



## Steamers and Robokids: Reliable European Projects to Enhance Young Children's Interest in Science and Robotics

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### Abstract

*The article is based on two projects, Steamers and Robokids - funded by the European Commission under the KA202 Erasmus+ Cooperation Partnerships in school education. The projects are being implemented by the EuroED primary school, Iasi, Romania, as well as by schools and institutions in the field of education from Croatia, Cyprus, Greece, France, Italy, Poland and Romania. The projects stem from the new challenges that education faces in today's digital society. In order to meet the new requirements of our digital society, access to high-quality state-of-the-art education embedding Steam-based issues and robotics is necessary since early childhood. Decision-makers are becoming increasingly interested in integrating STEAM methodologies into formal education as STEAM programmes are receiving growing attention in the global educational community. According to research, using STEAM approaches in early childhood will help children establish good attitudes toward this type of education later in life. The projects' goal is to establish training programmes for pre-primary teachers that are focused on the abilities and essential competencies required to foster positive attitudes toward the subjects, overcome their worries, and boost their confidence in motivating children's engagement in learning. The article outlines the findings of the desk research regarding robotics and/or STEAM education for preschool and primary schools in Romania, including private schools and clubs, and provides some insight into the projects' objectives, target users, and main deliverables.*

**Keywords:** children, robotics, Steam, training programmes, teachers

### 1. Introduction

In order to properly understand our multidimensional, diverse, and technologically advanced world, which is increasingly interconnected, new analytical techniques are needed. They impose new demands on educational institutions, including what and how teachers should teach young children. Children need to be prepared in school to handle communication and collaboration across disciplinary boundaries. STEM (Science, Technology, Engineering, and Mathematics) and STEAM (Science, Technology, Engineering, Art, and Mathematics) are two new cross-curricular approaches that offer multidisciplinary education encompassing science, technology, engineering, math, and the arts.

Such methodologies ensure the development of skills and knowledge in fields relevant to science and 21st-century competencies [1,2,3]. They can help children develop their imagination and comprehend abstract topics by combining the knowledge of several fields. Robotics has lately advanced, creating new opportunities and challenges, and it is now present in primary schools and kindergartens as well as in colleges.

The interdisciplinary field of robotics combines engineering, technology, and science to explore robots. It develops knowledge and skills that children as young as five can understand and use while playing and having fun with robotic and digital technologies. Children exposed to robotics at a young age engage in memorable educational activities that resort to design, construction, imagination, creativity, and critical thinking [3,4]. In order to provide engaging robotics experiences, a new branch of pedagogy called Educational Robotics (ER) tries to connect pedagogy with robotics. In educational



robotics, play and learning merge, making learning a memorable activity that is easy, engaging, and efficient.

## **2. The STEAMERs and RoboSteamkids projects**

It is crucial to provide early learners with access to high-quality, appropriate STEAM and robotics education. Preschoolers demonstrate a natural curiosity about the world around them and a willingness to anticipate, investigate, make hypotheses, evaluate, and come up with ideas. In spite of this, research indicates that primary and early childhood teachers have little to no training in STEAM. The STEAMERs and RoboSteamkids projects aim to bridge this gap by creating STEAM training programmes for pre-primary teachers that focus on the abilities and key competencies required to foster a positive attitude toward STEAM, get over fears, and boost self-efficacy and confidence to implement cutting-edge STEAM teaching techniques in the classroom.

The projects address:

- early childhood education teachers
- children aged 3-6 years old
- parents/caregivers
- stakeholders, training providers, etc

### **2.1 The STEAMERs project**

The STEAMERs project - STEAM and Educational Robotics in PrePrimary Education (2021-1-FR01-KA220-SCH-000030010) is being developed within a partnership of schools and organisations in the field of education from France, Cyprus, Poland and Italy. The project creates a programme training course for preprimary and kindergarten teachers to develop STEAM and educational robotics knowledge, skills and key competencies (STEAMERs). The project enables teachers to develop children's skills to carry out STEAM-related tasks which include cognitive, technological skills and collaboration and communication skills.

The project's results range from the STEAMERs Compendium (a complete report identifying the training needs of pre-primary school teachers to effectively carry out STEAM education with their preschoolers), the methodological training course (the curriculum for pre-primary school teachers) and an e-Learning platform promoting an online training course.

