project official website, e-learning platform, e-newsletters, memorandums of digital commitment were given special attention with a view to reaching students and teacher population interested in subscribing and becoming program ambassadors so as to keep track of the project in progress.

A more **targeted Dissemination Campaign** took place during the actual period of the Piloting Testing in Cretan schools, aiming at promoting the project results and the e-platform tools and arouse the interest of relevant stakeholders that would like to implement it. In fact, a pilot training Facebook group was created on the onset of the pilots, sharing the experience among the members of the piloting schools, while at the same time, acting as the medium for disseminating CODESKILLS4ROBOTICS material from piloting moments with the wider teacher and student population.

Special weight was placed to the **Dissemination Campaign** launched by RDPSEC for the period from 12 February to 31 March through press releases and articles in the various **local** and **national media**, local and national **Printed press** and **new portals**, along with special TV shows tributes on **local TV Channels** and **Radio Programs**. Thus, the project aims and results, piloting photographic material and testimonials from the involved teachers and students were communicated to a broad and diversified audience, ranging from teachers, parents, students, stakeholders and the wider general population on a local and national level, as a means to enhance project visibility, exploitation and sustainability efforts.

The completion of piloting implementation has signaled the commencement of an updated **online campaign,** as part of RDPSEC **Sustainability Strategy**, which was officially heralded by the organization of a **successful online Multiplier event** on Webex platform, seeing the participation of approximately 80 teachers. In fact, the event, was also broadcasted from RDPSEC You-tube channel, giving the chance to be attended by a larger audience and enhancing in this way the prospects for greater dissemination of the project. The participants were informed about all projects IOS, expressing a special interest in the pilot testing results in RDPSEC schools.

Along the same line, the C2 Training activity moments as well as the Final Conference results and relevant snapshots were also disseminated by

imaginative posts. Eye-catching posts were also created with specially designed audio-visual material, illustrating all the IOS products, intending to make the project accessible to a wider target audience and enhance its **exploitation** and **sustainability** prospects. After the life cycle of the project ends, RDPSEC is planning to keep the project alive by making use of various opportunities to exploit its products along with similar RDPSEC Erasmus+ projects currently in operation.

Demokritos

As analytically described in Io5, an **online social media campaign** was run **prior to the implementation** of the Tool Kit, through the use of imaginative and slogan-based posts with emojis and images, videos, links to related articles, hashtags along with links to the developed e-tools in the e-platform, aiming to invite people to follow closely the progress of the project, with the logo and the project colors extensively used so as to make CODESKILLS4ROBOTICS project instantly recognizable.

Demokritos implemented a **new online campaign**, through the social media and the project website **upon completion** of the pilot trainings in order to ensure the **sustainability** of the project and the **exploitation** of its results by new stakeholders and especially by schools. Specially designed posts for each of the six Intellectual Outputs were used together with the visual identity of the project in the form of flyers, brochures, promo badges, etc.) and links to the results and the developed e-tools in an attempt to raise awareness of more teachers, attract more followers, enhance the image of the project and make it easily recognizable.

The dissemination and exploitation activities of Demokritos culminated with the organization of a **very successful online multiplier event**, which attracted more than 300 registrations and over 200 participants, most of which were teachers. During the event, all results were presented in detail to the over 200 strong audience and a discussion was initiated on how to bring the project to more schools. In addition, Demokritos actively participated in the multiplier event of the Regional Directorate of Primary and Secondary Education of Crete and of course in the online International Conference, which officially closed the project.

Demokritos will continue the campaign to keep the project alive after the financial lifetime ends and is already arranging the continuation of pilot activities in the summer provided that the conditions permit it.

Hellenic Mediterranean University

Hellenic Mediterranean University has run an **online campaign** through its websites and social media page in order to inform audience about the CODESKILLS4ROBOTICS program and raise the awareness about the STEAM skills and educational robotics. There has been cooperation with RDPSEC in the context of the dissemination of the program, since the 12th primary school belongs to its responsibility. In fact, there was a **publication in the local press** presenting the results of the program as well as impressions from participants during the pilot implementation. Also, HMU participated in the multiplier event organized by the RDPSEC and presented a part of the educational pack and the results of the IO1.

Emphasys Centre

Emphasys Centre ran an **online campaign** through its social media page aiming to inform tis audience about the CODESKILLS4ROBOTICS programme and raise the awareness about the importance of STEAM skills acquisition. As an ICT training centre, Emphasys visibility is focusing on the digital skills and more specifically on programming, robotics and coding skills. Miss Chrystalla Thrasyvoulou, the dissemination leader of Emphasys, was responsible for the online campaign that ran via Emphasys Centre social media to promote the project results and raise awareness.

Moreover, Emphasys had the opportunity to run an **offline campaign** as well with its participation at national dissemination activities, where an opportunity for presenting the CODESKILLS4ROBOTICS project and its results was given.

Halsingland Education Association

As analytically described in Io5, in connection with in-service training days for teachers, Halsingland Education Association has received face to face information session, where the CODESKILLS4ROBOTICS project was presented to more than 150 teachers in Söderhamn municipality. Photos from the event were published on Facebook.

Additionally, it has implemented a **social media campaign** on the organization´s Facebook group, where project C1 Training videos along with news feeds and current activities have been continuously published. Besides social media campaign, Local media have published articles and photos from activities during C1. In particular, during the Tool Kit **pilot implementation** videos and posts on the pilot activities along with visual post regarding the projects IOs have been posted on Facebook and You tube, as well the C2 training activities.

Finally, via e-mail correspondence with 80 teachers they were informed about the results from the work with the Tool Kit and the opportunities that CODESKILLS4ROBOTICS Program offers. Then an invitation was sent to teachers and other stakeholders to participate in a TEAM´s conference on Monday 29 March 2021.

Following the brief overview of the overall arrangements made along with the campaign followed by each partner organization, aiming to ensure the best conditions for the pilot testing implementation and the subsequent successful completion of the latter at schools or in-house within the particular national context, an **evaluation** of the **piloting results** was made on the basis of the feedback provided by each partner, the findings of which are to be analytically presented below.

2.2. Evaluation of Tool Kit Piloting Implementation

The present section focuses on a comprehensive and analytical presentation of the evaluation process, focusing on the **evaluation results** of the Tool Kit **Piloting Implementation** per each partner in all countries.

Evaluation Framework and Tools

In particular, the evaluation of the Tool Kit Pilot implementation at the associated schools or in-house in each partner country is based on the quantitative and qualitative feedback drawn from the evaluation tools developed both for the **teachers** and the **students** for purposes of triangulation. The **evaluation forms** employed, which constitute an integral part of the Tool Kit and can be found in **IO5 Annex A**, are the following:

- Teacher Evaluation Form I
- Teacher Evaluation Form II (Tool Kit Pilot)
- Student Evaluation Form

Student quantitative questionnaire included 12 statements of agreement on 1-5 Likert scale, offering also the opportunity for qualitative feedback by means of an open-ended question. Teachers were asked to fill in a quantitative questionnaire of quite similar content to that of the students for reasons of triangulation. However, a second open-ended questions evaluation form was also completed by the teachers, in order for the qualitative input to allow to delve deeper into their perceptions and form a clearer picture of the impact of piloting testing of the CODESKILLS4ROBOTICS program.

Besides the aforementioned forms, the overall evaluation report is additionally supplemented by the input of 1-2 teacher testimonials and 2-4 student testimonials from the piloting schools/institutions. The entire content of the testimonials of all partners' piloting implementation can be accessed at the following google drive link: The evaluation framework designed containing the corresponding evaluation form items, measuring certain parameters are illustrated in table 1. of the present IO Annex.

Overall, the item analysis of the evaluation forms has led to the emergence of the following criteria that evaluation is contingent on and pertain to:

What are the Evaluation Criteria of the Tool Kit Pilot Implementation?

- **Usefulness** of the Tool Kit Robotic lessons
- **Quality** of the educational material in the e-platform
- **Quality and usefulness** of the e-platform
- **Usefulness** of the Open Badges System
- **Special value** of the CODESKILL4ROBOTICS Tool Kit Implementation Classes
- **Leaning Impact** of the Tool Kit implementation classes
- **Participants' intentions** to further exploit the program products in their life
- **Participants' intentions** to recommend the platform and the program to others

Hence, on the basis of the aforementioned criteria a descriptive analysis of the data obtained by each partner in **Greece**, **Cyprus** and **Sweden** is attempted below:

2.2.a. Tool Kit Piloting Implementation Evaluation Results per partner

Greece

Regional Directorate of Primary and Secondary Education of Crete

i. Tool Kit Piloting Implementation Evaluation Results

In accordance with the evaluation criteria set, RDPSEC schools data analysis of 51 student and 18 teacher questionnaires has generated the following results:

- Usefulness of the content of the robotics lessons

Teachers were in total agreement that the CODESKILLS4ROBOTICS piloting robotics classes were very useful for the development of coding skills and competences by the students and highly interesting for the latter. In fact, students were reported to have been actively involved throughout the piloting and as teacher A interestingly highlighted:

"they were eager for the classes!"

This heighted interest on the part of the students could be attributed to the fact that, as teacher B effectively noted:

"learning was experiential, organized and based on discovery".

The vast majority of students seem to converge with the teachers', reporting that they really liked the robotic classes and found them very interesting.

- Quality of the teaching material in the e-platform

Pertaining to the teaching material in the e-platform, the teachers expressed their agreement that it was very useful and as teacher B interestingly noted:

"It contained a lot of elements that could help them with the activities. The student could work autonomously under the guidance of the teacher".

In particular, several teachers highlighted the appeal of the four creative scenarios presented.

Students' responses were similar to those of their teachers, expressing in their vast majority their agreement that the educational material was very helpful and very interesting for them.

- Usefulness and Quality of the e-platform

Regarding the e-platform per se the substantial majority of the teachers mentioned that it was innovative, pretty easy to use and very helpful for most students. As teacher B commented:

"Students could browse around and do the activities themselves"

In a few cases the difficulties that might have initially been encountered were reported to have been overcome with the teacher's support.

The opinions expressed by the majority of the students seem to be in congruence with those of their teachers' perception, as for the young pupils the e-platform was said to be easy to use and helpful.

- Usefulness of the Open badges System

According to most of the teachers, the open digital badges that students were awarded as a means of certification for the acquired skills seem to have acted as an important incentive and conducive factor that, as teacher C noted:

"*activated students team spirit and their enthusiasm*".

This is also reflected in the students' positive responses, as the great majority of them stated that they really liked the badges.

It should be highlighted though that according to the teachers' qualitative feedback the acquisition of badges was not the primary incentive though, as they had developed intrinsic motivation, with robotics classes per se and their engagement with the robots being the inner motive and the source of their eagerness for the upcoming classes.

This can be said to be the added value of the RDPSEC schools piloting implementation of the project, verifying research findings in educational robotics literature pointing to the beneficial motivational effects of such classes. Still, they were awarded a very satisfactory number of badges.

- Special value of the CODESKILL4ROBOTICS Tool Kit Implementation classes

What is of particular interest, is that teachers, when asked about the special value of the robotics classes instead of focusing on the enhancement of their professional profile, they accentuated the possibilities generated for them to help their students acquire coding skills and bring them into contact with new Technologies, while promoting cooperation. In this spirit, teacher E alluded to the importance they had for her:

"*In order to evolve my knowledge on a tool that is has a great appeal on students and is among the most useful ones for their present and future*".

Placing also at the center of attention students, teacher F pertinently mentioned the skills acquired in robotics classes allow them to:

"learn through play, hands on, increase creativity, enhance knowledge and algorithmic thinking"

On the same wavelength, it seems that for students the special value of CODESKILLS4ROBOTICS classes is encapsulated in three categories, namely the new coding knowledge acquired, robot construction and the potential for cooperation with their team. In fact, the prospect of cooperation featured prominently among students' answers.

Pertinently, when asked about what they liked more, a female student interestingly commented:

"What I really liked most in my robotics classes is that I learned how to programme robots and that I cooperated with my friends".

In a similar spirit, another student pertinently noted that:

"What I liked most is that I constructed something of my own and cooperated with my friends"

Overall, what is really worth noting is that the students' answers on which parts of their robotics classes they personally valued more, reflect that they appear to have grasped the importance of the robotics classes attended; Interestingly, the three overall categories their answers fall into reveal that they have placed particular emphasis on the key benefits of educational robotics that are also widely recognized in the relevant body of literature. This finding can be can be said to bear more evidence to the positive impact and by expansion the effectiveness of the CODESKILLS4ROBOTICS piloting implementation in RDPSEC schools.

- Learning Impact of the Tool Kit implementation classes

The aforementioned feedback is closely intertwined with the project learning impact, which appears to have been high, as learning outcomes seem to be very positive with the vast majority of students denoting that they have learned many new things, while expressing at the same time their strong desire to attend more CODESKILLS4ROBOTICS classes.

The good learning outcomes are verified by the teachers themselves, who unanimously underlined the fact that all students acquired engineering construction knowledge and basic coding skills as well. In particular, echoing teacher C:

"They grasped basic coding conceptions like code sequence, coding repetition and code choice structure"

Besides Coding skills, the students were also involved in activities that develop overall STEM skills. Pertinently, having verified that her students had learned a lot, a teacher remarked that:

"*They had the opportunity to analyze and design actions and engage in activities that required the application of mathematic and technological concepts and skills*

These findings bear all the more considerable significance, being reminiscent of the fact that the majority of the students participating in the pilot testing were novice in robotics and coding. Besides the core coding skills though, particular emphasis was given το the acquisition of other soft skills as well.

According to the testimonial of the piloting experience, as described by a school principal:

"It gave students the possibility to develop creative skills, logical thinking, problem-solving skills and cooperation skills, which are very important for contemporary learning and education…"

- Participants' intentions to further exploit the programme products in their life.

All teachers unanimously expressed their intention to make use of the CODESKILLS4ROBOTICS Tool kit for teaching other students in their class, with teacher D stressing that:

"The Tool Kit is an exceptional teaching tool"

Of particular interest is also the fact that the great majority of students as well stated that they intended to use the acquired skills and knowledge both at school and in their daily life.

- Participants' intentions to recommend the platform and the programme to others.

Finally, it is noteworthy that the largest majority of students mentioned that they would definitely recommend their friends and classmates to attend CODESKILLS4ROBOTICS robotics classes themselves and use the e-platform.

Accordingly, all teachers stated that they would definitely recommend their colleagues to make use of the Tool Kit, so as to make use of the benefits offered. As teacher D effective stressed:

"It would be a good opportunity to broaden their knowledge but also the children's skills as well".

