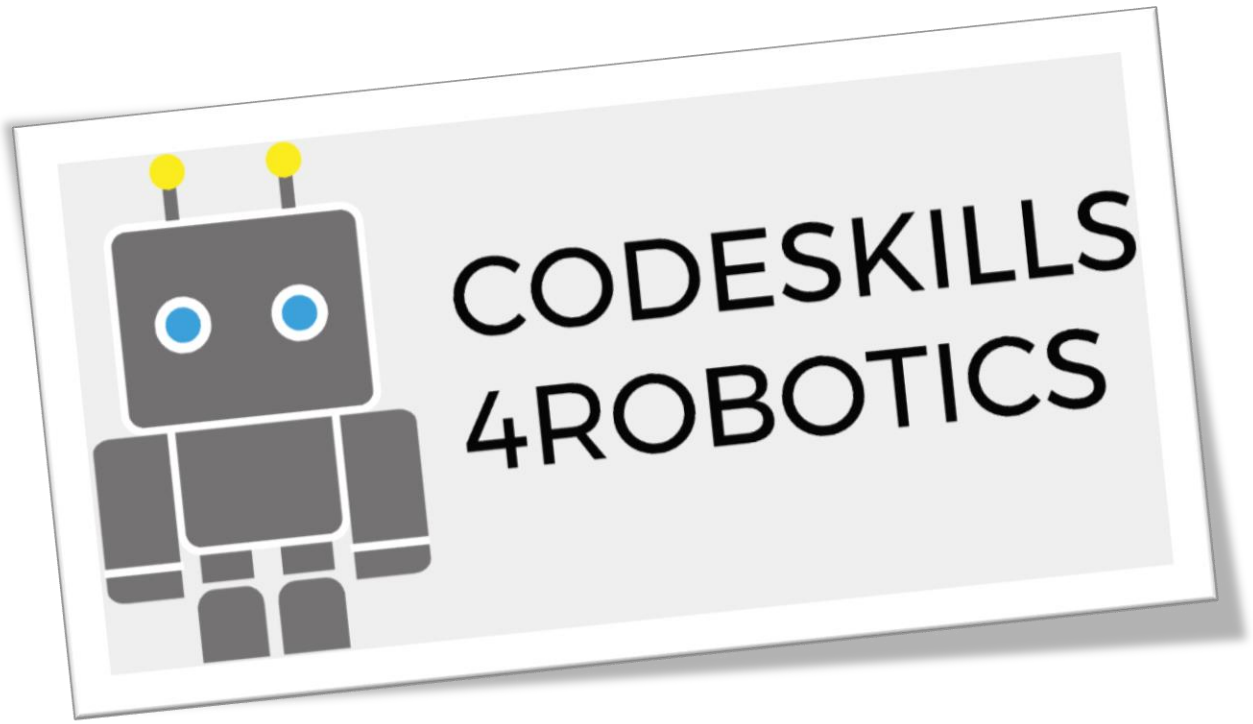

NATIONAL REPORT - CY

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

IO1: Building the CODESKILLS4ROBOTICS Competence Framework: From Theory to Practice

Partner: Emphasys Centre, Cyprus

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Website: http://codeskills4robotics.eu/

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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”

Executive Summary

This report presents the current state of digital education in Cyprus and more specifically on Coding, Robotics and STEM skills in primary school using both qualitative (desktop research) and qualitative (surveys) methods.

After presenting the importance of this project in the context of Cyprus, more details are provided regarding the digital education policies for primary school in the country and the infrastructure to support ICT and Robotics based on the existing literature.

The consortium of CODESKILLS4ALL project has designed and conducted two qualitative surveys, addressed to primary school teachers and students. The survey for teacher aims to explore the existing situation in primary schools regarding infrastructure, teachers' knowledge, culture, etc. and its use for educational purposes. The survey for students aims to explore students' attitudes towards Educational Robotics at school.

The data mining from the questionnaires demonstrate that both teachers and students are willing to be trained to use robotics for promoting and integrating STEM skills through their lessons.

The overall conclusion of the written report validates the importance of expanding national curriculum of primary schools to allow the introduction of programming and robotics through various STEM disciplines while promoting transversal employability skills.

CODESKILLS
4ROBOTICS

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1. Introduction

The introduction sets the scene for primary school education in Cyprus including:

- Description of the project

Programming and computational thinking skills are becoming ever more important in our society and working life: an increasingly digitalised economy has transformed the labour market and brought digital skills to the forefront of the educational scene. As emphasised by the 2015 new priorities ET 2020, "knowing how to code is empowering. It allows 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, ICT school curricula have been shifting their focus from computer literacy to digital literacy, i.e. on teaching students not only how to work a computer, but mostly how a computer works and how to make it work for you. Often selected as an introductory channel to programming, robotics effectively initiate students to various STEM disciplines while promoting transversal employability skills such as problem solving, leadership and creativity.

In the above context, the CODESKILLS4ROBOTICS project pioneers:

- To design, pilot-test and evaluate a complete tool kit that will support primary schools in developing their own digital-inclusive strategies for the promotion of coding, robotics and STEM skills;
- To develop an educational pack containing all the essential materials, tools and resources for the introduction of coding and robotics to primary schools; the educational pack will be based on a targeted Digital Competence Framework, which will also serve as a basis for the monitoring and assessment of the students' progress;
- To introduce the Open Badges system as a method to validate and award the coding skills acquired by both teachers and students, in conjunction with an online assessment tool developed to this purpose; a mobile app meant to support teaching, learning and assessment will also be developed;
- In accordance with the 2018 Digital Education Action Plan for EU, to design a strong campaign as part of the EU Code/Robotics Week; to organize CODESKILLS4ROBOTICS Competitions at the regional, national and EU level, thus promoting transnational cooperation.

- Explain the importance of the project in Cyprus

As far as the Cyprus context is concerned, CODESKILLS4ROBOTICS will produce useful resources for the development and implementation of strategies to promote coding and robotics in primary schools, and it will contribute to bridging the existing gap between EU- and national level digital education policies, as well as between the policy and organisational level. It will record perhaps for the first time the current scene in primary schools whereas it will provide useful information for future plans at the regional and national level.

- Description of the IO1

IO1 - BUILDING THE CODESKILLS4ROBOTICS COMPETENCE FRAMEWORK:

FROM THEORY TO PRACTICE

The development of IO1 will be done through the following activities:

- IO1/A1 - National Reports on the state of the arts in relation to digital, coding and robotic skills, the EU Recommendations and the needs of the primary teachers and the students based on a survey conducted to identify the digital gap.
- IO1/A2 - Comparative Digital Index to fill in the gap that appears to exist among the data provided in National Reports.
- IO1/A3 - The Coding, Robotics and STEM Competence Framework analysing the skills to be used as part of the innovative CODESKILLS4ROBOTICS programme to be offered.
- IO1/A4 – Selection of Robots based on a market research which will be initiated to identify the type most appropriate to be used for introducing coding in primary school while considering cost, students' and teachers' skills, testing, availability and property rights, licences, requirements etc.
- IO1/A5 – Setting up of the Expert Advisory Group – Synergies – Associate Partners to support the quality assurance of the project.

2. Coding, Robotics and STEM skills in primary schools

- Digital education policies for primary school education in Cyprus

The Educational System in Cyprus is based on a centralized educational model. This implies that the financial resources, school curricula and additional programs as well as the teaching staff (appointments, promotions etc.) are controlled by the government. Compulsory education begins at the age of 5 years and 8 months and lasts until the age of 15 or until the 3rd grade of secondary education (gymnasium). Formal school education is organized into three levels: elementary (ages 6-12), gymnasium (ages 12-15) and lyceum (ages 15-18).

In Cyprus the education system is centrally managed by the Ministry of Education and Culture. Local School Boards are responsible for the maintenance and equipment of the school buildings in collaboration with the Ministry of Education and Culture. Public schools are not free to decide either on the content of the curriculum, the textbooks used, appointment of the teaching staff or raising and managing money for the school.