### **2.2 The RoboSteamkids project**

The RoboSteamkids project (2021-1-FR01-KA220-SCH-000030010) is being developed within a partnership of schools, organisations in the field of computer science and robotics, universities and parents' associations from Poland, Italy, Greece, Cyprus, Romania, and Croatia. The project aims to:

- encourage and equip early education teachers with digital competences and pedagogical skills
- provide teachers with the necessary tools and resources to deal with the challenges faced across Europe.
- promote the European values of respect, acceptance, diversity, equality, solidarity etc.
- prevent the digital divide across member states

The Project's Results include the STEAM and robotics in early childhood education and care (ECEC) handbook, a peer-review for the exchange of good practices and transnational cooperation, the roboSTEAMkids toolkit for teachers, parents and children and the roboSTEAMkids inclusive platform

## **3 Findings of the Research**

### **3.1 Context**

According to the results of the two projects' research, STEAM and robotics education are still relatively new in Romania, but they are anticipated to be extremely important in educating the next generation about the future. The "Action plan for education in Romania 2019-2030" was created by the Ministry of Education in 2019 with the aim of enhancing the quality of public education through the implementation of new teaching/learning approaches, encouraging a calibrated evaluation of learning outcomes, developing new STEAM curricula for all grade levels, etc [5]. Education for Robotics and/or for STEAM is mainly extracurricular, non-formal in Romania, for preprimary and primary schools, including private schools and clubs (e.g., the STEM Kids Robotics Academy, Robo Club, etc). These clubs enhance the children's interest in using technology by offering online tutorials, free online courses and encouraging children's participation in local or inter/national events. The activities creatively stimulate children to build robots, learn how the robot communicates with the tablet, and implement software programmes in age-appropriate platforms.



Romanian preschools need STEAM, robotics, and programming professionals. As it stands, a club, a private school, or an outside instructor could be hired to provide optional classes if parents are interested. Many national or regional programming schools that are franchises of international schools are available (for example, LOGISCHOOL has over 130 sites in 21 countries, including 50 in Romania).

There are few organizations and projects providing resources and materials for teachers and promoting and implementing STEAM education practices and programmes in Romania (e.g., Crestem, Educating for an Open Society with STEAMonEdu and Fundatia EOS, Asociatia Techsoup). The research identified several associations, which engage children in STEAM-based extracurricular programmes suited for the context and specifics of the Romanian education system.

Preschool and primary school teachers in Romania are unable to find formal CPD programs on educational robotics and STEAM education. This is due to a lack of formal teacher training courses on robotics and STEM. The only tools and training courses on offer come from different learning platforms such as Hour of Code, Logischool Romania, or Nextlab.tech. Building simple robots, plant-caring robots, aeroponics towers, and robotic greenhouses is made possible by these learning tools for educators, children, and students.

### **3.2 Research on benefits and challenges of STEAM and Robotics as perceived by teachers**

Nonetheless, it seems that early childhood education is incorporating educational technology more and more. Educators' prevailing attitude toward instructional technology is positive (6,7,8). Instead of the pedagogical argument that technology improves learning, opinions are more likely to be based on the social argument that children need access to technology because it is a part of their daily lives. According to research, young children have a natural curiosity towards STEAM fields and the novel learning environments brought about by digital technology. Also, studies have shown that teaching children simultaneously about material from several academic fields encourages them and speeds up their learning [7].

The research explored teachers' views about STEAM and robotics education and looked at the degree of teachers' confidence in implementing STEAM in classrooms. Teachers showed positive perceptions towards the introduction of STEAM and robotics education in early childhood. Most of them thought that it would be beneficial to explore STEAM as it stirs children's interest in science, technology, engineering, and mathematics. They also appreciated it as it increases children's enthusiasm, stimulates children's knowledge and agency and has positive effects on learning skills (such as problem-solving, collaboration and creativity). Through play, robots help children develop basic cognitive skills of mathematical thinking at an early age: computational thinking, learning from mistakes, teamwork, collaboration or creativity. In addition, the need to search for solutions and the freedom to assign new functions to these robots stimulates imagination and creativity. Teachers described the great interest aroused among children when engaging in STEAM or robotics activities, emphasizing their improved understanding of science, mathematics and robotics concepts. Teachers were optimistic about the implementation of robotics, recognizing its contribution to developing technological, mathematical, social, and language skills.

However, although teachers were confident when teaching mathematics and organizing exploration activities, they stated they were less confident about exploring science, technology and engineering with their children. Their perceived limitations were related to a lack of material, a lack of tools-infrastructure and no or little teacher training. All teachers were of the opinion that they needed additional training and professional development for classroom practices.

While all teachers believed that STEAM or robotics activities increase children's motivation, engagement in learning, creativity, and self-confidence, main difficulties were related to curriculum limitations and a lack of resources, experience, and training in the STEAM and robotics approaches.

## **4 Conclusions**

According to research findings, the perspectives of early childhood educators are evolving; they are now more confident when employing technology, introducing robotics and teaching science to very young children than they used to be before the pandemic. Research has highlighted that positive attitudes toward the integration of science, technology, and robotics are linked to the number of hours educators use technology and the associated pedagogy they learn from necessary training programmes.

As regards the teaching-learning process, combining science and educational robotics may improve students' understanding of and ability to analyze and interpret their environment.

Consequently, it can be concluded that engaging children in robotics and science-related activities is beneficial as it activates and builds their knowledge, inspires actions, and increases and maintains



their interest in learning. These exciting activities help children gain knowledge about science and technology while resolving issues and getting them involved in their surroundings, which is beneficial to the development of cognitive abilities.

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