These findings can be said to be of great importance in terms of the sustainability of the project outcomes per se.

National Center for Scientific Research 'Demokritos'

ii. Tool Kit Piloting Evaluation Results

According to the evaluation criteria set, Demokritos schools data analysis has led to the following results:

- Usefulness of the content of the robotics lessons

According to the answers of teachers and students the pilot application of the project was described as very useful. According to the teachers, the students were excited about the lessons and at the end of each lesson they expressed their impatience for the next one. This tendency is confirmed by the answers of the students who stated that they liked the courses of the program very much and found them very interesting.

- Quality of the teaching material in the e-platform

Regarding the quality of the educational material in the e-platform, the teachers stated that the material was very useful and also that the way it was presented was very helpful. A teacher stated:

"*The way the material is presented, in the form of "micro-chapters", was very helpful for the students.*"

The students also, as a whole confirm this observation of their teachers stating that the content of the e-platform was really interesting and helpful.

- Usefulness and Quality of the e-learning platform

Regarding the usefulness and quality of the e-platform itself, the teachers replied that they found it easy to use and very helpful. As far as the attitude of their students is concerned, they stated that its existence was useful and that they did not encounter any problems using it. The teachers stated that by having all the educational material on the e-platform helped a great deal since students tend to lose the material that is given to them in printed form. There was no such a problem by using the e-platform. The students themselves, when asked the same question, stated that the use of the e-platform was very easy and helpful.

- Usefulness of the Open Badges

The fact that students would not just participate in the program but also be awarded with digital badges certifying the skills they acquired acted as a strong incentive for them, according to the teachers. In particular, they stated that the students were very excited and eager to acquire them.

The same enthusiasm is reflected on the students' answers who stated that they really liked the Digital Badges and were very keen on showing them to their friends and peers.

- Special value of the CODESKILL4ROBOTICS Tool Kit Implementation classes

Regarding the special value of the CODESKILL4ROBOTICS Tool Kit Implementation, teachers responded that this kind of training is really useful for their Continuous Professional Development (CPD), since they feel it is their obligation to acquire these new skills and knowledge in order to be able to transfer them to their students, which in their opinion will be very valuable later in their lives when they seek employment.

What was very interesting was that students also realized how valuable the aforementioned skills and knowledge are for school and later in their lives. As a young student enthusiastically commented:

"I liked everything! Build the robot from scratch and then think about how to program it to make some moves. It was something different from the regular lessons we do and I really enjoyed it. I hope to take F2F lessons again so I can learn other nice and useful things!"

- Leaning Impact of the Tool Kit implementation classes

As far as the learning impact of the pilot implementation is concerned, the responses of both teachers and students suggest that it is more than satisfactory. Teachers reported that their students have acquired new skills in educational robotics and programming, which are considered very important since their students had no previous knowledge on these subjects. Students appear to be very excited and stated that they learned a lot of new things and that they would like to attend educational robotics and programing courses again in the future.

- Participants' intentions to further exploit the program products in their life

All participants, teachers and students, stated that they intend to take advantage of the knowledge and skills acquired from the piloting implementation both in their school environment, in other subjects, as well as in their daily lives. It's worth mentioning that a teacher, when asked if he intends to use this educational material for the rest of his students he responded:

"I believe that this educational material is very well made and introduces, in a smart and understandable way, the principles of educational robotics and programming. My intention is to use this educational material with all my students."

- Participants' intentions to recommend the platform and the program to others

Regarding the questions about whether they would recommend to someone else to attend the CODESKILLS4ROBOTICS program and sign up to the online platform, both teachers and students responded that they would do it with great pleasure. The teachers also pointed out that based on their experience, and especially the way that their students enthusiastically participated in the courses, they would recommend other colleagues to use the CODESKILLS4ROBOTICS Toolkit educational material with their students.

Hellenic Mediterranean University

iii. Tool Kit Piloting Evaluation Results

Based on the evaluation criteria set, HMU school data analysis has come up with the following results

- Usefulness of the content of the robotics lessons

The two teachers that participated in the pilot training agreed that the content of the robotic lessons was very interesting and useful. In particular, as teacher A stated:

"It was an excellent experience and attracted the interest of children who had not been in contact with educational robotics in the past"

Teacher B also added that:

"The educational implementation was very useful for the students, as it gave them the opportunity to develop their research interest».

From the side of the students, all of them liked the lessons and have agreed that the content was very interesting.

- Quality of the teaching material in the e-platform

The teachers agreed on the very good quality of the teaching material not only for the basic principles but also for the creative and interesting scenarios. All of the student agreed that the quality of the teaching material was good enough for them.

- Usefulness and Quality of the e-learning platform

Both teachers agreed that initially there were some problems with the use of the platform, but after some time they familiarized with it. Students also had the same problem, but the issues had been resolved after the teachers' assistance.

- Usefulness of the Open Badges

As far as the usefulness of the badges is concerned, the teachers have the opinion that the open badge system is not so important for the students. However, the students earned 30 badges, with some of them not so motivated or impressed by them.

- Special value of the CODESKILL4ROBOTICS Tool Kit Implementation classes

Regarding the particular value of the CODESKILL4ROBOTICS Tool Kit Implementation, as one teacher responded the tool Kit improves:

"skills that support both the structured way of thinking and the possibility of outside the box of thought"

Another teacher commented that:

"The tool Kit improves skills that promote a constructive understanding of the learning activity and introduce modern and innovative tools into the education, making the learning process more attractive and effective"

The students want to continue using the platform and participate in new lessons, since they said that it improves their creativity. In fact, when asked what they enjoyed most, a student effectively noted:

"What I liked most in the robotics classes is to create things that I was not able to"

- Leaning Impact of the Tool Kit implementation classes

Both teachers and students said that it is satisfactory and creative to program and construct small educational robots. In particular, the teachers stated that students understood the basic principles of educational robotics, learnt new things, and would like to participate in more lessons

- Participants' intentions to further exploit the program products in their life

Teachers feel motivated to apply the knowledge and tools gained from the pilot implementation of the program to their working environment. They also intend to use the CodeSkills4Robotics toolkit to teach educational robotics to other students. In addition, students also feel that they have learned several things that they will use in their daily lives.

- Participants' intentions to recommend the platform and the program to others

Based on the questionnaire answers, teachers would unreservedly recommend the educational platform to other colleagues. The students who participated in the pilot implementation of the program intend to do the same.

Cyprus

Emphasys Center

iv. Tool Kit Piloting Evaluation Results

On the basis of the evaluation criteria set, Emphasys Center data analysis has generated the following results:

- Usefulness of the content of the robotics lessons

Both teachers and students evaluated the content of the robotics lessons as very useful and interesting. Teachers stated that CODESKILLS4ROBOTICS lessons were an alternative way to teach basic and advanced digital skills. According to the teachers, the participants were looking forward to the lessons and as a teacher stated:

"It was quite challenging to convince students to leave the class"

- Quality of the teaching material in the e-platform

Teachers stated that the teaching material was creative, and the way it was presented on the platform was very easy to follow. More specifically, students showed great interest in the Moving REA chapter, following the line with REA and the gears. In addition, including the clear step-by-step guide for building REA was extremely useful part of the material. Some of the students stated that they prefer to have the teaching material in a digital form instead of carrying books in their bags, as they do in schools.

- Usefulness and Quality of the e-learning platform

According to the results, the eLearning platform is easy to use and user friendly, and none of the users encountered any problems using it. Also, neither did the students face any difficulties using it. And the assistant teachers were always there to provide help and support.

- Usefulness of the badges

In general, the badges were a great motive for students, especially for this age. Thus, teachers found the Open Badges a great and useful way to engage students and keep them motivated to earn and learn more. Students loved the badges; As one student noticed

"I really like the Open Badges! It was a great motivation for me",

However, they were also asking for the printable version of it!

- Special value of the CODESKILL4ROBOTICS Tool Kit Implementation classes

The development of the CODESKILLS4ROBOTICS Tool Kit is an inclusive deliverable for the project, as it consists of the material needed for the successful implementation of the program. The teachers mentioned that the toolkit was extremely useful for exploitation and its value to transfer new skills and knowledge to learners. When students asked what they like most about their robotics classes a student commented:

"The teachers were very supportive!"

With another student interestingly adding:

"Mr. Robotakis (Mr. Nicholas nickname) was very friendly and funny!

- Leaning Impact of the Tool Kit implementation classes

Both the teachers and students have acquired new skills in both coding and robotics. One of the main aims of CODESKILLS4ROBOTICS program is to improve students STEAM skills and cultivate their soft skills as well. Students have reported that the CODESKILLS4ROBOTICS program helped them acquire skills outside the school's curriculum, such as creativity, teamwork and problem-solving.

- Participants' intentions to further exploit the programme products in their life

Acquiring new skills such as coding and robotics is a huge advantage for learners' future. Teachers stated that they would definitely use the material,

either in other European courses (KA1, etc.), summer or intensive programs or as a base for other robotics courses.

- Participants' intentions to recommend the platform and the programme to others

As far as the recommendation questions are concerned, both the participant's types responded positively, with a teacher relatively commenting

"An extremely interesting course that should be widely promoted and used by other schools"

Acquiring new skills such as coding and robotics is a huge advantage for learners' future. Teachers stated that they would definitely use the

Sweden

Halsingland Education Association

v. Tool Kit Piloting Evaluation Results

On the basis of the evaluation criteria set, Halsingland Education Association piloting school data analysis has generated the following results:

- Usefulness of the content of the robotics lessons

The robotics lessons according to the teachers were said to have been very useful and as one teacher noted:

"The students and I have thought that the pilot project has worked well and the students have thought it was fun and had full focus on the mission"

All students also unanimously agreed that the robotics classes were very interesting and that they really liked them very much.

- Quality of the teaching material in the e-platform

Both teachers and students found the teaching material on the platform to be of high quality, easy to follow, fun and inspiring. Responding to the question whether the teaching material in the e-platform was helpful and interesting for the students, the teacher's short and definite answers was:

"absolutely!"

As another teacher commented:

"The students found the material on the platform useful and also helped them in their progress. The Space Scenario inspired them to measure and understand easier distances".

- Usefulness and Quality of the e-learning platform

According to the teachers, all students have found the platform useful and easy to use with their assistance. Thanks to the step-by-step instructions, it became possible for some students to work very independently.

Students themselves have responded that the platform was easy and useful.

- Usefulness of the badges

Regarding the Open Badges the majority of students appear to have liked them. Teachers have also verified that Badges have been quite motivating, but robotics classes themselves have been the primary motive. This is clearly reflected in one of the teachers' responses as to whether the badges were motivating:

"Yes, to some extend they motivated the students to gain the visual evidence of their progress. But the most motivating thing was to actually work with their robots and coding them".

- Special value of the CODESKILL4ROBOTICS Tool Kit Implementation classes

Both teachers were in total agreement that Coding and robotics skills are important, as they are included in the country's National Curriculum for primary education. Commenting on the usefulness of robotics kills a teacher stated:

To start with, it is in the Swedish National Curriculum to work with Robotics and Coding Skills make students think in a more innovative way.

The teachers emphasized in particular that CODESKILLSFORROBOTICS Tool Kit is a great way to introduce programming in a fun way.

All students also thought it was more exciting and fun to work with programming attending the program. A student stated that he enjoyed most the part:

"When we were coding a robot, so it moved!"

- Leaning Impact of the Tool Kit implementation classes

Both teachers responded that there was development potential in the group and a drive to continue working, as students wanted to continue the project after school day was over. The students learned how to use sensors in a new way. As a teacher commented:

"They worked in a concrete way, using both hands and brain in a collaborative way. It was not only a theoretical learning."

The vast majority of students responded that they had learned a lot of new things and expressed the desire to continue, having even more coding and robotic classes.

- Participants' intentions to further exploit the programme products in their life

The teachers expressed their intention to continue to use the CODESKILLS4ROBOTICS Tool Kit. As one teacher commented:

"The rest of the students in the classes will also gain form the programme".

Most students also stated that they would use what they learned both at school and in their every-day life.

- Participants' intentions to recommend the platform and the programme to others

Teachers mentioned that they would definitely recommend using the Toolkit and spread the CODESKILLS4ROBOTICS concept of materials and platforms to schools and leisure centers in Sweden. As a teacher commented

"The students have found it exciting and educational. I think that leisure centers could have great pleasure in using the material".

Finally, all of the students were very enthusiastic about recommending their friends and other kids at school to use the platform and the programme.

2.2.b. Concluding Evaluative Remarks

In a nut shell, drawing on the aforementioned corroborated evaluation feedback on the basis of the input provided by the teacher and student population engaged in the piloting implementation of all partner countries the reliable conclusion to be reached is that:

CODESKILLS4ROBOTICS Tool Kit Piloting implementation in all partner countries was met with great success.

Summing up the findings previously gleaned, it seems that in all countries, all the involved parties have reached the consensus that the **CODESKILLS4ROBOTICS** lessons were deemed **very useful and highly interesting** and **all the more motivating** for the students. On the whole, the educational material, the e-courses and the e-platform per se were ranked as **very handy** and **user-friendly** by the vast majority of the participants. Students across countries expressed their eagerness and enthusiasm about the Robotics journey, being in accord that they have learned a lot through play, with their teachers acknowledging that they have acquired important coding skills, STEM skills, problem-solving skills, developing critical and algorithmic thinking along with other soft skills such as creative thinking, in a harmonious cooperation with their peers. What is also noteworthy, is that students vehemently expressed their desire to attend more robotics classes. Finally, acquisition of badges did seem to act as a motivation factor, though to varying degrees in each country.

Hence, it is of utmost importance that the initial **dual aim of the project** to elevate teachers' digital profile and by expansion facilitate students' acquisition of Coding and Stem Skills **has been successfully fulfilled**, as the very satisfactory learning outcomes in all countries denote. In fact, what is of special interest is that the findings indicate that the CODESKILLS4ROBOTICS piloting implementation in all countries has been instrumental in helping students develop not only the core **coding** and **STEM skills** and **computational thinking**, but also the diverse accompanying **transversal skills** that are widely recognized in the relevant body of literature as educational robotics associated benefits. This can be said to be one of the added strengths of the overall piloting implementation.

The manifested variation in terms of the motivational value placed on the Open badges can be accounted for by the fact that its philosophy as a form of digital validation is not equally widespread in all countries depending on the educational national context. In any case, for those students mainly from Crete and Sweden for whom robotics classes per se were the primary genuine driving force behind their intrinsic motivation, this finding can be said to contribute the most to the added value of the piloting implementation in the particular cases.