At the beginning of every school year methodological instructions for the various subjects of the curriculum are usually given out to teachers as part of seminars facilitated by the inspectors of each subject. The National Curriculum for public primary schools is determined by the Council of Ministers upon suggestions by the Ministry of Education and Culture. Primary education in the public sector comprises a six-year cycle of studies, which is free and compulsory for children who have reached the age of 5 8/12 years. As of the 2020/2021 school year, the entry age into primary school will be gradually raised to 6 years.

Since 2011 the Government of Cyprus has initiated an ambitious Educational Reform Programme with the view to turn into reality the vision of a better and more modern educational system that would meet the needs and challenges of the 21st century. As a result a New National Curricula for the primary education was introduced, accompanied with new timetable. Although new subjects and changes were introduced such as Natural Sciences and Technology, English, Life Education (Health/Environmental/Consumer Education), etc.

The Department of Primary Education gives particular attention to the use of modern technological achievements for the improvement and enrichment of curricula in Primary Schools. The Department gives to the teachers the best alternative way to achieve course objectives, through an integrated programme which implies the use of ICT in educational process.

The Program comprised three important pillars:

a) Development of a modern and adequate infrastructure in all classrooms

b) A continuous and comprehensive teachers' training on their personal skills and computer usage

c) The reconstruction of existing curricula in the terms of goals and activity level with the perspectives provided by multimedia and the internet.

Pillar A: Schools and all classrooms converted into small computer laboratories to enable both the teacher and students to acquire knowledge through their interaction with computers. The access of on the Internet and the use of applications are the major achievements of MEC.

Pillar B: Continuous teachers' training on the use of technology. Initially, the basic training for teachers on their personal computing skills and internet applications would be provided, followed by in-service training on how the computer can be used in a course. The presentation of educational software is within this training.

Pillar C: Reconstruction of curricula to integrate the utilization of new technologies. In various courses, there is space and time to substitute the traditional activities with new dynamic interactive activities using computers. With the development of digital material, every teacher can participate in training in order to learn how to use this alternative way of teaching.

Having said that ICT is taught as an extra-curricular topic as part of the curriculum of Compulsory Whole Days Primary Schools or Optional Whole Day Primary Schools. Pupils choosing to attend either of the two type of schools are offered lessons on ICT topics, such as MS Office, and in some cases coding and robotics.

In the primary school curricula ICT is not viewed as a distinct subject yet; it is used as a powerful tool that has the potential to enhance teaching and learning, in line with the current pedagogical methods. In the absence of teachers specialized in computer science / ICT, the Ministry of Education and Culture (MOEC):

a) Formed a team of ICT advisors-consultants, consisting of seconded primary school teachers, with qualifications and expertise in ICT and

b) Assigned a small number of teaching periods to one or two teachers in every school so that the teachers may have time to deal with ICT-related duties.

According to Eurydice's Key Data on Learning and Innovation through ICT at school in Europe, in Cyprus there are national strategies covering training measures in the areas of ICT in schools, and training and research projects in the area of digital literacy. There are central steering documents for ICT learning objectives at primary and secondary education level for using a computer, using office applications, and searching for information. According to official steering documents, both students and teachers at

primary level are expected to use ICT in all subjects, both in class and for complementary activities, except for in natural sciences, social sciences and the arts at primary education level, where students are only expected to use ICT in class. There are no central recommendations on the use of ICT in student assessment.

The integration of ICT in primary education aims not only at the technological enrichment of the learning environment, but also at the essential differentiation of the educational process. The ICT integration plan suggests the enrichment of the national curriculum at the level of objectives and activities in order to include ICT use in schools and also the development of essential educational material (software and other) in order to assist the use of ICT in the educational process.

It is important to note that the Ministry of Education plans to introduce digital technology courses in primary education, and according to the current Minister Costas Hambiaouris (https://in-cyprus.com/education-ministry-to-introduce-robotics-courses-for-primary-school-children/), pupils will be taught digital skills, internet safety, computational thinking and robotics.

- Infrastructures in primary schools that support ICT and Robotics

As mentioned before, the Cyprus educational system is highly centralised. Therefore the great majority of the responsibilities for ICT in schools lie with the Ministry of Education and Culture (MoEC). At the national level, the MoEC has established a number of ICT teams, responsible for each of the project's main areas:

- ICT infrastructure and equipment
- Digital educational content & software
- LMS & educational portal
- Teacher ICT education and professional development School Management System
- Internet/Web services
- ICT contracts monitoring
- ICT budget and planning

In regard to the infrastructure, the MoEC is continuously providing advanced ICT equipment to all public schools in Cyprus, such as desktop computers, laptops, interactive white boards, printers, scanners, video projectors and computer labs.

Based on the Survey of Schools: ICT in Education, a study prepared for the European Commission in 2013, for the academic year 2011-2012, in Cyprus there was one computer available for every 7 students (same as the EU average). On average in the EU primary school students are in schools where 58% of the computers are located in computer rooms. In Cyprus, almost all the computers are distributed equally in lab and classrooms, while there is a really small number of computers which are located in libraries or anywhere else (main building, offices, etc.).

In addition, regarding to Digital education content and software, 19 titles of software were purchased and installed in primary and schools. The software can be used as supplementary material for the large majority of curriculum subjects, while a number of educational software titles were translated to Greek and adapted so as to be in line with the national curriculum. Moreover, a concept mapping software was acquired for all school and Staff personal computers of primary education. This software was customized to be in line with the national curriculum and can be used interdisciplinary for all curriculum subjects.

- How are coding/robotics/STEM skills integrated in the school curriculum in Cyprus?

The national curriculum of primary school in Cyprus consists of the following courses:

- English
- Health education/ Life education
- Geography
- Greek modern language
- Cross-curricular lessons
- Art
- Religious studies
- History
- Literature
- Mathematics
- Music
- Environmental education
- Design and Technology
- Sciences
- Physical Education

As it can be seen from the list above, ICT is not a distinct subject of the National Curriculum in primary schools, and as a result no one would expect to find coding or Robotics. However, educational robotics have been introduced in the school subject of 'Design and Technology', in which STE(A)M skills are reinforced.

The 'Design and Technology' course is delivered at the Grade 5 and 6 for primary school (10-12 years old) for 2 periods per week and it aims to enhance students technologically literacy in the following areas:

(a) Technological knowledge
(b) Technological skills and competences
(c) Values, attitudes and experiences on solving technological issues

Robotics has been introduced in 2009 and today is a part of the 'Design and Technology' formal curriculum, in the 'System and Control Technology' module, with the prospect to expand their presence in the near future. More details of the specific module are provided on Table 1 (page 10)

In 2009, all public primary schools in Cyprus have been provided with the control boxes EGGBOX, LEARN&GO and ENGINO educational packs, while few years later the PROBOT robot, including its software and additional supporting material, has replaced the control boxes in schools. It is expected that new educational robots such as LEGO Mindstorms EV3 and Scratch programmable Bluetooth floor robot such as InO-Bot and Pi2Go will be introduced soon.

Figure 1 presents the steps taken for introducing robotics in primary schools.