Another salient finding is that the fact that the student participants saw eye to eye they would apply the acquired skills in their everyday life and that in their overwhelming majority they **were favorably disposed** towards the idea of recommending the robotics classes to their peers. Coupled with this, the absolute majority of teachers expressed their strong intention not only to implement the program with other students, but also to recommend its products to their professional environment. The aforementioned finding all the more reflects **the program favorable impact**, enhancing the prospects for its sustainability.

Finally, the overall **high level of congruence** found among the **respondents' perceptions** of the CODESKILLS4ROBOTICS implementation across countries, on a primary level can be said to strengthen the project research findings credibility and transferability. On a deeper level though it manifests the project's **highly positive impact**, simultaneously signifying a very **promising mind shift** in terms of the perspectives opened for implementation of such novel and innovative teaching practices for promoting **21st century skills** that should inform policy makers' decisions both on a National and EU level.

2.3. Overall Tool Kit Impact

In the light of the aforementioned **Tool Kit piloting evaluation results** and on the basis of the supplementary qualitative feedback received by each partner across countries, a **brief overview** of the overall Tool kit impact is tackled below, focusing on the particular benefits reaped by the Tool Kit implementation process on the whole, as experienced by each partner separately in the three countries.

Greece

Regional Directorate of Primary and Secondary Education of Crete

51 Cretan students and 10 teachers from the four RDPSEC piloting schools across all regions of Crete, namely, Plakias Primary School in Rethymno, 19th Heraklio Primary School, Nea Anatoli Primary School in Agios Nikolaos and Tavronitis Primary school in Chania, were offered the opportunity to share a valuable educational robotics experience either as part of their morning school program or engaged in extra-curricular activity after their school during extended zone.

Under the supportive guidance of their highly motivated teachers, **all students**, the majority of whom had no previous experience of coding classes, regardless of their **diverse background**, be it learning difficulties, special needs and abilities, race, have embarked on this **amazing educational robotics journey**, taking on the role of **little explores** and **engineers**, inherent in such ages, while having as co-travelers the Lego Boost robots. According to the feedback received, the **overall impact** of this Tool Kit piloting journey can be said to be **enormous** both for the students and their teachers on various levels.

Firstly, with a special emphasis **on learning by doing-hands on experience**, all students in their CODESKILLS4ROBOTICS classes were actively involved in robot

construction, acquiring construction knowledge in the most **fun and highly engaging way** that learning through play approach offers. In fact, the presence of the robots seems to have increased their interest and motivation, as robot construction is among the piloting aspects reported to have been more appealing for the students.

Furthermore, through the piloting robotics classes, children's **way of thinking** can be said to have been **improved,** as the **coding skills** and the **algorithmic thinking** coupled with the metacognitive skills developed in their attempt to train the robot how to solve a problem are instrumental in that direction. All the coding skills acquired have contributed to students' enhancement of **STEM skills** integrated in other subjects as well. Besides the core benefits derived from coding skills, the teachers' feedback also reveals that students have been equipped with various other **transversal and soft skills** the development of which is closely associated with the benefits of robot programming activities in the educational robotics literature, such as creative and critical thinking, problem-solving skills etc.

In addition, the CODESKILLS4ROBOTICS Tool kit has presented an **excellent opportunity for project-oriented learning** and its generated benefits, as students were reported to have enhanced their cooperative skills and their overall communications skills, which are considered to be among the most important life-long learning skills. In fact, it is worth highlighting that cooperation with their peers and the team work has had a very prominent place in the students' qualitative feedback pertaining to what they enjoyed most in their classes. Echoing a student:

"What I really liked was that I constructed something of my own, and we cooperated with my team"

Besides the opportunities for **peer learning** that team-work cooperation has generated for students during the actual teaching piloting implementation classes, the **blended learning opportunities** Tool Kit offered by means of the e-learning platform and educational material and the e-courses available can be said to have a substantial contribution to i**ndividualized** and **personalized learning** as well. Students were able to engage in self-studying and tailor their robotics consolidation plan to their own pace, cognitive level, learning style and overall interest at the comfort of their home with the help of their parents, always under the guidance of their teacher with whom they could have instant

communication by means of the various communication tools of the e-platform.

Apart from students, the Tool Kit has had a **considerable positive impact** on **teachers** as well, being an important **Training Tool on Educational robotics**, empowering them with the necessary digital skills, which were validated by the acquisition of badges. This is all the more important, in the light of research findings in the relevant robotics literature showing that teachers' participation in educational robotics programs result in an increase of their self-esteem and their effectiveness in STEM teaching. In fact, the opportunities offered to teachers for inter-disciplinary application of the Tool Kit with the enrichment of the educational material with the proposed teaching History, Space, Culture creative scenarios not only has it increased teacher motivation but it has also made it more relevant and meaningful for their everyday teaching practice.

On the whole, regarding the target pilot audience directly involved in the piloting implementation, the Tool Kit has been a **valuable tool** for **teachers' Continuous Professional Development** and the enhancement of their **professional digital profile** and by expansion for improving those piloting schools' students' skills that constitute the **fundamental 21st century skills** so as to become the prospective **digitally literate citizens.** Furthermore, in an attempt to raise further awareness by means of the invitation to sign the **Memorandum of Digital Commitment** and become the project ambassadors to the rest of the teaching staff in the Digital Piloting School clubs, they also became acquainted with the important purposes of the digital education the program supports. Generally, the Tool Kit can be claimed to have opened a window for all the school stakeholders into the digital world, bridging the gap between school education and the labour market.

Overall, the prior mentioned multi-faceted highly positive CODESKILLS4ROBOTICS Tool Kit **impact** in RDPSEC schools is effectively encapsulated in the following teacher testimonial:

"Through the program we had the opportunity as teachers to become aware of the potential and the benefits of educational robotics in schools. The students, who are the best judges of a program responded not only with joy, but enthusiasm. They sipped knowledge of robot construction, engineering and coding, played, experimented and finally saw a whole new world unfolding in front of their eyes. They have become the central protagonists along with their robots on a journey that will follow them for years. The program was the start we

needed so as to continue with the necessary knowledge, experience, strength and joy"

Teacher Expert from Plakias Primary School

Admittedly faces speak louder than words; In retrospect, the pandemic conditions may not have allowed us to capture to the full the image of the brightest smiles on the faces behind the protective masks; Nonetheless, against all odds amid the Covid-19 pandemic, the enthusiasm with which the CODESKILLS4ROBOTICS Tool Kit was met by the students' smiley eyes in Regional Directorate of Education in schools in Crete is clearly reflected in one of the students comments on his piloting class experience:

"I would do it 1000 times again!!!!'

Plakias Primary School student

Demokritos:

Despite the difficulties encountered due to the pandemic and the subsequent uncertainty it brought with it, with schools constantly opening and closing, the impact of the toolkit in Athens, Greece was huge for all parties involved and especially for the children. The 3rd and 11th Primary School of Marousi, its teachers and most importantly its pupils had the unique opportunity to engage in a very interesting and engaging extra-curricular activity after school hours and during their stay at school in the framework of the extended - all day zone (oloimero).

They were introduced to the **fascinating world of coding and educational robotics**, using the appropriate equipment and the developed e-learning platform for further reading and for communication with each other and the teacher. This was done in a **fun and engaging way** with "learning by doing" and "learning by playing" concepts in mind. All parties involved commented positively on the usefulness of the e-platform and how it complements the whole educational process. In the words of a teacher:

"Pupils tend to lose or misplace their notes so, having all the educational material stored in one place was a great help as students could access the e-platform and revisit the material that they were taught. It also gave them a way to communicate with one another in a controlled online environment".

Their **enthusiasm** and **commitment** were beyond expectations and they expressed their will to continue even after the end of the project, which is something that Demokritos also wishes and especially in a face-to-face context in order to give the children more time to actually build and program the robots to perform certain actions hands-on. According to one of the students:

"I was fascinated by the capabilities of the Lego Boost robots and the magic that happens when programming it! I wish we could spend more time building and programming these robots. They are fun and we learn very nice things playing with them".

In fact, arrangements have already been made with the principal and with the parents in order to transfer the educational robotics classes to Demokritos premises in the summer after the schools close as a summer school with the participation of more children, if the pandemic conditions permit it. In case that this is not possible either, it is the will of both parties to arrange such an activity when the conditions allow it as part of our exploitation and sustainability strategy.

Additionally, teachers and school leaders were introduced to the **benefits of educational robotics** and how it can be combined with traditional lessons in the classroom. Through the informative and training activities they realized the importance of algorithmic thinking and STEM skills combined with soft skills for the pupils. In the words of one of the teachers:

"I had heard of educational robotics and STEM skills but didn't have an opportunity before to see them hands on. They are such a powerful tool both for us as professionals as we saw ways of using them in more traditional lessons such as history but most importantly for the kids as it introduces them in a fun and engaging way into how to think with a critical mindset, how to solve problems and how to work in a team."

The pilot training offered an insight for all involved in the future of education and the required skills to match the needs of the labour market and the ways to bridge its gap with education. It also offered both students and teachers an **empowering way** to understand better the **digital life** we live in nowadays. Finally, it offered both target groups a valuable tool for the **continuous**

professional development of the teachers and the building of a robust CV for the students who through the earning of open badges can validate and prove their newly acquired skills.

Overall, it should be mentioned that the whole educational process brought **joy**, **smiles** and **impatience** to the pupils for the next lesson. It was apparent from the first day that they were enthusiastic about the process of being introduced to a new exciting and interesting world where they could learn by playing and actually building something. Even when the training was switched to online, the enthusiasm was still present, as it was a gateway for them to meet with their peers and with new exciting and worth-while knowledge in an informal setting. In the words of the teacher:

"Initially I expected disappointment from the students after the training was switched to online but instead I met smiling faces, eager to engage and continue learning and eager to communicate both with me as well as with each other in a time when the Covid-19 restrictions do not allow them to meet every day".

Finally, the impact of quickly transferring the setting from face-to-face to online was really powerful as not only were pupils able to continue the pilot training but also introduced and paved the way for an **innovative way of teaching educational robotics** in these times of the **Covid-19 pandemic**.

Hellenic Mediterranean University

Regarding the overall Tool Kit impact, its implementation **improved the students STEM skills** and the **way of thinking**. Moreover, students understood the basic principles of educational robotics and would like to enroll and participate in more lessons.

Teachers feel **motivated** to apply the knowledge and tools gained from the pilot implementation of the program to their working environment. They also intend to use the CodeSkills4Robotics Tool kit to teach educational robotics to other students. In addition, students also feel that they have learned several things that they will use in their daily lives. In addition, teachers would **unreservedly recommend** the educational platform to other colleagues, while

the students who participated in the pilot implementation of the program intend to do the same.

HMU, after the pandemic restrictions, intends to **invite several schools** to visit the Control Systems and Robotic Lab at HMU in Heraklion Crete not only to present the codeskills4robotics modules, but also to show students a number of real robots that have been designed by the Lab's team (https://www.youtube.com/channel/UCfuikKvPiJgEVQiqFWRotzA).

Cyprus

Emphasys Center

The impact of the COSESKILLS4ROBOTOCS tool kit was **huge** for all the parties who were involved in this piloting. First of all, Emphasys' staff member profiles have been developed through the acquisition of new competences. The new teaching approaches, style and methods followed to cover the project's needs, improved teachers' effectiveness and enhanced their creativity.

Another important aspect is the **reinforcement** of the **relationship** between teachers-students, teachers-parents, but also parents-students. The robotics lessons have helped many parents, teaching them that school-related skills (STEAM) can be also acquired through other innovative ways. Both students and parents have realized that learning can also be fun.

It is worth mentioning that the **students' motivation, self-esteem** and **self-confidence** have been developed, as they have been exposed to programming. The participants had the opportunity to apply their newly acquired programming skills into practice and understand the digital world and how simple and daily things work (such as how electric devices work using sensors).

Their introduction into this new world of robotics has also improved other skills such as their **problem-solving skills**, **analytical thinking**, and **creativity**, which will better equip them with skills that match the labour market's needs. Having

validated their skills with the Open Badges eco-system, a well-known recognition mechanism, which can **strengthen** their **CV**.

Sweden

Halsingland Education Association

COSESKILLS4ROBOTOCS tool kit has been **huge** for all the parties who were involved in this piloting., both students and teachers.

The students saw and learned to see opportunities with the kit. They wanted to continue and develop their own constructions with the help of the Toolkit They have acquired basic **coding skills**. Some of the students found it easy to build and code REA and they managed to continue building Robot Vernie. The robotics classes have contributed also to their **cooperation**.

It should be also stressed that according to the teachers, they saw that students working with and programming robots has also increased their **motivation** in other **STEM subjects**, especially Physics. The possibilities will be reviewed for starting robot clubs in schools and leisure centers. It is a good way to work with CODESKILLS4ROBOTICS Tool kit, since it connects smoothly to STEM and its skills and the students are provided with a clear and good tool.

CODESKILLS4ROBOTICS Tool kit has also had a very positive impact on teachers' **digital skills**. In fact, as coding and robotics skills is part of the National Curriculum and its part of Swedish schools' governing documents to work with programming, the Tool Kit material is a perfect tool for this. As a teacher noted:

"Programming is part of the Swedish curriculum for primary school. This means that as an educator I must be able to teach our students what programming is, and how things work. Programming is an important educational tool to help children understand our increasingly digital future".

2.4. Pros and Cons

In view of the overall highly positive impact that the tool Kit has had in all countries, the present section briefly touches upon the **positive aspects** and **potential difficulties** encountered by each partner in an attempt to provide an insight into strengths, weaknesses and **opportunities** generated for **improvement** and avoidance of future pitfalls.

Regional Directorate of Primary and Secondary Education f Crete

Positive Aspects

- ✓ An aspect of paramount importance for the piloting implementation in Crete was the **great number** of the **students** and **teachers** involved, on the basis of the RDPSEC project pedagogic team conscious decision not to limit to the perquisite of one school participation. Hence, the strong network of schools under RDPSEC supervision has allowed it to offer the opportunity to more students to avail of the benefits of this innovative educational robotics program, seeing that its results would reach student population even in small-scale and somehow more remoted schools. This increased number of participants has made it also possible for the project products to be pilot tested to a greater sample, enhancing in this way the **credibility** and transferability of the results obtained.