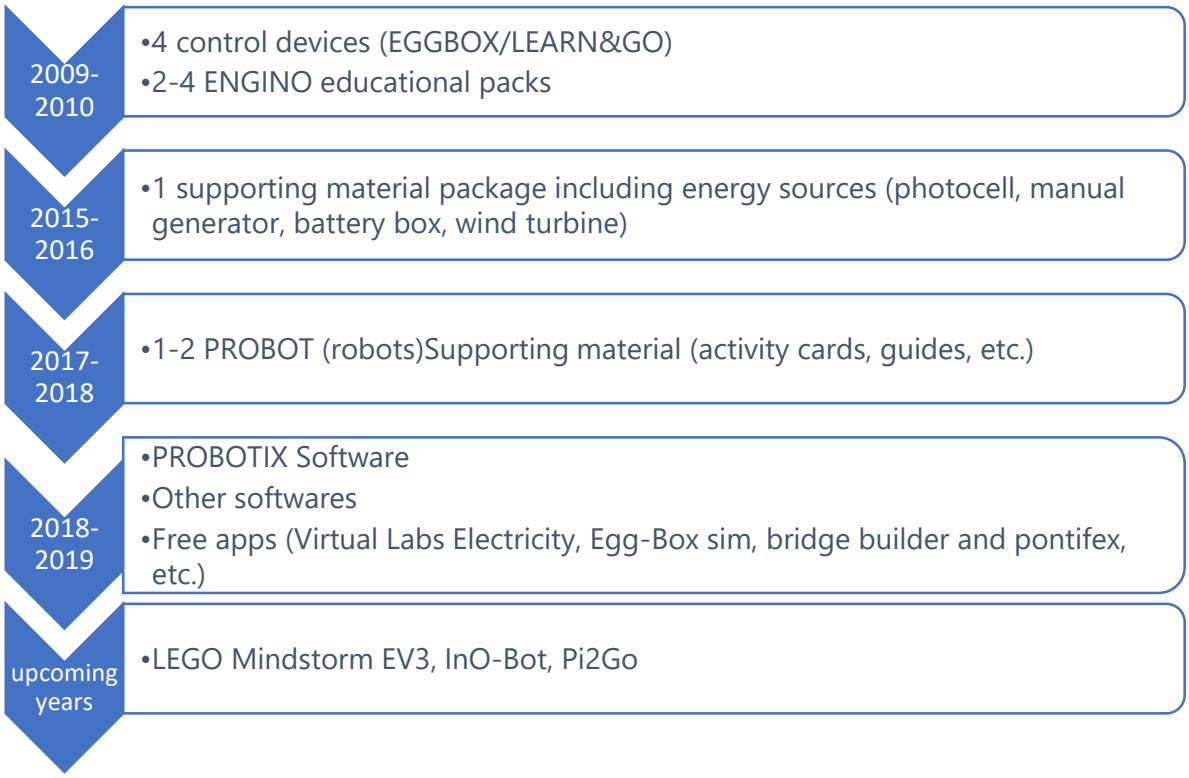

Figure 1: Roadmap: Introduction of Robotics in primary schools

EGGBOX

The control devices EGGBOX and LEARN&GO do not connect to a computer and are designed to work with models containing simple bulb, buzzers and motors.

LEARN&GO

ENGINO

The Engino® Robotics Platform (ERP) is specially designed for Primary and Secondary school. It takes into account the latest technological trends and the most modern pedagogical principles and STEM learning. it consists of all the necessary parts for building and programming a variety of robots. The package includes the ERP controller, RJ cables, touch sensor, InfraRed sensors, motors, LED lights, USB cable accompanying with a booklet.

PROBOT is a car-shaped robot which has 'bumper' touch-sensors front and back, a light sensor on the bonnet and a sound sensor underneath. A year later, the schools have been also provided with the PROBOTIX software and an appropriate USB lead, to download and run programs from a computer.

PROBOT

As mentioned above, robotics are included in the subject matter of Module 4.

Table 1: 'System Control Technology' framework

Grade 6	
Module 1: Introduction	
Module 2: Construction Systems	
Module 3: Mechanisms: Wheel - Pulley	
Module 4: System and Control Technology	
Benchmarks and Indicators	
1. System and Control Technology	
The students should be able to recognize control systems through the industrial field and their environment (school, home, etc.) and describe their functionalities	- What is a system? Definition and examples - Basic system categories (electrical/electronical, mechanical, building systems). Examples
2. Control Devices (EGG BOX and LEARN&GO)	
The students should be able to design models, to build and program simple control system to solve problems	- What is a control system and why is it important in our life? - Problems solved with the use of control systems - Control systems' programs
3. Robots (PROBOT)	
The student should be able to program robots (movements, distance, degrees, sensors, repeat until, etc.)	- What is a robot? - Which are their features? - Which are their basic parts? - Robots in our life - Robots: threat or evolution? - Programming using software (light-bot, probotix, etc.)
Aims	
	- To know the functionalities and features of control systems and robots - To give examples for the usage of control systems and robots in daily life - To understand and explain a sequence of instructions - To program specific control systems and robots - To evaluate the procedure of their work and improve It, if needed

Table 1 presents the 'System and Control Technology' Framework (designed in 2018) is addressed to primary school students at Grade 6.

Coding/programming, robotics and STEM skills are introduced in this module, in the following ways:

- **Robotics:** PROBOT robot (features, functionalities, etc.)
- **Programming**: Programming robots (using PROBOTIX software to program PROBOT, etc.)
- **STEM** skills: integrate robotics into specific modules such as (design and build constructions using control devices)mathematics (geometry), Greek modern language (devices), etc.

It is also noted, that several educational seminars are organized by the Pedagogical Institute of Cyprus in order to enhance the teacher's professional development. The most recent seminars, which prove the potential of expanding and development of the robotics presence in primary schools, are presented below:

1st National Conference – STEM and Robotics in Education
Aim to inform primary school teachers about:

- The added educational value of integrating STEM and Robotics in Education
- STEM and robotics integration in the course of 'Design and Technology'
- Exploitation and integration of technological tools/equipment in the learning process

The 1st National Seminar was organized in March 2018 by the Pedagogical Institution of Cyprus in collaboration with ENGINO.net Ltd. In addition, during this conference, workshops on STEM and Robotics were organized using ENGINO Robots.

ΔΕ10.002 – Robotics in education
Aim to educate primary school teachers:

- to use robotics (Blue Bot, Code & Go Robot Mouse, Engino Robotics Pro Lego WeDo)
- ways to integrate robotics in the learning procedure.

ΔΕ10.004 – Design and Technology in primary school: Basic skills, simple solutions for building robots
Aim to educate primary school teachers:

- on subjects regarding robotics and the learning methodology of 'Design and Technology' course as well
- ways to enhance their skills for achieving an effective teaching on the practical part of learning
- ways to exploit modern and innovative methods through the use of robotics.

Both the above seminars (ΔΕ10.002& ΔΕ10.004) were organised in a form of workshops (5 seminars*2.5 -3 hours each) between Octobers – November 2018 in Nicosia, Cyprus.

- Identify the Existing gaps

While initiatives worldwide continue to place pressure on schools to improve STE(A)M education, the already overckrowded curriculum leaves little space for the integration of new courses or topics such as ICT, Coding and Robotics. Research has identified individual initiative by head teachers and Parents' Association to introduce robotics in their schools, either as part of extra-curricular activities or as part of the action plan of the school at the beginning of the academic year. These initiatives are usually supported by universities in the public and private sector, other organisations such as the Cyprus Computer Society, SMEs such as ENGINO or research centres/IT institutions such as Emphasys Centre.

In these cases, synergies are created among the key stakeholders of public and private sector to support the effort of promoting STE(A)M and soft skills using educational robots. It is also important to mention, that many private schools in Cyprus offer Robotics classes as extracurricular activity and some of them are listed below:

- The Grammar School: http://www.grammarschool.ac.cy/easyconsole.cfm/id/1542
- The GC School: https://www.gcsc.ac.cy/institute/rompotiki/

Numerous benefits are reported in the literature about the use of educational robotics; yet their integration in school contexts requires time that cannot be taken from other important courses; although they can be used in order to cover a variety of different and important aspects in the course of mathematics, science, technology, etc.

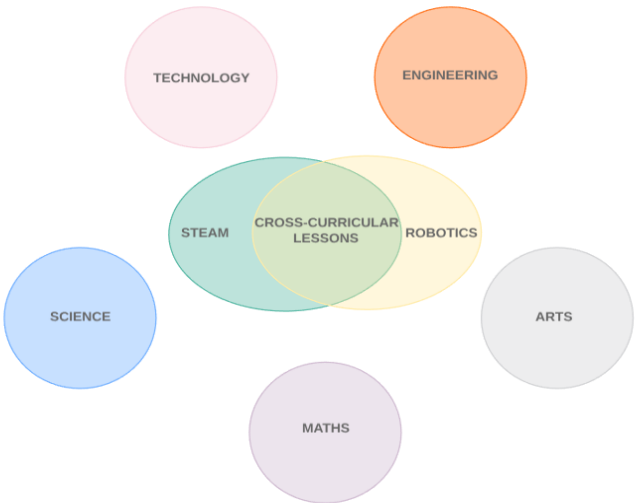

Figure 2: Cross-curricular lessons

Figure 2 presents an educational approach in which cross-curricular lessons can be delivered to teach primary school students STE(A)M skills using robotics.