- ✓ An equally important element characterizing the Tool Kit Implementation in the case of RDPSEC was the incredibly **active engagement** and **commitment** of all the stakeholders involved throughout the process, ranging from the four education coordinators and the school principals to the teachers and the teacher experts, with whom both the RDPSEC project manager and CODESKILLS4ROBOTICS Piloting Coordinator were in close cooperation throughout the whole process. This has a greater value in practice, bearing in mind the whole pressure exerted due to the pandemic conditions dominant in schools. Special reference should also be made to the substantial contribution

of the teacher experts both in terms of the development of the creative teaching scenarios included in the educational material, but more importantly the expertise sharing during training sessions and the constant support and guidance offered to the teachers all along. The **availability** and **highly cooperative stance** both of the teachers and experts has been instrumental in the success of the piloting implementation.

- ✓ An additional beneficial aspect is the fact that the pandemic conditions in effect at the time in Crete have favored the Tool Kit piloting teaching classes to take place **fully** in the **physical presence** of students, allowing teachers to provide on the spot guidance and support. Hence, this f2f teaching has made is possible for students to avail to the maximum of the benefits generated from the multisensory environment stimuli offered and by the real time contact and hands on experience with the robots in cooperation with their classmates, which has enhanced their motivation to a great extent.

- ✓ Of equal importance is the fact that in accordance with the initial digital strategy to be adopted for RDPSEC schools, Tool Kit **implementation** will **continue** after the official ending of the piloting period, where permitted by the pandemic conditions, aiming in this way to make use of the project benefits to the maximum, while at the same time laying a solid basis for its sustainability. In fact, after the official pilot period ending, during the period the primary schools were in online teaching mode, as reported by one of the teachers, her students kept asking how and when they would continue the robotics classes after the lockdown.

- ✓ Another aspect of Tool Kit piloting classes, being of paramount importance, is their **multi-fold learning impac**t, as students had the chance to develop a wider spectrum of skills, besides the fundamental **Coding** and **STEM skills**, namely the **soft** and t**ransversal** skills preparing them as life-long learners

- ✓ The prospects generated by the Tool Kit piloting in terms of i**nclusiveness** on **multiple levels** is an additional highly appreciable point in favor. To begin with, the high rate of girl participation per se, with boys surpassing girls only by 2% indicates that the project implementation has managed to increase **girl representation** in STEM world. In fact, according to the oral feedback of teachers, girls in many cases were even more passionate and committed than

boys. Furthermore, the active participation of a great number of students with an immigrant or foreign background is an additional factor conducive to their social and educational inclusion. Especially, as attested by a school principal, COSESKILLS4ROBOTICS classes have offered a valuable opportunity for a creative extra-curricular activity for these students, for whom due to geographical obstacles creative educational centers or after school activities are not available. Finally, the project has contributed to the successful **social** and **educational inclusion** of participating students with learning difficulties and other SEN students like Asperger syndrome, proving that educational robotics is for all students. In fact, according to the teachers' oral feedback those students have managed to acquire not only robot construction skills and basic coding commands, but more importantly, to be socially integrated into their teams in a very highly cooperative climate, showing visible improvement signs in terms of forging a closer relationship with their classmates. The latter verifies literature evidence that educational robotics can enhance improvement of social skills regarding children in autism spectrum.

- ✓ An additional advantageous point is the **strong dissemination campaign** launched by RDPSEC following the initial informative and raising awareness campaign. During the period of Piloting implementation, a systematic **social media campaign** was run, aiming at promoting the project results, the educational material and the e-platform tools to relevant stakeholders and arouse the interest of more schools and educational institutions that would like to implement the project. This was coupled with a targeted Tool kit piloting dissemination campaign **in local** and **national media**, by means of press releases, articles on local and national press and news portals, special TV shows tributes on local TV Channels etc. In this way, the project aims and results, piloting photographic material and testimonials from the participating stakeholders were communicated to a broad and diversified audience, laying a solid foundation for the Sustainability Plan to be followed. In fact, the dissemination strategy seems to have borne some fruit, paving the way for project sustainability and exploitation in Crete, as a new school in the region of Chania has already commenced the implementation of the CODESKILLS4ROBOTICS Tool Kit.

- ✓ A final point worth mentioning is the unanimous willingness expressed by the teachers to implement the project with other students and recommend the

project products to other teachers, bearing out all the positive sides of the Tool Kit implementation in Crete, while being the driving force behind a promising project sustainability future. Overall, all the aforementioned positive aspects would have rendered the pros list meaningless, had it not been supplemented by the most valuable feedback regarding the **students' great enthusiasm** and their **eagerness** for their robotics classes. It goes without saying that the fact that students have **embraced** the CODESKILLS4ROBOTICS program is a sine qua non condition for implementing the venture of Tool Kit as a whole.

Setbacks

– The limited time available for ICT teaching in the primary school curriculum has restricted the time available for the CODESKILLS4ROBOTICS classes as no more than two teaching hours per week could be devoted. Notwithstanding the barriers coupled with the uncertainty generated by the enforced lockdowns that could not be foreseen, extending the overall period of piloting in week time has made the piloting completely feasible in all schools.

– Budget limitations have restricted the opportunities for providing Lego Boosts Kits and tablets so that students could work ideally in pairs, resulting in their sharing the robots with more students.

– A final point of minor trouble were some technical difficulties encountered with the registration on the e-platform requiring a student email, which many of them did not possess. Although this may have generated some retardation, it was solved by the Project Coordinator with the use of parents' emails or the creation of fake ones. It is advisable that teachers who are to implement the project in the future could resort to the solution of creating an email for those of the students lacking one and provide them the credentials to log in, so as to save time.

Constructive Suggestions

In light of the lessons learned from the piloting experience in RDPSEC Schools the following suggestions are made:

- ✓ The presence of one teacher and one teacher expert is advisable for the most effective implementation of the Tool kit, especially in the case of large student groups.

- ✓ As most of the students were novice in robotics classes more time than initially planned was devoted especially to Module 1 in order to make sure that all students would grasp the basic concepts. Hence, it is sensible that more teaching hours will be needed for each module. Within this framework, it would be expedient to allow for more than two introductory lessons to familiarize students with the e-learning platform.

- ✓ Moreover, the Regional Directorate of Education of Crete piloting experience has revealed how important the training teacher-mentors had received was for the implementation of the project. Thus, it is expedient for those teachers interested in implementing the CODESKILLS4ROBOTICS programme with their students to have some training so as to be able to exploit the educational tools in the e-learning platform in the most effective way. Within this framework, and as part of the RDPSEC **sustainability plan**, training seminars and webinars will be organized with the support of teacher-mentors and CODESKILLS4ROBOTICS experts from the piloting schools who would act as the mentors for the new teachers.

- ✓ Pertinently, the strong community of learning formed by the four piloting schoolteachers with the substantial contribution of experts along with the strong potential for the project support by e-twinning groups could be a valuable source of expertise for the teachers wanting to implement the program. In any case, it is recommendable that those schools interested in implementing the project pay attention to the formation of synergies with the local community, out of which sponsors could also be sought to support the provision of Lego Boosts that cannot be purchased.

- ✓ Furthermore, the creation of synergies and volunteer experts' network has turned out to be significant for the successful completion of the program. In fact, RDPSEC close cooperation with the Hellenic Mediterranean University is an example of how a fruitful cooperation on a local level, whereby the two organizations have pooled their expertise, mutually supporting each other in their field of experience has contributed to the enhancement of the project

dissemination and its overall sustainability prospects opened up. In fact, as part of sustainability actions, when pandemic conditions permit it, RDPSEC piloting schools will be invited with other schools to visit the Robotics Lab in Hellenic Mediterranean University to have a hands-experience with real robots.

- ✓ It is suggested that the overall positive impact of the Tool Kit as implemented in RDPSEC schools could inform policy makers on the benefits yielded, so as to consider the more systematic **integration** of **Educational robotics** in the National Curriculum in primary schools. The CODESKILLS4ROBOTICS program could provide a valuable insight, as one of the teachers relatively pointed out: *"It can be integrated in the teaching of Coding and Robotics combined with already existing tool kits and platforms"*

Demokritos

Positive Aspects:

- ✓ One of the most positive aspects of the overall training process was the very **warm** and honest **response** from the schools that hosted the training as well as from the parents who provided their consent and ultimately from the children themselves. All involved participants showed an **eagerness** to be involved in an educational activity that was outside the traditional courses, serving as introduction to a modern and innovative world that school curricula do not provide yet.

- ✓ All children were able to see an actual robot for the first time and were given the unique opportunity to build one and make it move based on their commands through the programming environment. This process brought a **pleasant surprise** and **smiles** to their faces and eagerness to learn what comes next. This joy that it brought to them had an added value given the restrictions that have been imposed to them due to the pandemic.

- ✓ The fact that **2/3** of the participant pupils were **girls** in another positive aspect of the process, since one of the aims of the project was to introduce more girls in the field of educational robotics and STEM skills and eliminate all the negative stereotypes about girls not getting involved in such activities.

- ✓ Another positive aspect was the fact that the pilot training actually **started face-to-face** despite the difficulties and children had the time albeit limited, to see, build and program the Guitar 4000 and REA robots **in person** and see for themselves how things work.

- ✓ At the beginning of the training activities, the principal divulged the existence of a couple of **students** with **minor learning difficulties** (without naming them). However, this was not apparent during the training activities and no problems were caused. The fact that these children were so easily integrated might be an indication that a less formal learning setting, educational robotics and the "learning by doing/playing" concepts can contribute to their **psychosocial inclusion.**

Setbacks

– The most negative aspect of the process and the main obstacle faced was the fact that the lessons were forced to switch to online with the new measures imposed as a result of the Covid-19 pandemic, forcing all involved parties to adapt to a new reality since primary schools in the Athens closed. Thankfully, through distance learning using the Webex tool, which is the official e-tool that the Ministry of Education provides for the virtual classes in Primary schools, the teacher was able to show each programming process step-by-step involving the pupils every step of the way so that they would all build the program together and feel part of the whole process. In other words, an effort was made to make the process as interactive as possible, which was fruitful and brought the teaching of educational robotics to a new level in these difficult times. The teacher explained every step, in detail and actively involved the pupils in the solution of a given problem through trial and error in order to fully understand how to think and solve algorithmic problems. In addition, the existence of the e-platform, which hosts all the educational material and provides communication tools for the exchange of questions, ideas and thoughts, proved to be a very useful and necessary tool more so than ever.

– Another obstacle that was faced was the fact that vast majority of the children did not possess an e-mail address, which is essential for one's registration on the e-platform. This obstacle was tackled through either the use of their **parents' e-mail** or in some cases with the introduction of a **fake e-mail** in the system from the administrator in order to create the new account. Following the creation of the account, pupils were able to change their credentials in the e-platform.

– The last obstacle we faced was that although more parents had shown an interest in the program, with the worsening of the pandemic, they decided to opt out and expose their children only to the necessary and compulsory school engagements, resulting in a smaller number of students participating compared to the number anticipated. However, given the difficulties imposed by the Covid-19 pandemic, one of the most positive aspects was that the pilot training actually took place even though part of it wasn't in the shape and form that was initially planned.

Constructive Suggestions

- ✓ The experience of the pilot training in Athens showed that it is not necessary for teachers to follow a strict schedule but rather **adapt to the needs** of the **classroom** and dedicate more time where is required, especially regarding the 1st module, which is the basis for understanding educational robotics and basic programming principles.

- ✓ It is also advised that **two teachers** are present in the classroom (especially in the case where there are a lot of children in the class) so that one can teach and the other can be near the work benches where pupils work in order to divide the work load.

- ✓ Finally, the pilot proceedings in Athens showed that it is a good idea to hold an **introductory lesson** on educational robotics **with a ready-built robot** such as the Guitar 4000 robot using basic pre-programmed blocks in order to familiarize the pupils more smoothly with the robots and the programming environment. It proved to be a good practice for the children who did not have

any previous experience with robots and was an agreeable activity and a good ice breaker for all.

Hellenic Mediterranean University

Positive Aspects

- ✓ It was an excellent experience and attracted the interest of the students who had not been in contact with educational robotics in the past. The educational toolkit was very useful for the students and gave them the opportunity to develop their research interest. They liked the lessons and agreed that the content was very interesting.
- ✓ Another positive aspect was that during the covid-19 pandemic the pilot testing gave students a hope to believe in knowledge science and technology.

- ✓ In addition, many teachers from the12th Primary school of Heraklion became ambassadors acting as a seed for dissemination and further expansion of the project's boundaries.

- ✓ More girls than boys were participated in the pilot testing of the educational material, which was a special objective of the project.

Setbacks

– A technical problem from the beginning of the pilot testing was that many of the students did not have an email account in order to sign in to the platform.

– It took some time for young students to get used to the environment of the online platform.

– During the pilot implementation of the program, the use of a mask due to the pandemic restrictions did not help teachers to capture as an image the enthusiasm and the joy felt by the young students.

Constructive Suggestions

- ✓ In case the number of students is greater than ten, **two or more teachers** are needed in the classroom. One possible solution would be to divide the students into many groups.

- ✓ Another suggestion is the **use of cheaper educational robotics kits** that students' parents, parent's association or sponsors can either purchase for the school.

- ✓ We would suggest the Ministry of Education to put more emphasis and coordination on the **integration of educational robotics and STEM** into the **school curriculum** in conjunction with providing appropriate funding to supply the schools with the necessary equipment.

- ✓ In primary schools the time available for teaching ICT is only one hour per week. Unfortunately, in this time frame it is very difficult to integrate educational robotics in a meaningful way into the curriculum. It would therefore be very important to **increase the ICT teaching hours** in primary schools.

Cyprus

Emphasys Center

Positive Aspects

- ✓ Emphasys Centre, as an IT training centre that has a **great experience** in teaching **robotics**, as well as in the implementation of European projects, was the partner responsible for the development of the teaching material. Emphasys started the pilot testing implementation first and even earlier than the scheduled C1 activity, in order to receive the experience and improve the quality of the material to prevent any pitfalls.

- ✓ Emphasys Centre has worked with the **Open Badges** in the past; thus, its effort to disseminate and promote the Open Badges started a few years ago and it was quite easy to convince people to switch to a **digital way** of **certification**.

- ✓ The participation of Emphasys Centre in **several dissemination activities** where an opportunity was given to promote the CODESKILLS4ROBOTICS program was crucial for implementing the program. During the activities, both students and parents were invited to participate and get involved in several activities and participate in the upcoming program.

- ✓ In addition, a **great emphasis** was given to the **importance of developing STEAM** and other **soft skills** through their participation in the robotics lesson, and that was convincing enough for the students.

- ✓ The **great interest** shown by the participants, led Empahsys to divide students into five different groups and attended a weekly session of 2 hours each. There were approximately 14-15 meetings for each class, and the total teaching time was around 142 hours, with 28-30 hours dedicated per group. It is worth mentioning that all students were extremely excited to attend their lessons and keen to learn more about programming and robotics. It was really hard for the parents to convince the students to leave the class and persuaded them stay for a half-hour more.

Setbacks

– Unfortunately, lessons were interrupted due to the second wave of the pandemic and not all the modules were covered as initially planned. Nevertheless, a tremendous amount of the material was covered.

– Another obstacle faced was that all the primary school students did not possess an email account which was mandatory for their registration on the platform. Thus, the creation of email addresses was the way to tackle this obstacle and give access to students.

– Although many teamwork activities (using 1-2 robots) were planned to help students develop their teamwork skills, a lot of individual activities took place

instead due to the pandemic and its safety measures. Fortunately, Emphasys center, as a well-equipped center, had one robotics kit available for each student. The team activities were mostly implemented with the use of multiple robots.

– Unluckily, only 11% of the participants were girls, and as the project is focusing on involving girls, Emphasys should find additional ways to attract girls' interest.

Constructive Suggestions

- ✓ Five of the students participating where the children of immigrants from Syria. Two of these students, as their parents informed us, were students with learning difficulties. Four of the children had difficulties understanding Greek so in certain cases the teacher would explain also in English and in other cases the assistant teacher would be next to the students translating the instructions of the teacher. Thus, the presence of at least two teachers in the classroom was necessary, either for translating instructions to these students or helping others with learning difficulties in order to proceed, so as all students **would fee included and not stay behind.**

Sweden

Positive Aspects

- ✓ The first positive aspect regarding Halsingland Education Association piloting activity is that all participants have shown **great interest** in the activity that was carried out. The students could get an insight into how a robot can work and how to improve it. The interest was equally great among both girls and boys.

- ✓ An additional positive aspect was the opportunity to run the pilot training **physically** and it was appreciated as students could in a simpler and perhaps clearer way get help when things went awry.

- ✓ Another very positive point is that CODESKILLS4ROBOTICS Tool Kit **positive impact** has an **added value**, since robotics is part of the National Curriculum, which has increased teachers' interest for its products. In fact, the Tool Kit material will be available for all teachers in the municipality and will be a valuable feedback that the teachers will use in class. In fact, the greatness of the of this project has been realized by other teachers in the municipality. After the first information about the project they received by means of a flyer and the interactive contact they had with the CODESKILLS4ROBOTICS expert and the digital Conference event, a lot of interest has been expressed. As a result, a number of them have been chosen to be trained so as to implement the CODESKILLS4ROBOTICS with their students.

- ✓ Finally, though the teachers started building REA, the students soon wanted to come in and build both Vernie and the other constructions. The students wanted to move on and it is our firm opinion that the CODESKILLS4ROBOTICS project has opened new opportunities for teachers to increase students´ interest for subjects related to STEM. Through measurement and contact with concrete physical quantities such as speed, gravity, friction, the robots REA and Vernie will be a natural link to mathematics and physics.

Setbacks

– One negative technical aspect was that the light sensor did not work as well as it was thought, which has brought a bit of disappointment to the students.

– During the pilot activities, it was also discovered that if the students sat too close to each other with the learning tablets, it was difficult to connect the robot with the learning tablet. It felt like the learning board was searching for several robots at the same time.

– Another difficulty faced was that students did not have an email account, which was necessary to be registered on the platform, as in Sweden not all of them are allowed by their parents to have an email.

Constructive Suggestions

- ✓ As registration on the e-platform is important for the Tool Kit implementation it is suggested that teachers can register the group of students by creating a fake e-mail and providing them with the passwords to log in, in case some students do not have an email.

Having shed light to the overall Tool Kit Impact, as substantiated by all the involved partner organizations, along with the positive aspects highlighted and the silver linings paving the way for constructive feedback and potential improvement, the **overall insight** obtained across countries is to be outlined below.

2.5. Overall Insights gained

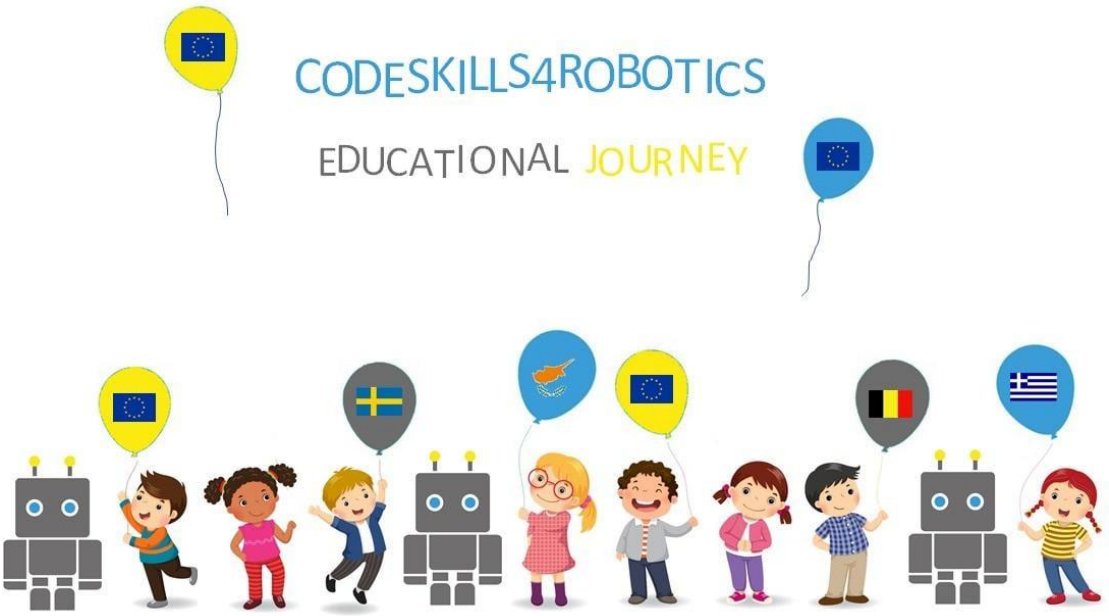
In view of the afore-described overall impact, as experienced by each partner organization in the three countries where the CODESKILLS4ROBOTICS Tool Kit has been implemented, the overall valuable insights gained are encapsulated in short in the following table:

In essence, **CODESKILLS4ROBOTICS Tool Kit** Implementation overall **highly Positive Impact** has generated **Opportunities** for**:**

- A **Fascinating Educational Journey** in the World of Coding and Robotics among **smiley**, **enthusiastic**, **eager** student faces.
- A **fun, engaging, motivating**, hands-on Learning Experience **through Play.**
- **Blended Learning** allowing for Individualized Learning on the e-platform.
- **Peer learning** in a highly Participative and Cooperative Environment.
- A **fruitful acquisition** of **Coding and STEM skills** coupled with diverse **transversal skills,** such as computational, creative and critical thinking, problem-solving and cooperation skills etc.
- **Enhancement** of **21st Century** students' **skills** allowing to bridge the gap between education and labor market.
- **Social** and **Educational inclusion** in terms of gender, ethnic background, special needs or abilities.
- **Enhancement** of students' **self-esteem**, **motivation** and **Self-Confidence.**
- **Enhancement** of teachers' **Digital Skills** and their validation through Open Badges.

- **Teachers' Professional Development** in a digital era
- **Reinforcement** of student, teacher, parent **relationships** and school **synergies** and **communities** of **learning.**
- **Great prospects** for CODESKILLS4ROBOTICS Project **Dissemination.**
- A **solid basis** for CODESKILLS4ROBOTICS Project **sustainability** prospects.
- **Strong Potential** for CODESKILL4ROBOTICS Tool Kit valuable feedback to inform policy makers decisions for integration of educational robotics in primary schools.

Overall, the predominant feeling expressed by all partner organizations is the **zest, commitment** and **earnestness** of all the relevant stakeholders engaged in the implementation of the CODESKILLS4ROBOTICS Tool Kit from all countries. In fact, this empowering feeling has been the driving force throughout the way, allowing the project not only to merely preserve against difficulties amid pandemic conditions, which have unquestionably affected the nature of Erasmus+ European projects, but flourish.



Admittedly, this has culminated in the **great zeal and enthusiasm** exhibited by the participating students in Greece, Cyprus and Sweden all along this Educational Robotics journey, which can be said to be a strong indicator that the CODESKILLS4ROBOTICS project has been a **remarkably successful venture**, managing to instill **strong intrinsic motivation** to the students participating in its piloting implementation.

The various positive aspects illustrated above regarding the potential benefits generated by the project for the direct and indirect target audience on a first level should be seen in the light of a more general macro-level pertinent to the potential for change it can bring forward on the educational scene in terms of the integration of robotics in formal education settings.

Thus, it is vital that all the implications of the key findings delineated above, pertaining to **Policy recommendations** and **Sustainability** issues be addressed in the following sections.

2.6. Policy Recommendations

As analytically described in the previous section, the insights gained from the evaluation of the CODESKILLS4ROBOTICS **Tool Kit** piloting implementation bear significance in terms of their inherent potential to set the ground for the inclusion of robotics in formal education. Thus, their implications on a policy level are addressed below in the form of a series of policy recommendations to be made for:

- **Practices which benefit both the teachers & the learners**

Analyzing outcomes of the piloting implementation, it is clear that educational robotics can impart coding skills both to learners and educators. As both educators and learners in the pilots have indicated, such practices can ***be instrumental in fostering and developing core coding and STEM skills*** and ***computational thinking***.

That should be valued both from the perspective of acquisition of skills and competences for learners (engaging and motivating) and from that of continuous training of teaching staff (blended and peer-learning based). Overall, it is considered to be a valuable training tool for educators which impacts both on their self-esteem and students' progress.

- **For a pedagogic system where, digital education is integrated**

Learning by doing, or through play, as indicated by the piloting implementation, motivates and draws students to engage in interactive learning and in doing so it also ***helps the development of soft, transversal skills and other skills and competences*** such as problem solving, creativity and imagination as well as developing their independence and interactions with others.

A strong focus on pedagogies for digital education is paramount to reaping the most benefits out of it, engaging learners and inspiring innovation. CODESKILLS4ROBOTICS project results highlight the necessity of a more ***systematic integration of such practices in the National Curriculum*** in schools.

- **Promoting accessibility, equality and inclusion**

Building up to a sustainable and long-lasting investment, the gap between urban and rural schools can be reduced. Education is a fundamental

human right and stakeholders must ensure that ***neither the size nor the location of an educational institute stand in the way of learning***.

That also integrally requires special attention to the ***socio-economic backgrounds and gender impacting students' access to STEAM fields*** to break down gender stereotypes, ensure inclusion (including learners with disabilities) and empower these students to enter a field that is usually not available to them. These three main aspects crucial to inclusion and accessibility, i.e. geographic disparities, gender representation and disabilities transpired through the results of the pilot activities giving a clear signal that equal space needs to be devoted to them.

- **Investment that ensures quality and provides opportunities**

If we wish to fully embrace the digital transformation and ensure everybody is on board and no one is left behind, there must be robust investment in up-to-date digital infrastructure - from good broadband speed to educational robots - and just as essentially in teacher training.

An investment which eventually goes beyond the school environment, reinforcing student, teacher, parent relationships and school synergies and communities of learning.

It will only be thanks to ***quality material, quality teaching, and opportunities to apply the knowledge gained***, as experienced in the pilots, that we can boost programming and computational thinking. Moreover, through this approach, children can be empowered as digital citizens.

- **Cross-sector cooperation across & beyond educational sectors**

Reflecting on the format of the partnership, outcomes present a **promising mind shift** in terms of the perspectives opened for implementation of such novel and innovative educational practices ***for promoting*** **21st century skills**.

Furthermore, the ***upscaling and transferability*** of the project's ***outputs to other sectors of education***, such as the non-formal and informal, and other stakeholders could support the uptake of digital skills and competences, diversify the offer and improve inclusivity, and could foster innovative approaches also in the realm of policy making.

Yet, with a view to ensuring sustainability prospects to a larger degree it is vital that the aforementioned policy recommendations take the form of a more practical ready-made policy strategy pack to be implemented by the relevant stakeholders, which is the focal point of the following section.

3. Design of the DIGITALSKILLS@SCHOOLS POLICY RECOMMENDATION PACK for UPSCALING-SUSTAINABILITY STRATEGY

Acknowledging the significance of the CODESKILLS4ROBOTICS project's outcomes under each process, the Partnership Consortium is looking forward to increasing both the engagement and reach out towards different stakeholders through. To achieve this, it provides an adequate vision to what comes after the end of this project.

To that extend, the Partnership Consortium aims to implement, disseminate and exploit the CODESKILLS4ROBOTICS project results in terms of two main perspectives:

- Expansion and promotion of the use of educational robotics in schools through well-structured and designed theoretical and practical digital tools,
- Engagement with key stakeholders who can help spread and further apply the use of digital school clubs, fostering further training opportunities for schoolteachers, students and members of the educational communities, where every school is acknowledged and act as an important cell.

The aforementioned goal is to be achieved by means of the following:

- The development of theoretical and didactical models in order to offer teachers concrete tools for their daily educational practices
- The development of a conceptual model of Educational Robotics

- Policy recommendations for promoting the inclusion of educational robotics in the school educational frameworks.

In order to communicate effectively the results to the identified target groups both traditional and customized dissemination and exploitation tools will be utilized. More specifically, the main target groups are as follows:

- Decision-makers and politicians at the regional, national and EU-level, who will gain information regarding what influences innovation in the educative system and so will be able to better define policies,
- The schools as direct beneficiaries of the CODESKILLS4ROBOTICS activities,
- Research community, whose research studies will benefit from a better understanding of how processes of promotion of educational robotic skills a motor of creativity can be, active participation, tolerance and acceptance,
- Other projects, which will benefit from increased cooperation and transversal approaches that can be an effective support for the implementation of other methods and practices,
- Local Authorities, which can introduce the activity and create a link with local educational policies,
- Other educational and research organizations (volunteers, universities, municipal structures etc.),
- Company representatives, who can provide a linkage with the job market, offering students a vision of what working in a related sector looks like,
- Parents, who can take part in the activity and learn alongside their off-springs or be trained in advance and take on the role of teachers,
- Volunteers (especially student volunteers), who can assist the teachers in implementing the programme, while developing their own computational thinking skills as well as other transferable skills,
- Students' siblings and/or friends, who in the context of an open day can be the audience of what the students have learned and created,

- The general public, which will have better access to research and easy to understand content regarding educational robotics, computational thinking and programming.