In Cyprus, robotics have been officially introduced in the current academic year (2018-2019) as part of the 'Design and Technology' course. However, concerning the above scheme (Figure 2), the information provided is limited regarding the design of cross-curricular lesson plans for the integration of STE(A)M skills using educational robotics.

The use of educational technology aims also to develop students' soft skills. Educational robotics is considered as such a technology tool whether it is used to enable students engage in problem solving or collaborative learning and creative thinking. Today, educational robotics is seen as an innovative, progressive and versatile educational tool for teaching and learning. Therefore, it is extremely important to exploit the fact that robots are also fascinating for students of all ages in order to develop their soft (personality) skills.

Overall, educational robotics has emerged as a unique educational tool that can provide hands-on activities in an attractive learning environment, boosting students' interest and curiosity. Yet, despite the great interest developed around this topic, formal educational robotics curricula and courses are currently lacking in Cyprus primary school education in terms of promoting STE(A)M as well as soft skills.

- Other European/National projects relevant to the scope of the project.

Cyprus Computer Society (CCS) is a professional and independent organization which seeks to improve and promote high standards among informatics professionals. CCS is engaged in a range of activities, expresses its views to the National Authorities on IT strategic issues and engages in European and other projects, such as **'CODE CYPRUS'. It is a leading organization and an active member of the Grand Coalition of Digital Jobs Strategy of Cyprus thus promoting the digital agenda of Europe.**

It is worth to mention, that ECDL (European Computer Driving Licence) is managed by **CCS** in Cyprus. Two new modules have been included in ECDL, Coding and Robotics. The induction of these modules has been considered extremely important since the educational system worldwide is evolving to incorporate robotics in the classroom so the students understand the fundamentals of this new technology while developing necessary building and programming skills associated with robotics.

In addition, '**getonlineweek.eu'** is another project that is leaded by CCS. The introduction of coding to students using Scratch programming language is one of the interactive activities organized within **'getonlineweek.eu'** event in 8 schools in all major cities covering geographically the whole Cyprus.

Moreover, **EU Code Week** is a week full of events and fun activities which promote informatics and programming to young people and **CCS** organizes some of these events. Within the framework of European weeks, **Hour of Code** and **EU Robotics Week** are widely known for the several events which are organized all over Europe during the same time, and Cyprus is one of the countries which is actively participated every

year with an increasing number of events. **Hour of Code** is a global movement reaching million students and it offers an hour tutorial designed for all ages in over 45 languages. It is an open and on-line resource used for teaching coding in non-formal or formal settings.

Engino.net Ltd is a programmable robot invented by a Cypriot teacher and engineer, for the purpose of helping pupils build technological models that they can experiment and learnt about science and technology in a playful way. **ERP** is specially designed for Primary and Secondary level students and takes into account the most modern pedagogical principles of learning. As it has been mentioned earlier, ENGINO has organized the 1st National Conference in Cyprus about STEM and Robotics in Education, in collaboration with the Pedagogical Institution of Cyprus.

Concerning private sector all around Cyprus, many institutes, clubs and youth centres take the initiative to participate in several events and workshops, using their own teaching methods, under formal and non-formal educational settings.

European University Cyprus and **Frederic University** are higher institutions in Cyprus which offer Robotics courses and facilities for the design and the development of robots. Moreover, they own Robotics club which helps members acquire the programming skills and knowledge of the hardware. The Club organizes on-campus competitions between member's robot creations and the students are get prepared for their participation in Robotics Olympiads.

European University Cyprus, University of Cyprus and Technological University of Cyprus were some of the hosting organizations for several activities within the **EU Robotics Week**.

Emphasys Centre, a private education and research Centre, introduces the Robotics course 'ROBOKIDS', suitable for primary school students, due to the need of motivating young students into programming and meet the needs of the current trends. The educational Centre also offers the ROBOCODE and ROBOEXPERT courses, suitable for secondary and High school students. Empahsys Centre is also organising events, workshops and seminars during in the EU CODE and EU ROBOTICS WEEK.

The Research department of Emphasys Centre has been involved in other European ERASMUS+ projects related to the topic. The projects are listed below:

- **CODE@YOUTH** is an ERAMUS+ project in the sector of YOUTH which aims to introduce Programming (Visual Basic) and Robotics (Edison robots) to young teenagers (14-16 years old) ad offer them career options in order to initially have a first-hand experience of the various field of computing and then choose to study in a related topic (More information: http://codeandyouth.eu/)
- **ROBOT4ALL** is an ERAMUS+ project in the sector of VET which aims to introduce Programming (C++) and Robotics (Arduino robots) to VET schools (15-18 years old) as an innovative way to address deficits, social exclusion, prejudice and learning disparities (More information: http://robovet.eu/)

The **CoderDojo** is another global movement in which volunteers all around the world help young people to build a positive future through coding. In Cyprus, there are **open schools** who organize several workshops and seminars under **CoderDojo** movement. The aim is to teach young people (7-17 yrs.) to learn to code, build a website, create an app or a game and explore technology in an informal, creative and social environment.

3. Empirical Research - Statistics

- Description of the questionnaires

Two different versions of questionnaires were designed. One version is aimed towards teachers and the other one towards students. The aim of the questionnaires is to establish the level of knowledge and skills that students and teachers have in relation to robotics. In order to develop suitable learning material for both target groups we first need to identify the gaps and weaknesses of the existing curriculum. Having identified the issues we can then proceed with the development of a syllabus which will enhance, improve and provide additional and essential skills for both students and teachers.

- Description of the target groups

The results presented in this report are based on the feedback from 57 teachers and 57 students of various schools and disciplines.

- Sampling and Method

Survey for teachers: Simple Random Sampling - The questionnaires have been sent to all primary schools provided in the list of Primary schools in Cyprus. Therefore, all the potential teachers-participants were equally likely to fill in the survey.
Survey for students – Based on teachers' participation: The sample of student participants was based on teachers' participation. Teachers who shown an interest about the project and willingness to get involved in the next phases of the project, have supported and motivated their students to engage in this survey.

- Results summary

All the statistical results including graphs are shown in Annex A (Survey for Teachers) and Annex B (Survey for Students).

Survey for Teachers

This survey has been answered from 57 teachers in Cyprus: 54.4% of women and 45.6% of men. Most of total number of respondents (40.4%) is between the ages of 36-45 years old and more than half of them (56.1%) are teaching in urban schools. 17/57 teachers have 11-20 years of work experience while the rest of them have either 1-10 years of work experience or over 20.

Most of teachers who had participated in this survey, claimed that their schools have the very basic facilities such as computers for the teacher, internet connection, and peripheral devices, while more than half of them have also computer laboratory for students, interactive whiteboard as well as computer for the students in the classroom.

It is noted that 4 out of 5 schools lack specialised equipment such as educational robots available for students.

It is worth mentioning that in 39 out of 57 schools' as per the teachers' responses, educational robotics is not taught at all as a distinct subject. In the schools in which educational robotics are taught is for supporting other lessons in which IT is incorporated.

Less than the half of respondents (26/57) do not have background knowledge on Educational Robotics, while the teachers who have, attended Educational Robotics seminars organised by Private Educational providers or are available online. Only a minority of them (8.8.%) have attended seminars which have been organised by a National provider.

Over a half (59.6%) of the participants have never come into contact with the term of STEM Education and 32,1% of the participants do not know how to integrate STEM learning into their lessons. However, it is noted that 22.8% of the participants have used educational robotics in their lessons.

Most of the participants considered that the suitable age for introducing Educational Robotics is between the ages of 9-12 years old.

Concerning the reasons which prevent teachers from using Educational Robotics in their lessons, it appears that lack of infrastructure (75.4%) in their schools and lack of training (68.4%) are the most important factors.

Overall, the participants believe that courses such as Computer Science and Mathematics are the most suitable for integrating Robotics and more specifically in the areas of problem solving and inventiveness.

Almost all the teachers who participated in this survey, showed their interest to use Educational Robotics in order to teach STEM through project work and cross-curricular work.