Each one of these target groups will be informed and involved through specially designed and targeted outreach activities.

Key Actors leading a sustainable future

As seen throughout the process, the actors that are instrumental in leading a sustainable and impactful implementation and the exploitation of CODESKILLS4ROBOTICS, breakdown to

- Experts,
- Mentors,
- Ambassadors.

This can be accounted for by the fact that engagement of these actors sets up the necessity to create and invest on meaningful synergies and networks. A component that could guarantee the continuation and the sustainability of the project's outcomes beyond its lifetime.

SYNERGIES and NETWORKS

The success of a European project depends on the EU's capacity to build a better future for European citizens. This is a key message of the Commission's White Paper on the Future of Europe. It is also at the heart of the initiative "Investing in Europe's Youth", while strongly relevant under the New Skills Agenda for Europe. A direction that the CODESKILLS4ROBOTICS Program is actually working towards.

The general purpose of the CODESKILLS4ROBOTICS Programme is to enhance the acquisition of digital competencies, fostering knowledge, critical thinking, creativity, understanding, and cooperation. To achieve that, it must ensure that results will be shared among the members of a large education-centered community.

It is vital that no stakeholder is left behind. Namely, schoolteachers, students, members of parental and cultural associations, scientific and local communities. More importantly, the aforementioned goal should be achieved through mutual respect and intercultural dialogue, as the project supports the inclusion of people with fewer opportunities.

Furthermore, it is expedient to invest in synergies with ICT/robotics companies, which can simplify the acquisition of the necessary technical material and favour the establishment of long-term cooperation, combined with schools and other educators who either implement the CODESKILLS4ROBOTICS or similar programmes.

Doing so, can provide a setting to exchange good practices and also promote opportunities for activities like organising robotics competitions, both components being of equal importance.

Digital Policy addressed by European Funding Programmes

In the new Erasmus+ Guide, Digital Policy is one of the most relevant and serious priorities for the next years. The COVID-19 crisis has shed light on the importance of digital education for the digital transformation that Europe needs. In particular, it emphasized the increased need to harness the potential of digital technologies for teaching and learning and to develop digital skills for all.

In line with the strategic priorities of the Digital Education Action Plan (2021-2027), the CODESKILLS4ROBOTICS Program aims to support this endeavour to engage learners, educators, youth workers, young people and organizations in the path towards this digital transformation. The CODESKILLS4ROBOTICS Program is strongly relevant and supports the first strategic priority of the Action Plan, focusing on the development of a high-performing digital education ecosystem.

A set up that provides capacity building and critical understanding, across the different educational sectors and training institutions, on how educators and learners can best exploit the opportunities offered by digital technologies and how to develop digital transformation plans.

This priority is in line with the implementation of CODESKILLS4ROBOTICS Erasmus Network, in the frame of already existing platforms that will permit **CODESKILLS4ROBOTICS** to be more valorised and expanded.

In particular, the project intends to further make use of the ***eTwinning***, ***School Education Gateway***, ***European School net***, aiming at a fruitful and promising collaboration either for the establishment of an eTwinning project on Robotics or a more ambitious Erasmus project.

What is of utmost importance is that the above prospect would allow actual pilot schools of all partner countries to act as expert schools and therefore coordinate school virtual (eTwinning) or real (Erasmus) exchanges programmes.

This can be easily achieved, since the eTwinning live space provides this opportunity by means of the CODESKILLS4ROBOTICS **eTwinning group**, which RDPSEC has created. eTwinners all around Europe could be members of this group and have direct access to all educational and pedagogical material in order to:

- Propose new projects
- Enrich their theoretical background on robotics
- Get ideas for educational activities
- Find common interests with other teachers on Robotics

Hence, all the aforementioned prospects, will allow CODESKILLS4ROBOTICS project to move forward, paving the way for expanding its life expectancy and having a second life cycle anew.

Overall, there are primarily two means that can support the network. The first one, as prior mentioned, pertains to:

- ✓ the collaboration of schools in every country participating in CODESKILLS4ROBOTICS project in order to propose their own Erasmus or eTwinning project on Robotics.
- ✓ The aim is to foster small-scale partnerships (KA2) and short term or accredited projects (KA1 – group mobility – job shadow-assignments). These will bring on-board schools from different countries that will accept to collaborate and participate in this "CODESKILLS4ROBOTICS" Erasmus project, signalling in this way the commencement of a European network on school digitals clubs.
- ✓ Partner organizations will support and give the necessary assistance in the preparation of the proposal for different Key Actions, but also for eTwinning projects as well.
- ✓ For this purpose, an **eTwinning** CODESKILLS4ROBOTICS **group** has been created and managed by RDPSEC that will be the virtual place of meetings and exchanges for all eTwinners in Europe interested in educational robotics.

The second is directly associated with:

- ✓ offering several structured seminars conducted by the CODESKILLS4ROBOTICS experts to every possible beneficiary that has applied under Erasmus + Key Action 1 in every relevant category (school and adult education) for a short term or accredited project (KA1 – courses).

- ✓ Structured courses could be proposed on blended form from the educational and research partners of the project (P1, P4 and P5). These courses could be attended by a large public of school educators and adult learners, teachers and other staff from schools and other beneficiary organizations.
- ✓ As mentioned also in the CODESKILLS4ROBOTICS Sustainability and Exploitation Strategy, Regional Directorate of Education of Crete, will propose the connection with the **Go Digital Erasmus+** RDPSEC Project that has already been completed and **3D2ACT Erasmus+** project that is currently run by RDPSEC in VET Education, as it has been highlighted during the RDPSEC Multiplier Event and the kick-off meeting of Erasmus+ 3d2act project.

Further actions aiming at maximizing the impact of the new generated knowledge, will be evaluated in order to identify actions to enhance the support from the institutional environment and useful analysis for the project sustainability will be provided.

CODESKILLS4ROBOTICS will benefit a great number of potential beneficiaries at European level and in the participants' countries, aiming to:

- ✓ promote the process of horizontal scaling up (expansion) and vertical scaling up (institutionalization),
- ✓ provide knowledge and a wide analysis to increase the scalability and transferability of the innovative results of the project,
- ✓ establish connections with national and European initiatives and organizations working in the fields of the project,
- ✓ identify actions to enhance the support from the institutional environment and provide useful recommendations for the project sustainability.

As part of the exploitation strategy, all partners will collaborate and enhance the promotion of the project. In fact, the CODESKILLS4ROBOTICS project has developed a strong dissemination plan and has already received support from several organizations and persons related to the educational, entrepreneurial and innovation sector.

At this point, it is of high importance to mention the strong collaboration of partnership with members of European and National Committees for EU Code Week and EU Code Week Hackathon, who are also eTwinning ambassadors and at the same time are working for the review of educational policy and the introduction of Robotics in primary school curriculum.

A number of ICT experts, engaged previously or invited to join as keynote speakers at the CODESKILLS4ROBOTICS Final Conference, are aware of the project and its overall impact per se. More importantly, to the partnership's knowledge, they share the same concerns and the same vision for the role of educational robotics.

Maintaining cooperation with ICT experts, while ensuring their active engagement, will add to the sustainability of the project, as they will be in charge to transmit its values, priorities and results to the Institute of Educational Policy of the Ministry of Education and Religious Affairs at the National Educational Institute, where they are in collaboration offering their consultation regarding the changes in the new robotic era. In Greece, this is the case of ICT expert Stamatis Papadakis.

Thus, in order to ensure the project's products exploitation after its life cycle it is of utmost importance to place synergy creation and maintenance at the centre of goal setting, a matter of discussion in the following section.

4. SETTING UP THE DIGITALSKILLS@SCHOOLS POLICY COMMUNITY

To best exploit the project's results and to make sure that we continue advancing the work put forward by the project, the consortium and the synergies that have been created through the projects lifetime, we have envisioned the setup **DIGITALSKILLS@SCHOOLS Policy Community.**

The Community targets and will primarily engage audiences from the existing partnerships and stakeholders engaged during the project. As the Community advances in terms of engagement and output, partners will encourage new stakeholders to get on-board.

As indicated in the "Exploitation Strategy", partners aim to expand the community by creating links and promoting it in upcoming events, future projects and partnerships.

Towards Inclusive Digital Strategies for All

A) Organisational level

B) Institutions and

C) Educators and Practicioners

Integrating the users engaged in the Platform

e-Community

(Open Learning Environment)

e-Academy

(Open Badges Ecosystem)

D) Ambassadors' Community

engaging and expanding to more educational institutions

DIGITALSKILLS@SCHOOLS Clubs

In setting up the Community, we acknowledge the different layers to be addressed in achieving our aim to support schools, educators and other stakeholders to develop Inclusive Digital Strategies for All.

The project primarily focused on Primary Schools, yet to ensure the **sustainability of the community** and to ensure that it is **engaging, meaningful and impactful**, we foresee the **expanding towards more advanced levels and other sectors of education**.

To achieve that, we propose the creation of the following set up (presented above):

DIGITAL POLICY FORUM

The Forum's aim will be to cover and further upscale educational policies which incorporate inclusive digital strategies. The initial process will build up on CODESKILLS4ROBOTICS's tools and frameworks, good practices and policy recommendations. The input and discourse will become more diverse as the Forum expands, bringing in diverse views and contributions from new stakeholders.

NETWORKS AND COMMUNITIES OF PRACTICE

Building up on synergies created throughout the project, we put forward a suggested number of communities of practice across the private and public sector.

Each community can provide an opportunity for the audiences engaged to

- Apply and test strategies share expertise, collaborate on projects
- Reach out to more educational institutions, while having the chance to test and upscale educational practices.

A) Organisational level

This level brings together technical expertise, like members of staff, colleagues working in other departments or involved in other projects/partnerships, thus sharing inputs and ideas.

B) Institutional

This specific group aims to engage policy makers and institution actors that can help not only share their thoughts and concerns, but also act as voices of change within the different layers.

C) Educators and Practitioners Community

This community aims to engage educators and practitioners and those interested in relevant insights. They get to share expertise, collaborate on projects, and promote the use of insights to support robust policy outcomes, used to support the work of the Forum.

Considering the existing tools and methods developed within the project (in this case the platform, infrastructure and training) this community will utilise

- the e-Community**,** where members get to exchange their inputs and engage in an online dialogue, promoting their cooperation and advancing the learning process.

  That can also help to adequately address issues like theoretical and/or technical preparation of educators, supportive schemes like mentors-experts, face-to face training events, webinars etc.
- the e-Academy, where members get to apply existing or future educational methods. This is also a space or a channel, used to both train educators like teachers and to bring in new members through the opportunity to engage in a training.
- the e-Resources Data Bank, to update and include developed educational material (e-courses) and useful e-tools & resources, including teaching material.

D) Ambassadors' Community

Parallel to educators, going closer to grassroot level, the Ambassadors community will come together to practice fore sighting, use outcomes and resources and spread their value through interacting and working with educators and learners.

Key part of their work is interconnected to DIGITALSKILLS@SCHOOLS Clubs, their maintenance and further development, using the input they receive from the other structures.

Synergies with teachers, trainers, business and ICT experts, professionals, banks, enterprises, SMEs etc. needed for the sustainability and exploitation of the project. We therefore believe that with this setting, we get to foster stakeholders' meaningful engagement, allowing us to bring more members on-board.

The proposed setup can help and support educators and practitioners (within two different settings), while actively collecting and translating their experiences and learning outcomes to shape both policies and strategies in local, national and European level.

Despite the proposal and initiation of the process, partners will be evaluating the advancement of the community, allowing and opening up its structure to the stakeholders engaged. Thus, developing a sense of ownership and therefore fostering their commitment.

Moving ahead, we look forward to setting up a sustainable Community, as we engage with the stakeholders engaged throughout the project. These include the users of the Online Platform, students, teachers, IT experts, academics, inspectors, supporting organisations and policy makers.

Nevertheless, in order to ensure further sustainability of the project results efforts it is imperative that efforts be directed to intensifying digital initiatives on multiple levels, an issue addressed below.

5. Digital Policy Recommendation Movement - EU DIGITAL WEEK

A strong dissemination Campaign throughout the life circle the project lays the foundations, paving the way for an equally effective strategy plan to be designed in the direction of the project visibility and sustainability after the official end of the project life cycle. Bearing this in mind, the project Consortium has reached the decision to consciously focus their efforts on designing strategic and impactful dissemination and communication schemes having a twofold purpose: disseminating the project results at the specific period it run, while at the same time ensuring in advance the increase to the maximum of the chances for sustaining the project products preceding its official ending. The rationale behind this decision was also reinforced by the unexpected challenges coming along with the spread of Covid 19 and the pandemic adjustments imposed. Hence, as analytically delineated in the first part of the present IO, all partners launched a multileveled Dissemination Campaign throughout the whole phase of the CODESKILLS4ROBOTICS Tool Kit implementation.

The aforementioned rationale has led to various actions to be put into effect aiming to design and apply a targeted action plan that in order to be pilot tested and revised in practice by all partner organizations making use of various landmark events taking place in the framework of digital transformation.

In particular, this overall effort has led to a Policy Recommendation Movement in support for the importance of digital skills acquisition to meet the transformation caused by the digitalization of the economy and the labour market. The **MOVEMENT** targets mainly students as well as teachers, parents, the community to raise awareness for prospects challenges and needs of the digital revolution. Having identified the target to be included, namely the inclusion of Coding and Robotics in formal education, in the light of the current status quo of digital school reality in all partner countries on the basis of the Comparative report results produced as part of IO1, the partners have prepared a strategy of actions involving the specific key actions analytically delineated in the following sections.

5.1 Promoting a Digital Strategy

To ensure that the CODESKILLS4ROBOTICS project could reach out to as many stakeholders and target audiences as possible, it was vital to analyse what channels are available and how they are used by each target group (addressed in various ways throughout different processes and outcomes i.e., the Toolkit).

Ensuring versatility and diversity of channels helps foster higher reach out. However, to make ensure that choices are evidence based and thus well thought beforehand, it is important to clarify:

- the format, accessibility and requirements to share content when using a certain channel,
- the audience, for who or which target groups is it addressed to, and
- the expected outcome, used as a way to spread information or to engage and attract interest.