In the additional section of the current questionnaire, in which teachers have been asked to leave their comment, the following statements have been reported:

- Robotics can be embedded in primary schools in many ways such as all day school, summer schools or cross-curricular school activities.
- Robotics should be taught by teachers who took the proper training
- Anyone who is interested and willing to take a training, could teach robotics
- Robotics clubs could be a fascinating way to integrate robotics in primary schools
- ICT is not a distinct course in primary school curriculum. However, as teachers, we can attend robotics seminars and integrate robotics in other courses such as 'Design and Technology'

- Robotics can be taught in collaboration with educational institutions (who have the experts), universities, private centres
- It is not easy to integrate robotics in the national curriculum of primary school education. However, robotics can be taught in all day school or summer schools in collaboration with the Parent Association
- It is impossible to teach robotics without having the know-how. However we can collaborate with external providers.

Survey for Students

This survey has been answered from 57 students in Cyprus: 59.6% of boys and 40.4% of girls. The most of them (71.9%) are between the ages of 124-13 years old and some of them (26.3%) are 10-11 years old, while only 1 kid is 8-9 years old. 47/57 kids are attending urban schools while the rest of them are going to rural schools.

Over a half of respondents (57.9%) know what Educational Robotics is, while the 75.4% shown a great interest to learn more about robotics. Based on the survey results, it has been also noted, that 78.9% of the participants have tried to build or program a robot before.

Among the terms which are most related to robotics the respondents stated: engineering, computing and mathematics. 43.9% of the participants believe that Educational Robotics cannot use be used in other lessons, while the 35.1% claim that it can be used in Computing and 21.1% in Sciences.

Only the 21.1% of participants' school offer robotics classes in which the lesson is offered 1-2 times per week. 61.4% of students would like to attend robotics classes in order to learn how to build a robot, while 56.1% would like to attend robotics classes in order to learn new things and program a robot.

40 out of 57 have answered the question 'A robot I would like to construct will…

Here is a list of some answers:

- Play with me
- Learn new things
- Help me with my homework
- Help my mother out with the house works
- Play football with me
- Be my friend
- Take/travel me anywhere in milliseconds
- Cook for me
- Talk with me
- Have emotions so I can share my problems
- Have loud speaker
- Do everything I want
- Be a girl, so I can talk and sing with it

- Help me to draw, play the piano and have fun
- Look like a human
- Be smart
- Do whatever a human can do
- Collect all the rubbish in the earth
- Carry my school bag
- Be a football player
- Be beautiful with nice accessories and high tech features
- Be able to construct other things

4. Results and Conclusion

Overview of the country strengths and weaknesses, examples of good practices, relevance of this project to the country – how it could add value

Programming and coding skills are already as useful as knowledge of foreign languages. In the upcoming years, it will become a skill essential to the majority of workers. Already in the Cyprus labour market, there is an increasing demand on programming skilled specialized personnel.

Document analysis at the national level revealed that ICT is not a formal subject of the National curriculum of primary school in Cyprus. However, evidence suggests that it is integrated in all other aspects. In terms of infrastructure and equipment public primary schools in Cyprus are well equipped with technology tools, but not with robots.

Educational robotics are presented in the syllabus and national curriculum of Design and Technology course, specifically in module System and Control Technology which promotes in a constructive way STEM and soft skills. Apart from that educational robotics are not officially included in the time schedule of public schools. Evidence suggests that several Whole Day Schools and Optional Whole Day Schools are teaching ICT and in some case coding and robotics on a weekly basis. Also individual initiatives by head teachers or Parent's Associations have been reported to exist in introducing coding and robotics to schools. Equally, cooperation with universities in the public and private sector, other organisations or research centres are also reported.

Findings from this study-survey support the project's standpoint about the value of using educational robotics to expand the curricular space. The current report presents evidence that the education system in Cyprus does not integrate STEM skills using Educational Robotics in a comprehensive and holistic way. Though Coding and Robotics is considered an important subject for both primary and general education, there is no official training policy in these issues, yet.

There is evidence to suggest that since 2016 the Pedagogical Institute in cooperation with the Ministry of Education and Culture has been offering short in-service training courses for primary school teachers for introducing robotics in schools. Also, the P.I. offers an optional afternoon training course for teachers.

Although, the infusion of educational robotics requires some extra preparation on behalf of the teacher, the benefits seem to be rewarding. With careful design, a cognitive bridge is created between curriculum objectives and the educational robotics experiences, encouraging students to acquire content knowledge in addition to STEM and soft skills.

These findings, although preliminary, are strengthened in terms of consistency across data sources (i.e., teachers and student questionnaires) and school settings (i.e. digital policies in Cyprus, infrastructure in schools).

The data mining from the questionnaires demonstrate that both teachers and students are willing to be trained to use robotics for promoting and integrating STEM skills through their lessons.

Educational Robotics has positive effects not only to the cognitive field, but also in the emotional field (self-esteem, self-confidence) and social field (socialization, demystification).

Overall, the study demonstrated the importance of expanding national curriculum of primary schools to allow the introduction of programming and robotics through various STEM disciplines while promoting transversal employability skills.

Teacher professional development should provide inspiration for the creative integration of educational robotics in the existing school curricula.

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Annexes A & B

ANNEX A: Survey for Teachers

EDUCATIONAL ROBOTICS IN YOUR SCHOOL – INFRASTRUCTURE

Which of the following facilities do you have at your school?

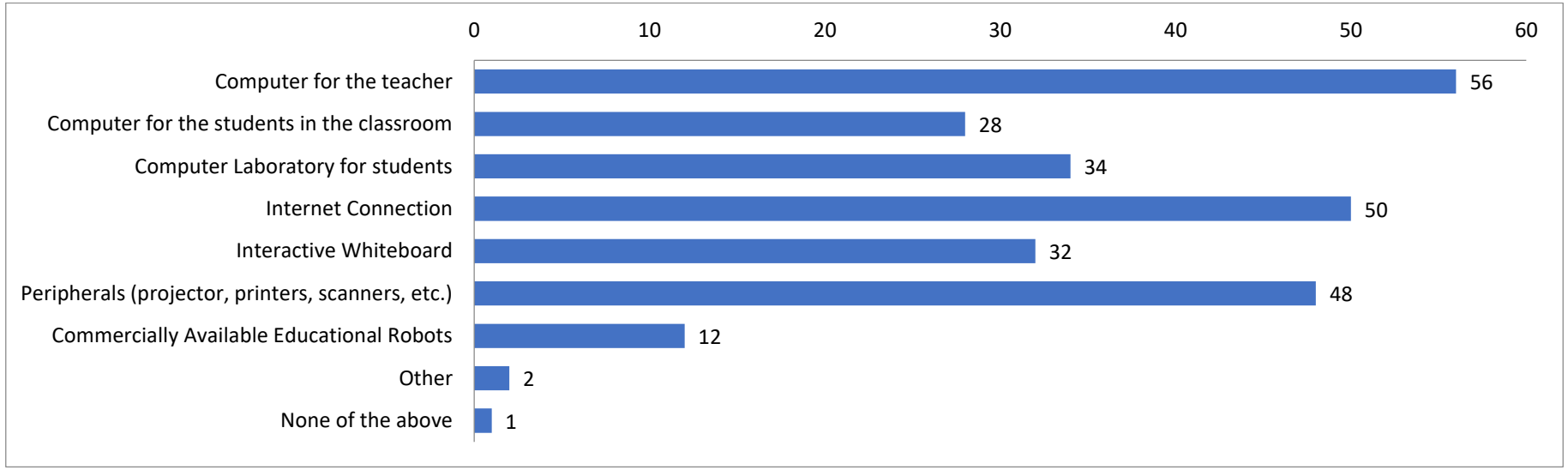

Figure 3

The above graph (Figure 3) shows that in most of schools have very basic facilities such as computers for the teacher, internet connection, and peripheral devices, while more than half have also computer laboratory for students, interactive whiteboard as well as computer for the students in the classroom. It is noted that 4 out of 5 schools lack specialised equipment such as educational robots available for students.

In what ways is educational robotics taught in your school?