Beyond taking these points into account, it's important to reflect on existing national specificities - acknowledging the possibility to face different realities per region. Moreover, before closing the process, it is important to reflect on the existing relationship between the stakeholder(s) and the institutions implementing the CODESKILLS4ROBOTICS programme. (if any).

In general terms, the following channels have proven to be successful in reaching specific stakeholders, as they

- set clear aims and objectives for each process or means used (audiences, inclusion of coding and robotics in formal education etc.)
- follow a planned and prepared strategy of actions (high level meetings at national level, newsletters to send to officials and EU Representatives, workshops for parents to promote digital related aspects such as safety on-line, protection of data, cyber bullying etc)

Within this framework set, the primary objective was to promote the CODESKILLS4ROBOTICS programme and particularly the implementation of CODESKILLS@SCHOOL Clubs previously analysed. Then, the secondary objective, focused on fostering the process of raising awareness about educational robotics and ensure the visibility, sustainability and exploitation of project results.

Hence, the digital identity of the strategy was also prominent in the **systematic communication online Campaign** that took place on the project website and the partners' **social media** during the implementation phase of the project. As part of this, a **systematic raising** digital **awareness** online **Campaign** was launched during which various FB Posts were posted to promote and disseminate scientific articles on **Coding and Educational robotics** accompanied by visual material. By means of the posts about robotics and coding it was intended for the target audience to be informed on the latest developments and at the same time raising their awareness on the benefits of educational robotics and digitalization, while maintaining a constant contact with CODESKILLS4ROBOTICS project serving the purposes of future sustainability.

Furthermore, LLLP produced samples of social media (Facebook/LinkedIn) posts to be posted on the page of partners organization as illustrated in figure 1:

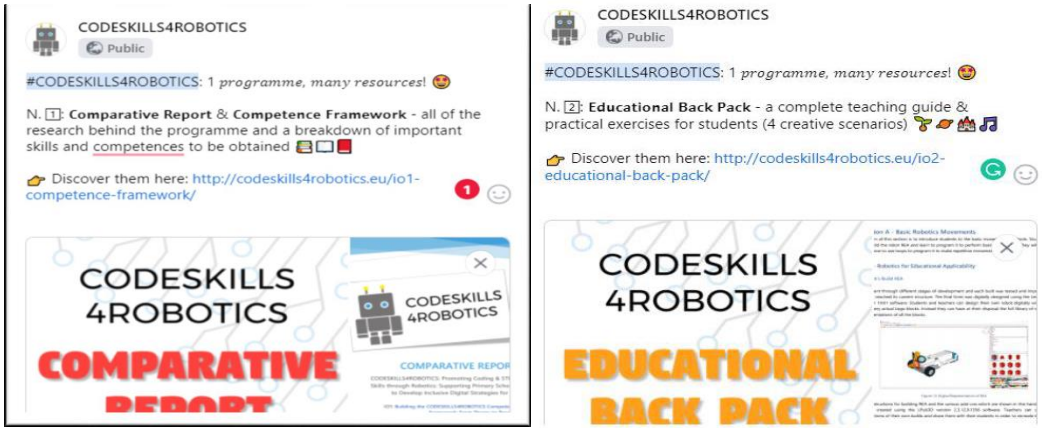


Figure 1. Post templates

These specially designed posts for each of the six Intellectual Outputs were used together with the visual identity of the project in the form of flyers, brochures, promo badges, etc. and links to the results and the developed e-tools in an attempt to raise awareness of more teachers, attract more followers, enhance the image of the project and make it easily recognizable. Overall, the project logo and colours figure prominently in all the relevant post made with a view to establishing its visual identity to the target audience and aiming for establishing sustainability on a visual level as well in the eyes of the target audience.

In order to promote educational robotics CODESKILLS4ROBOTICS project creates a list of practical pedagogical instruments to be used by teachers, educators, parents and in general by which it can propose an additional educational program for students apart the official one.

The piloting in the four partner countries in the EU countries, proved its ability to foster understanding, collaboration, and critical thinking among students in primary schools.

However, certain limitations need to be addressed and opportunities utilized to facilitate the achievement of the educational robotics full potential. The Manual is highly effective for the conduction of a limited number of lessons, but cannot serve as a stand-alone basis for a fully-developed program, part of the regular school curriculum. The model's successful implementation relies on tackling some fundamental obstacles it faces in the classroom:

- limited time for the learning activities' implementation, dysfunctional and strained teacher-student relationship,
- non-productive immediate learning environment, stern scholastic traditions, disparities

These identified barriers could be addressed and overcome by taking actions at system, institutional, and individual level.

Below, we present some key recommendations for such actions:

The immediate addresses of these recommendations are authorities, institutions and policymakers at European Union (EU) and national level, municipal agents, administrative school bodies, students' and/or parents' associations, educators' organizations and the civil society.

• Integrate educational robotics in regular curriculum

• Create a structured teaching program for Educational robotic classes

• Create a network of experts, mentors, ambassadors and teachers

Systemic Level

• Design and creation of the optimal learning environment

• Tailor teaching approaches and practices to the specific needs of educational robotics trainings and learning activities

Institutional Level

• Support educational robotics and computational thinking

• Strengthening the bond between teachers and students

• Refining the Pedagogical Manual

Besides the Digital strategy a more targeted Campaign was designed under the umbrella of Digital Policy Movement.

5.2 Promotional Campaign for the EU Week

EU CODE Week

EU Code Week is a grass-roots movement that celebrates creativity, problem solving and collaboration through programming and other tech activities. The idea is to make programming more visible, to show young, adults and elderly how you bring ideas to life with code, to demystify these skills and bring motivated people together to learn. In 2019, 4,2 million people in more than 80 countries around the world took part in EU Code Week.

The average participant was 11 years old and 49% of participants in 2019 were women or girls. 92% of EU Code Week events took place in schools, which show that efforts to empower teachers during the 2019 campaign have been successful.

The added value of the EU Code Week as resource for the Digital policy recommendation movement

The EU Code Week is a yearly campaign which aims to bring basic programming skills and digital literacy to everybody in a fun and engaging way. The initiative is decentralized across the EU (and beyond, to a smaller extent) and gathers thousands of events that promote coding under a single label, giving them visibility and cohesion.

The EU Code Week was an ideal time to launch an initiative such as the CODESKILLS@SCHOOL Clubs or generally to promote coding-related events and projects.

To take part in the EU Code Week and gain visibility, the consortium:

- Organised activities and event and pinned it on the map,

- Used the official EU Code Week visual resources to promote the initiative,
- Explored other initiatives happening in their countries to identify other stakeholders and created synergies,
- Networked with other initiatives to gain a Certificate of Excellence,
- Posted on social media, using the hashtag #CodeWeek and tagging @CodeWeekEU,
- Contacted their national Ambassadors, promoting CODESKILLS4ROBOTICS and for more information on the EU Code Week.
- CODESKILLS4ROBOTICS training for teachers was submitted and approved as one of the coding-related activities of the EU Code Week initiative.

On 5-9 of October 2020, the CODESKILLS4ROBOTICS Team gathered online to introduce a group of teachers to the learning tools we developed. Each of them followed remotely but with their own LEGO Boost kit at hand.

In the following months, we supported all participating teachers in the implementation of the CODESKILLS4ROBOTICS programme in their schools.

Our participation in the EU CODE WEEK brought with it a certificate of recognition for our training, which was awarded to the CODESKILLS4ROBOTICS Team.

All partners committed to make CODESKILLS4ROBOTICS results available on their website, newsletters and/or social media. Additional platforms for dissemination included Erasmus Courses Cyprus, E-twinning platform, School Education Gateway.

The CODESKILLS4ROBOTICS participation in the EU Code Week was promoted to thousands of contacts. It was disseminated via the social networks of LLLP and other partners (LLLP Facebook, Twitter, LinkedIn, combine 20k followers).

Besides the main event of Project Participation in the EU Week Code, the Regional Directorate of primary and secondary Education of Greece, as co-leader of IO6, has been responsible for designing and coordinating the promotion of a general campaign for the EU Digital Week and producing the relevant material to be localized by each partner. Hence, within this framework, a multifaceted Campaign was designed, which consisted of a social media Campaign, organization of relevant seminars and various events conditioned by the Covid -19 Pandemic restrictions. The Campaign which was designed to be applied for purposes of sustainability of the project was intentionally materialised within the project life cycle in order to be revised before the final Campaign Plan be made readily available to interested organisations.

The primary objective of the campaign is to help promote the CODESKILLS4ROBOTICS Programme and particularly the implementation of CODESKILLS@SCHOOL Clubs. Furthermore, the campaign help raise awareness about educational robotics, while increase visibility of project's activities and results.

To achieve these objectives, a set of actions were used under set weeks like the EU CODE/ ROBOTICS WEEK. The multi-leveled Campaign consisted of a social media Campaign by relevant posts, organization of EU Code Week webinar and

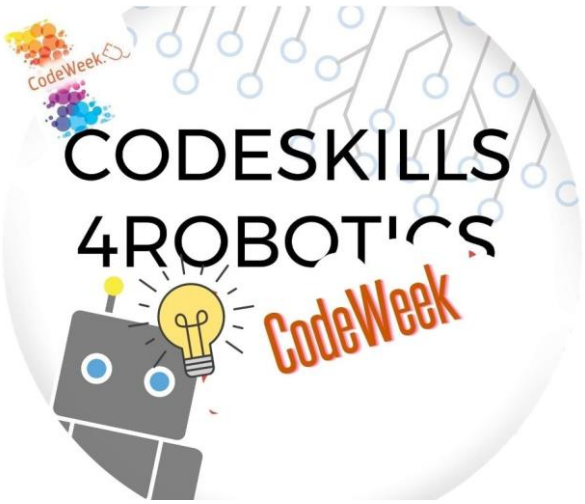
events conditioned by the Covid-19 Pandemic restrictions. In particular, the following took place:

Social Media Posts

Frequent posts on social media and or the partners' webpages in English and when applicable, in the National language of each partner. Each post included the CODESKLLS4ROBOTICS aims and results, with further emphasis on the EU Code week. Additionally, it was commonly suggested to have and use in each of the posts, a special CODESKLLS4ROBOTICS logo designed for the EU Code Week.

Events

- The Regional Directorate of Primary and Secondary Education of Crete organized a **2- Day Open Air Event** at its premises, celebrating **Erasmus+ Days** in combination with **EU Code Week** on 15th and 16th October 2020, whereby the projects aims and results were disseminated using brochures, leaflets etc, while protective masks with Erasmus+ were distributed.



- To celebrate the EU Robotics Week, the Emphasys Centre team organized an Info Day for the 40th Scout Troop of Engomi, upon invitation by the Cyprus Computer Society. The Info Day took place on Saturday the 16th of November 2019, during which various robotics activities were organized, using a series of robots such as Arduino, Lego Mindstorms, Lego Boost and Edison.

- On another occasion, **Emphasys Centre** participated in the Cyprus International "Education and Career" Exhibition in 2019 and 2020.

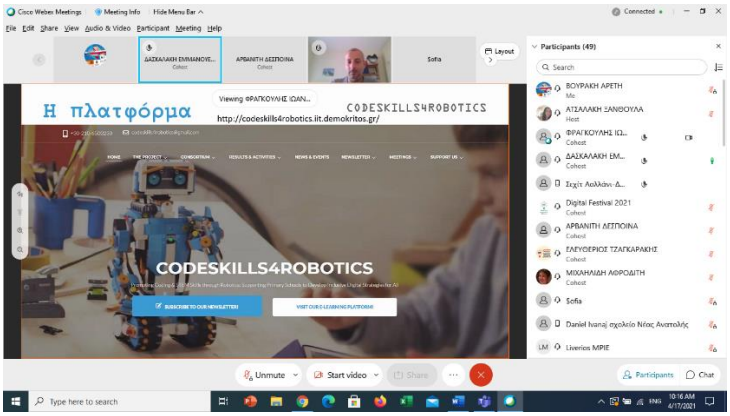
The 'Education and Career" Exhibition was organised by The Ministry of Education, Culture, Sports and Youth of Cyprus, the Cyprus Chamber of Commerce and Industry (CCCI), the Cyprus Employers and Industrialists Federation (OEB) and the European Office of Cyprus (EOC), in cooperation with the British Council Cyprus. One of the largest events of the field of education in Cyprus, the EduFair 2020 featured prominent educational organisations from across the world.

- The N.C.S.R. Demokritos' Net Media Lab organised a demonstration of robotics for Primary School students, during the **Researcher's Night 2019** Pre-event. Twenty-two (22) students from the 6th Primary School of Agia Paraskevi and twenty-two (22) students from the 11th Primary School of Amarousio registered and attended the educational workshop, which took place two (2) times.

- The Regional Directorate of Education of Crete participated in the 9th "**Student Digital Creation Festival**" held from 10-13 April 2019, which is an educational event as part of a computing teachers' initiative that brings together thousands of students in Greece, giving them the opportunity to create and present digital projects developed at their school. It is open to the public and gives students, teachers, parents and visitors the opportunity to take part in original educational and entertaining activities in Information Technology and Digital Technology who express themselves through computing. In particular, workshops, piloting implementation and presentations of the Erasmus+ CODESKILLS4ROBOTICS program along with GODIGITAL were materialized.

- The Regional Directorate of Crete participated in the 10th "**Student Digital Creation Festival**" held online from 13-18 April 2021 under the umbrella of the Ministry of Education of Greece, which is an educational event bringing together thousands of students in Greece every year, allowing them to present digital projects developed at their school.

During the event, the headteacher of Nea Anatoli Primary school, which was one of the four RDPSEC CODESKILLS4ROBOTICS piloting schools, presented the project to students and teachers from all over Greece. Then the CODESKILLS4ROBOTICS Club members form Nea Anatoli primary school also shared their experience and the results from their participation in the CODESKILLS4ROBOTICS project demonstrating the educational History scenario, which they had worked on during the piloting implementation.



Seminars/Webinars

- Given the pandemic restrictions, instead of a physical activity, **CODESKLLS4ROBOTICS project** took part at the EU CODE Week by organising a webinar for teachers interested in submitting for obtaining Erasmus Accreditation 2020. The webinar was held by means of Webex link.
- Net Media Lab of N.C.S.R. "Demokritos" participated in the Pitching Event organized by ahedd – Digital Innovation Hub along with the Hellenic Association of Mobile Applications Companies (ΣΕΚΕΕ-HAMAC), which was held online on 20 & 21/1/2021. The aim of the activity was to give prominence at the research groups and enterprises of partners, with the enterprises-members of SEKEE, and for examining the emergence of

possible collaborations in order to reinforce the Digital Innovation scene. During the second day of the event, Dr. Athanasios Drigas, head of Net Media Lab, gave a speech entitled **"E-inclusion & 21st century skills"** and presented the **CODESKILLS4ROBOTICS** project.

Given that the major digital aforementioned events take place on an annual basis in each partner country, the EU Digital Week Campaign designed will be applied by all partners after the completion of the project as part of its sustainability plan regarding the support of digital transformation.

The final constituent of the Digital Movement are the Declarations on a EU level and the Memoranda of Digital Commitment, both of which are part of the final sections.

5.3 Declarations Produced on a EU Level

POLICY RECOMMENDATIONS FOR EUROPEAN STAKEHOLDERS (ANNEX 1)

A set of policy recommendations have been produced and distributed to the European Parliament, the European Commission and other EU institutions via LLLP website, social media and the newsletters.

The main policy makers / public authorities to whom the project has been promoted are public and private authorities at local, regional and national level (i.e. educational institutes, municipalities and ministries) in Cyprus, Greece, Sweden, local and European NGOs, EQG AG members, the European Commission (DG EAC, DG EMPL, DG CONNECT) and the Council of Europe.

Policy recommendations for promoting the inclusion of educational robotics in the school educational frameworks have been sent to decision-makers and

politicians at the regional, national and EU-level, who gained information regarding what influences innovation in the educational system and so will be able to better define policies.

Policy recommendations have been sent to relevant and selected contacts via the newsletters of the LLLP organisation (with over 7k recipients), as well as via the website and social networks of the project (www.codeskills4robotics.eu and the project's Facebook and Instagram profiles) and of the partners.

LLLP also engaged its network in the promotion of the event and related policy recommendations by flagging the event on the internal platform it uses for communication with its members, the event gathered the attention and the support of over 40 European networks active in education and training.

The Lifelong Learning Platform created a video presenting the key points of the International Conference of the CODESKILLS4ROBOTICS Project, where main recommendations were highlighted.

5.4 Memoranda of Digital Commitment

Two Memoranda were created as a way to bring together schools, organisations and individuals that share our values and are eager to promote them. They are readily available in Annex A. These two versions included some statements towards a collaborative culture among all the actors or stakeholders involved in digital education, including parents, youth workers/organisations, etc. in order to have a clearer picture of the learners' needs and aptitudes which can then contribute to more holistic and effective pedagogical practices.

Aiming to a widespread and engagement of signatories, the Memoranda have been shared on the project website, inviting stakeholders and the general public to join the Campaign, as part of the actions taken for Project visibility,

exploitation and sustainability. They also include a point about well-being, encouraging learners to make responsible/balanced use of digital tools and manage their screen time - this aspect was also claimed in the LLLP digital position paper.

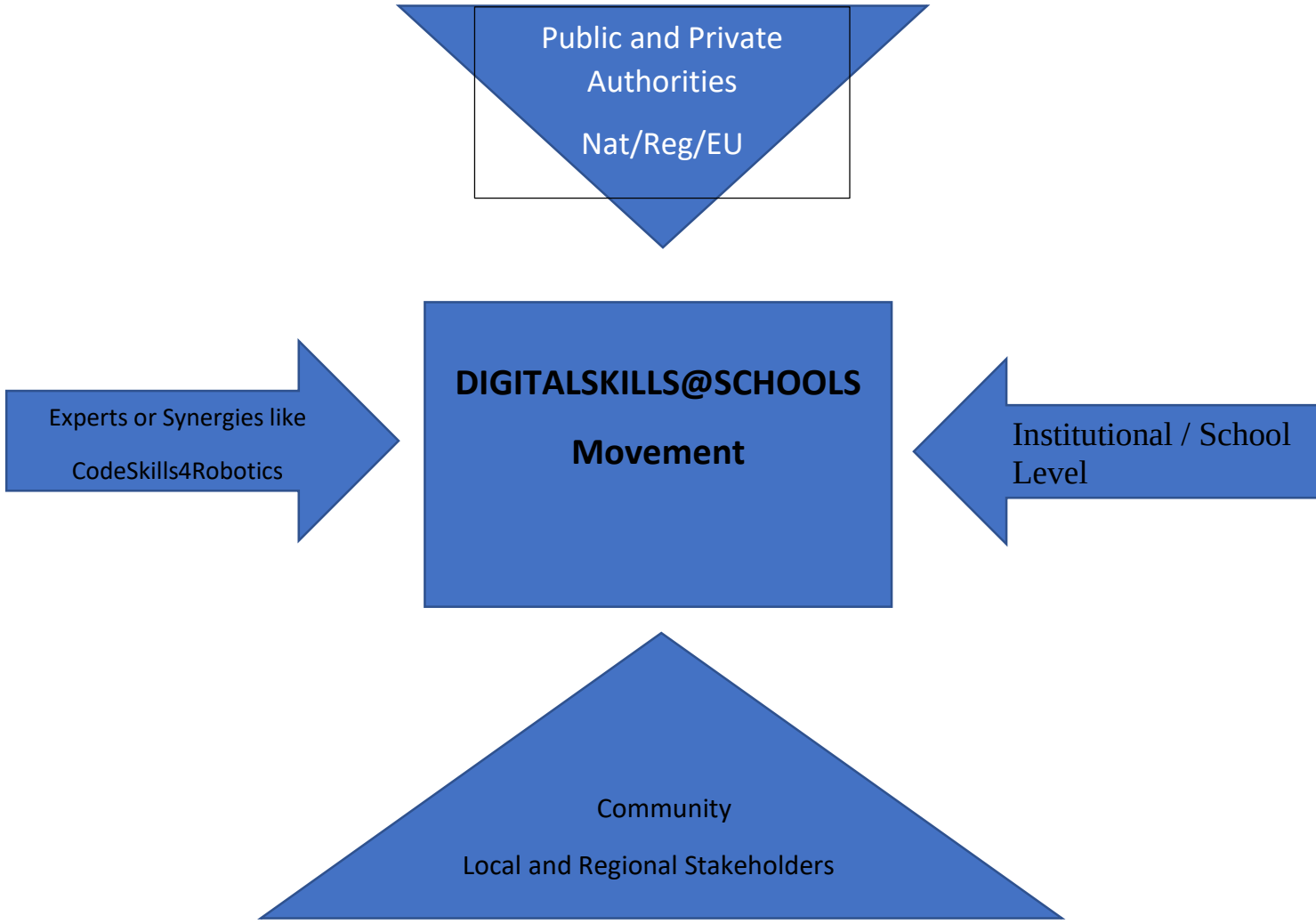
- Memorandum of Digital Commitment for Organizations
- Memorandum of Digital Commitment for Schools

DIGITALSKILLS@SCHOOLS Policy Community

With the Strategy approved and running, dissemination and representation moving ahead, that also ignited this parallel process that led and puts together a community. Each partner, actively engaged in:

- Setting aims/objectives,
- Identifying targets to be included i.e. inclusion of coding and robotics in formal education etc.
- Planning and preparing strategy of actions, while following a dissemination strategy: social media, press releases, posts, articles etc.
- Actively supporting the Campaign etc.

Each step of the way supported this community and ignite a movement that can support the importance of digital skills acquisition, to be able react adequately to the transformation caused by the digitalization of the economy and the labour market. To spread that message, taking part in actions and events held in educational environments was important.


Public and Private Authorities
Nat/Reg/EU
Experts or Synergies like
CodeSkills4Robotics
DIGITALSKILLS@SCHOOLS
Movement
Institutional / School Level
Community
Local and Regional Stakeholders

Annex A

Memorandum of Digital Commitment for Schools

Policy Recommendations for EU Institutions and Policy Makers

Memorandum of Digital Commitment for Schools

We believe…

Programming and computational thinking skills are becoming ever more important in our society and working life. As emphasized by the 2015 New priorities ET2020, "**knowing how to code is empowering**. It allows us to understand the digital world we live in and to shape it. Basic coding skills are essential for accessing the jobs of tomorrow and today".

In light of these recommendations, the CODESKILLS4ROBOTICS project aims to promote **robotics** as an effective introductory channel to programming and other STEM disciplines, as well as a way to develop transversal employability skills such as **problem solving**, **leadership** and **creativity**.

The CODESKILLS4ROBOTICS project is developing the following resources:

→ A **Comparative Report** on the status quo of educational robotics in 4 EU countries;

→ A **Competence Framework** on programming and robotics skills;

→ An Educational Back Pack in 2 modules, available both **for download** and **on our e-learning platform**;

→ A Toolkit to guide schools in setting up educational robotics classes and Clubs;

→ An EU-wide campaign and policy recommendations.

In light of the objectives of the CODESKILLS4ROBOTICS project and of our belief in the current and future centrality of inclusive digital education,

We commit:

→ To strive to ensure **equal access**, for all students and at all levels of education, **to STEAM learning opportunities** (Science, Technology, Engineering, Arts and Mathematics), and to guarantee their **inclusiveness** regardless of gender, ability, disability, race, religion, sexuality, socio-economic status or any other difference;

→ To encourage the provision of continuous, relevant **teacher training** in order to support the development of teachers' and learners' digital competences;

→ To work with parents and other actors in the local community in order to ensure a **holistic approach** towards integrating digital technology in education in a way that best suits students' needs and development;

→ To take full advantage of state-promoted funding opportunities and support the adoption of **up-to-date ICT infrastructure** for schools, including higher-capacity broadband and educational robots;

→ To encourage the implementation of **educational robotics**, both as a self-standing discipline and in its numerous interdisciplinary applications, either

during curricular or extra-curricular hours, as an introductory channel to STEAM subjects that is sure to spark the interest of young minds;

→ To strive for the implementation of **innovative assessment methods** (including self-assessment and formative assessment) by exploiting the potential of digital technology to understand learners' needs in the digital age.

We hereby agree to include the name of our school in a public list of signatories until the end of the project lifetime and to identify the following person as CODESKILLS4ROBOTICS Ambassador. They will be the first to be informed about upcoming project-related opportunities (pilots, events, competitions etc.), and they will represent the point of contact between their school and the CODESKILLS4ROBOTICS project, also allowing for direct support in case clarifications on any of the project-related tools and materials are needed.

Memorandum of Digital Commitment for Organizations

We believe…

Programming and computational thinking skills are becoming ever more important in our society and working life. As emphasized by the 2015 New priorities ET2020, "**knowing how to code is empowering**. It allows us to understand the digital world we live in and to shape it. Basic coding skills are essential for accessing the jobs of tomorrow and today".

In light of these recommendations, the CODESKILLS4ROBOTICS project aims to promote **robotics** as an effective introductory channel to programming and other STEM disciplines, as well as a way to develop transversal employability skills such as **problem solving**, **leadership** and **creativity**.

The CODESKILLS4ROBOTICS project is developing the following resources:

→ A **Comparative Report** on the status quo of educational robotics in 4 EU countries;

→ A **Competence Framework** on programming and robotics skills;

→ An Educational Back Pack in 2 modules, available both **for download** and **on our e-learning platform**;

→ A Toolkit to guide schools in setting up educational robotics classes and Clubs;

→ An EU-wide campaign and policy recommendations.

In light of the objectives of the CODESKILLS4ROBOTICS project and of our belief in the current and future centrality of inclusive digital education,

We commit:

→ To support a vision of digital education where **technology is carefully integrated** - and not "dumped" for its own sake - **into education systems**, based on the belief that digital technology can support and enhance people's learning if it is incorporated in a purposeful and strategic way;
→ To embrace a **learner-centered approach** to digital education which seeks to empower learners by taking into account their needs rather than adhering solely to the needs of an increasingly digitalised labour market;
→ To aspire for **cross-sector cooperation** by building bridges between formal, non-formal and informal learning in order to foster innovative and inclusive

approaches to meeting learners' needs

→ To advocate for **increased support for teachers and educators** involved in the implementation of digital technology in learning environments, including calls for investments in their competences and initial and continuous professional development;

→ To advocate for **equal access**, for all students and at all levels of education, **to STEAM learning opportunities** (Science, Technology, Engineering, Arts and Mathematics), as well as for their **inclusiveness** regardless of gender, ableness, race, religion, sexuality, socio-economic status or any other difference;

To being active advocates for **inclusion** as the **key guiding principle** for policies on digital education at national, European and international level, placing particular emphasis on the implementation of **educational robotics** as a flexible, effective and interdisciplinary introductory channel to STEAM subjects.

We hereby agree to include the name of our organisation in a public list of signatories until the end of the project lifetime and to identify the following person as CODESKILLS4ROBOTICS Ambassador. They will be the first to be informed about upcoming project-related opportunities (campaigns, events, policy statements etc.), and they will represent the point of contact between their organisation and the CODESKILLS4ROBOTICS project, also allowing for direct support in case clarifications on any of the project-related tools and materials are needed.

In order to promote educational robotics CS4R project creates a list of practical pedagogical instruments to be used by teachers, educators, parents and in general by who can propose an additional educational program for students apart the official one.

The piloting in the four partner countries in the EU countries, proved its ability to foster understanding, collaboration, and critical thinking among students in primary schools.

However, certain limitations need to be addressed and opportunities utilized to facilitate the achievement of the educational robotics full potential. The Manual is highly effective for the conduction of a limited number of lessons, but cannot serve as a stand-alone basis for a fully-developed program, part of the regular school curriculum. The model's successful implementation relies on tackling some fundamental obstacles it faces in the classroom:

- limited time for the learning activities' implementation, dysfunctional and strained teacher-student relationship,
- non-productive immediate learning environment, stern scholastic traditions, disparities
-

These identified barriers could be addressed and overcome by taking actions at system, institutional, and individual level.

Below, we present some key recommendations for such actions.

The immediate addresses of these recommendations are authorities, institutions and policymakers at European Union (EU) and national level, municipal agents, administrative school bodies, students' and/or parents' associations, educators' organizations and the civil society.

• Integrate educational robotics in regular curriculum

• Create a structured teaching program for Educational robotic classes

• Create a network of experts, mentors, ambassadors and teachers

Systemic Level

• Design and creation of the optimal learning environment

• Tailor teaching approaches and practices to the specific needs of educational robotics trainings and learning activities

Institutional Level

• Support educational robotics and computational thinking

• Strengthening the bond between teachers and students

• Refining the Pedagogical Manual