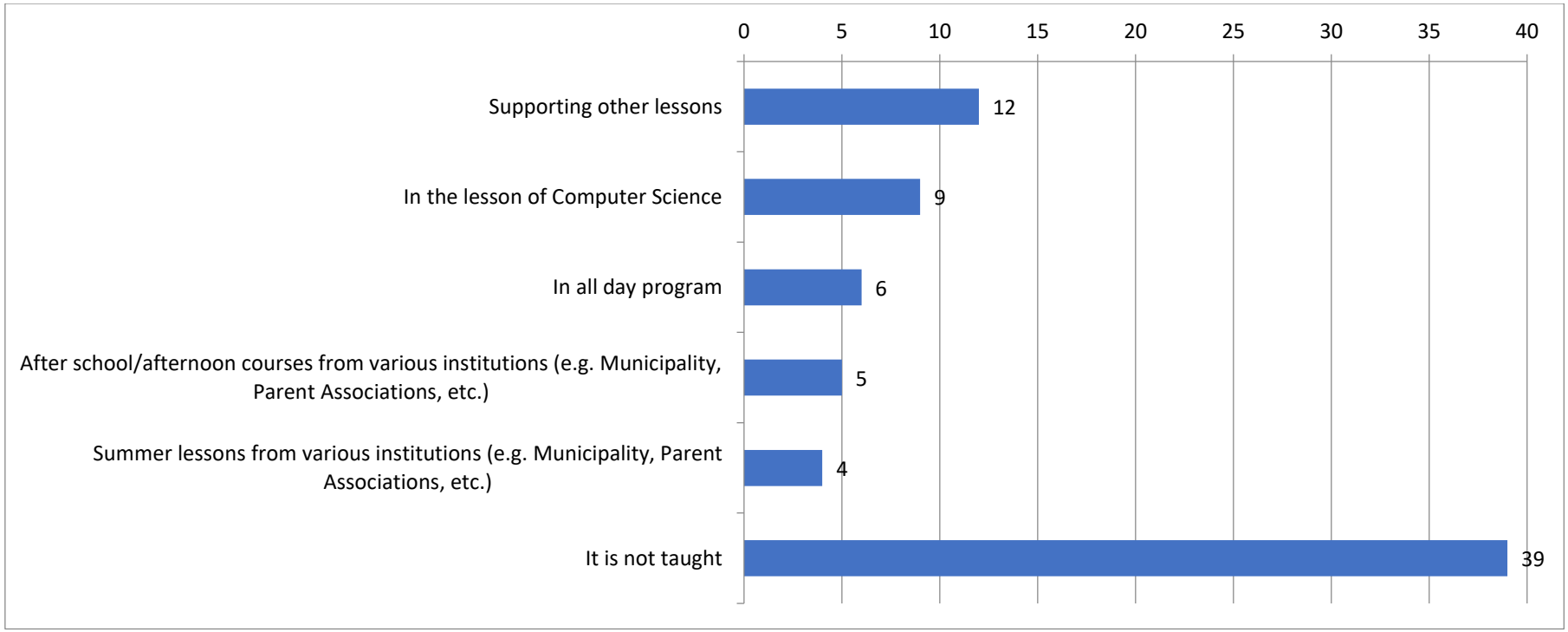

Figure 4

Figure 4, shows that educational robotics are taught in schools to support other lessons or in the lesson of Computer Science. However, 39 out of 57 schools do not teach educational robotics at all.

In what ways is IT (ICT) incorporated into your school?

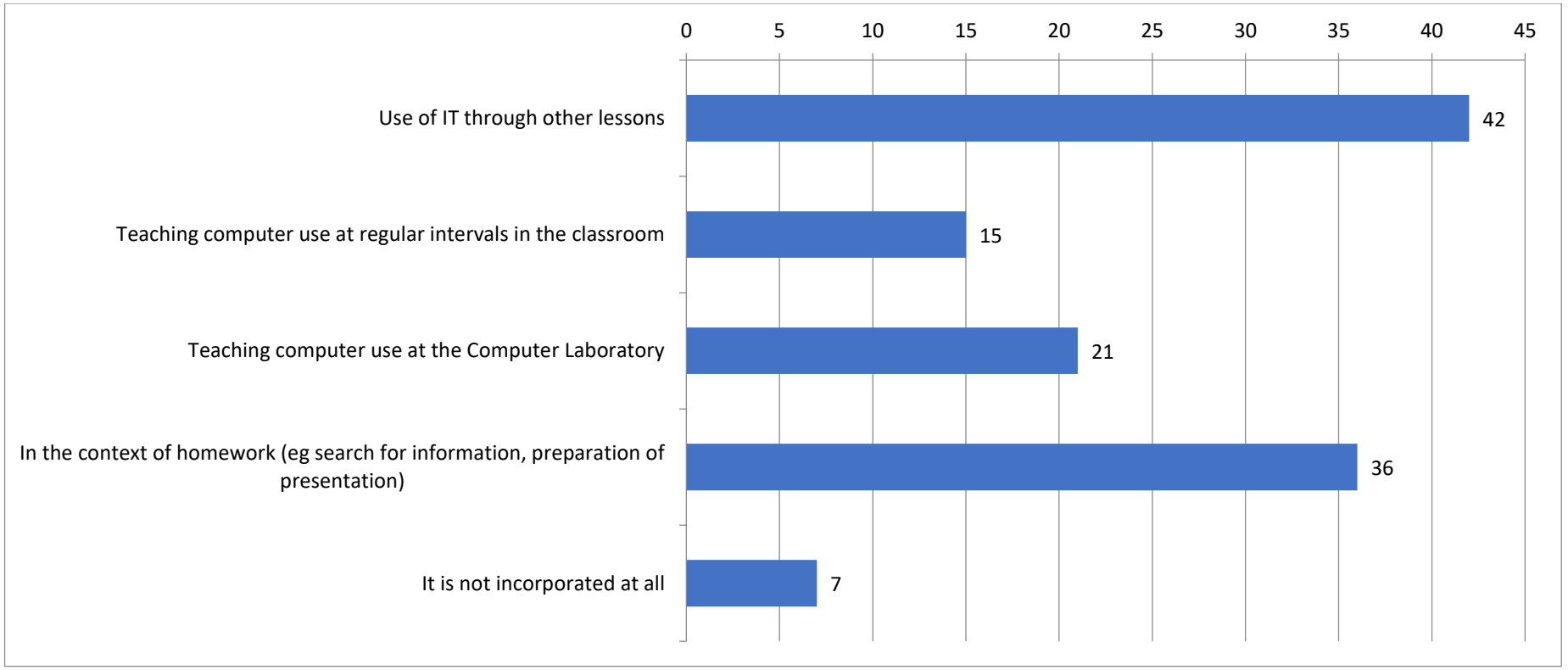

Figure 5

The majority of respondents (42) teachers use IT through other lessons, while more than the half teachers incorporate IT in the context of homework.

KNOWLEDGE CONCERNING STEM EDUCATION AND EDUCATIONAL ROBOTICS

Do you have knowledge in any of the following areas?

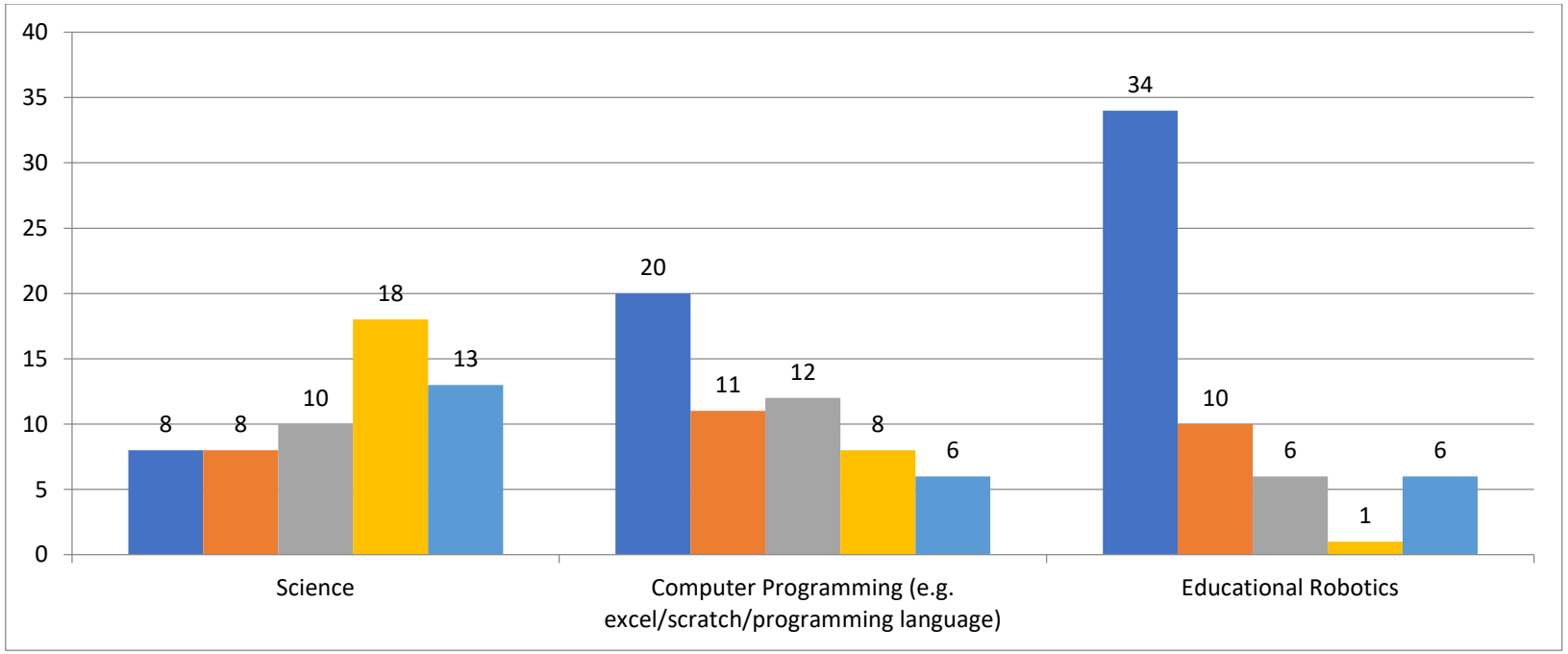

Figure 6

Figure 6 illustrates the background knowledge of the respondents. Most of teachers who participated in this survey have background knowledge on science. 34 out of 57 teachers do not have any knowledge on educational robots, while 6 of them shows to be confident on the subject.

How did you acquire this knowledge?

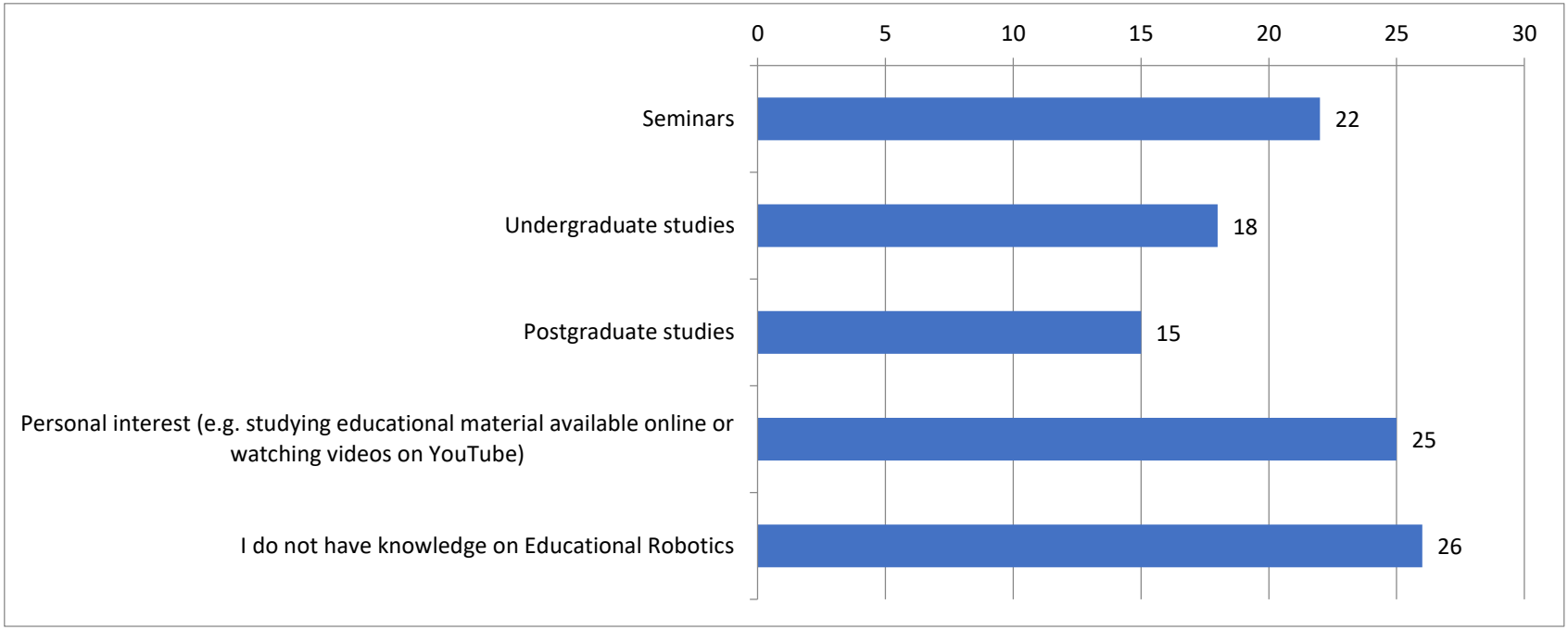

Figure 7

Less than the half of respondents (26) teachers do not have any background knowledge on Educational Robotics. The teachers who have knowledge on the field, they have either acquired this knowledge during their studies or attended face to face and online seminars.

Have you ever attended seminars on Educational Robotics?

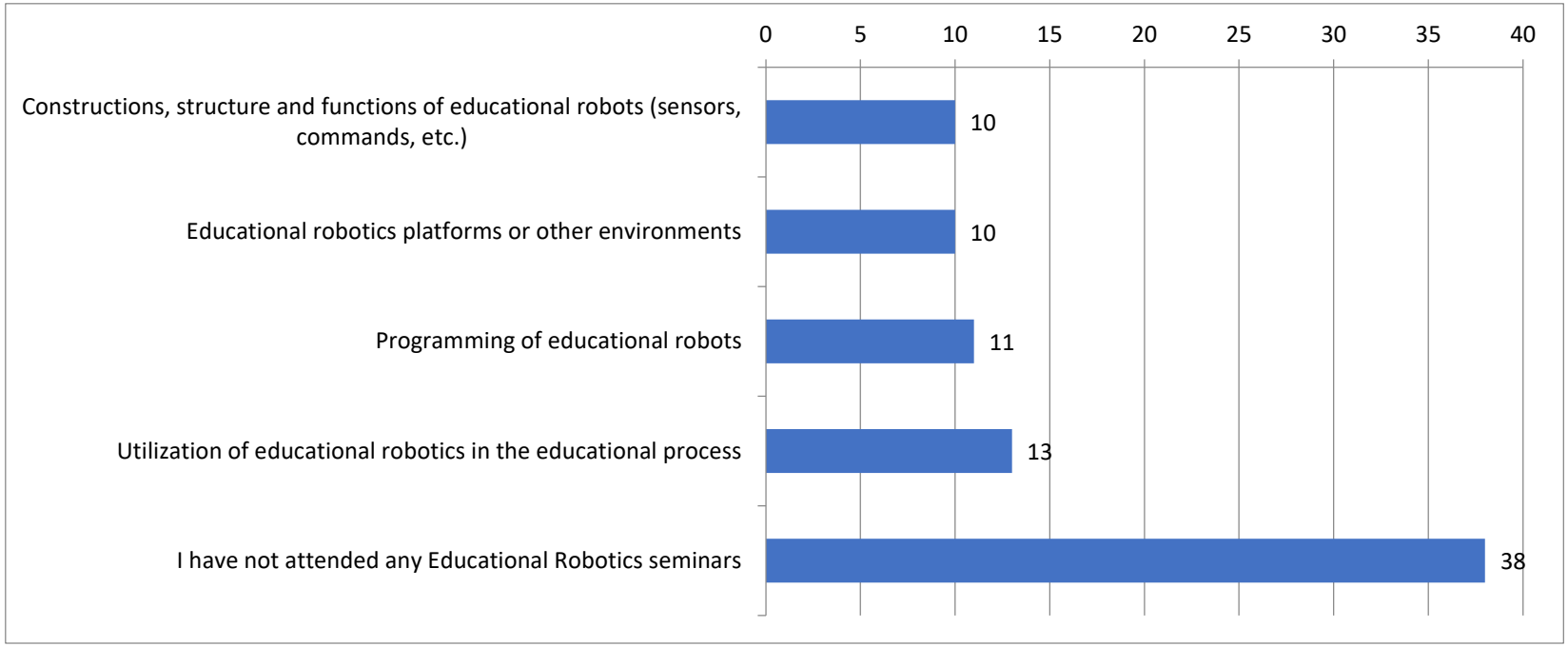

Figure 8

Figure 8 presents the subjects of seminars that teachers have attended, such as constructions/structure of robots, platforms, programming and utilization of robots in education. It seems that at national level, all the relevant subject on Educational Robotics are available.

Who provided the Educational Robotics seminars you attended?

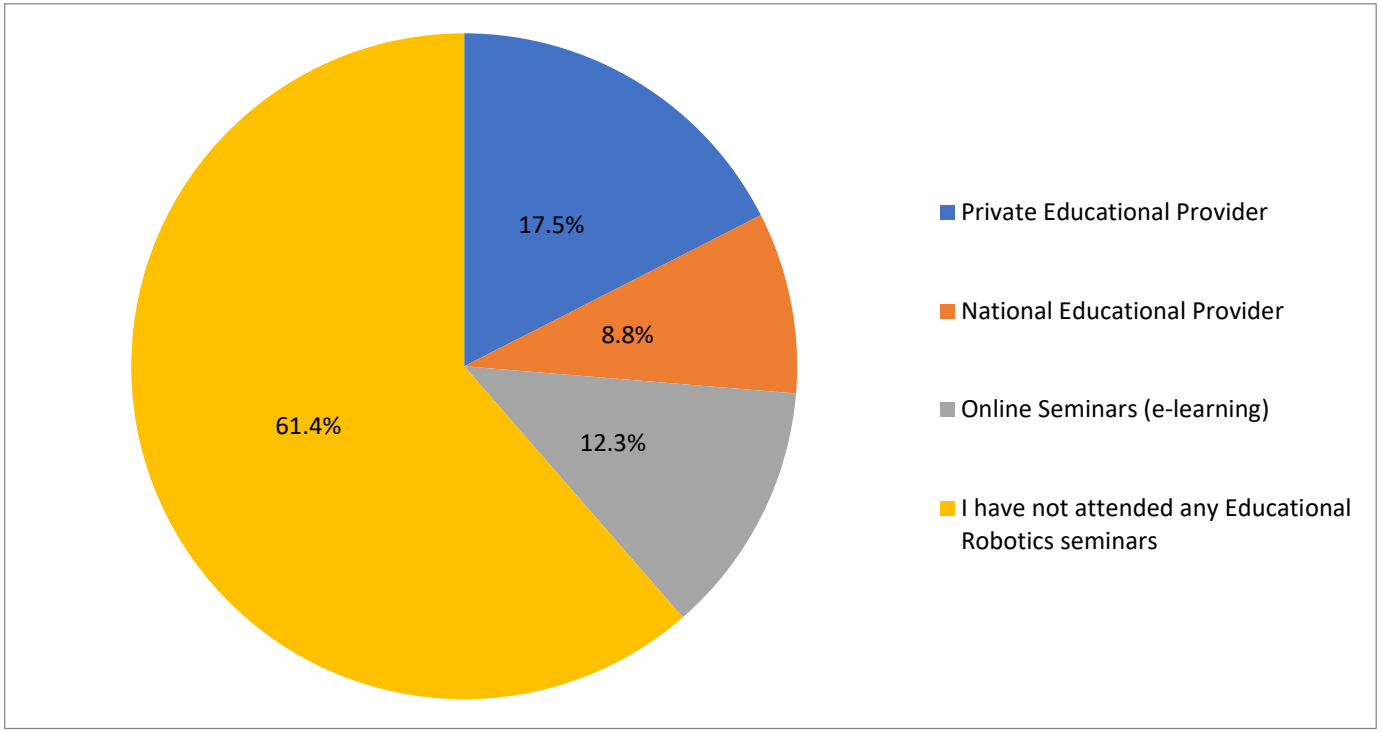

Figure 9

In regards to the providers of seminars on educational robotics organised in Cyprus, the most seminars have been provided either by private institutions (17,5%) or they are available online (12,3%). Although a minority of them have been organised by a national provider (8,8%).

Have you ever come into contact with STEM Education term (Science, Technology, Engineering, Mechanics)?

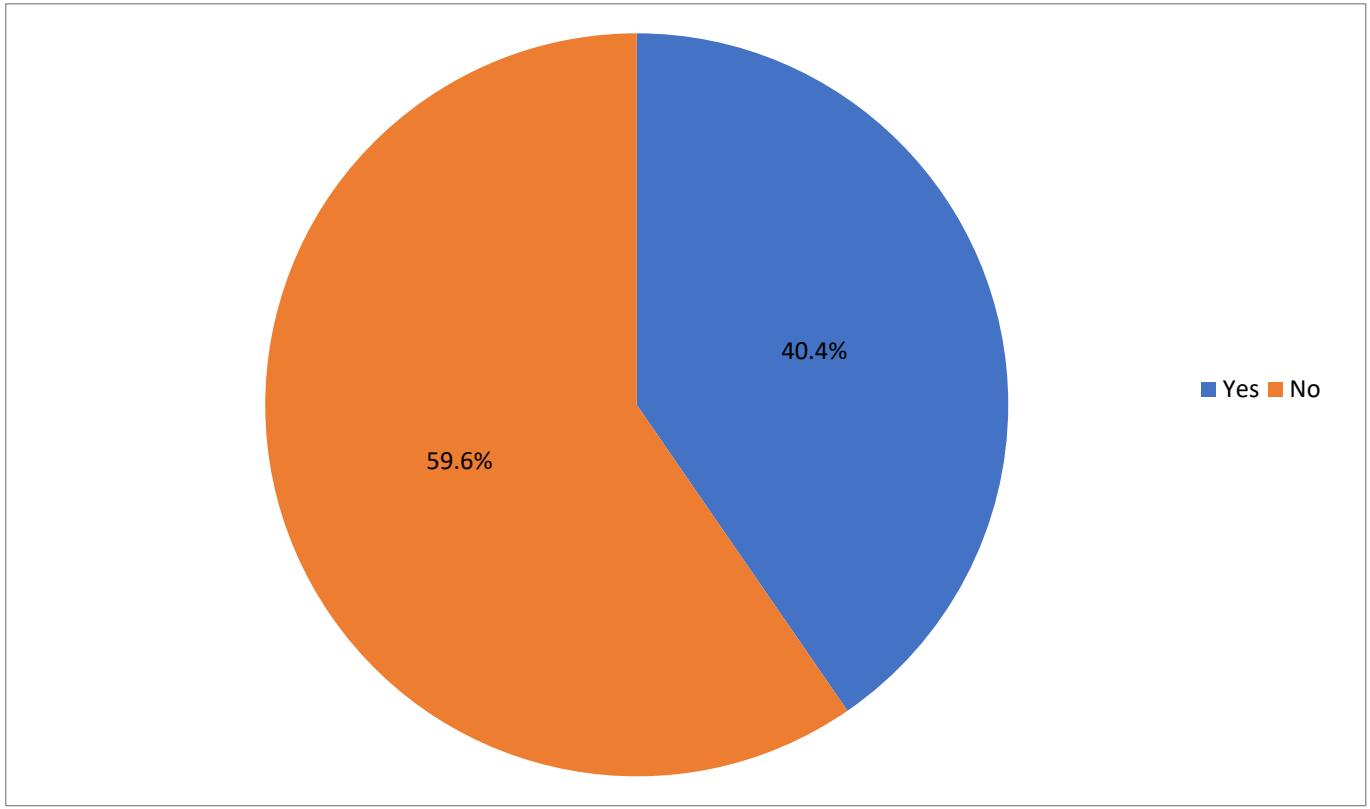

Figure 10

Over a half of respondents (59.6%) indicated that they have never came into contact with the STEM Education term.

Do you know how to integrate STEM Training into your lesson?

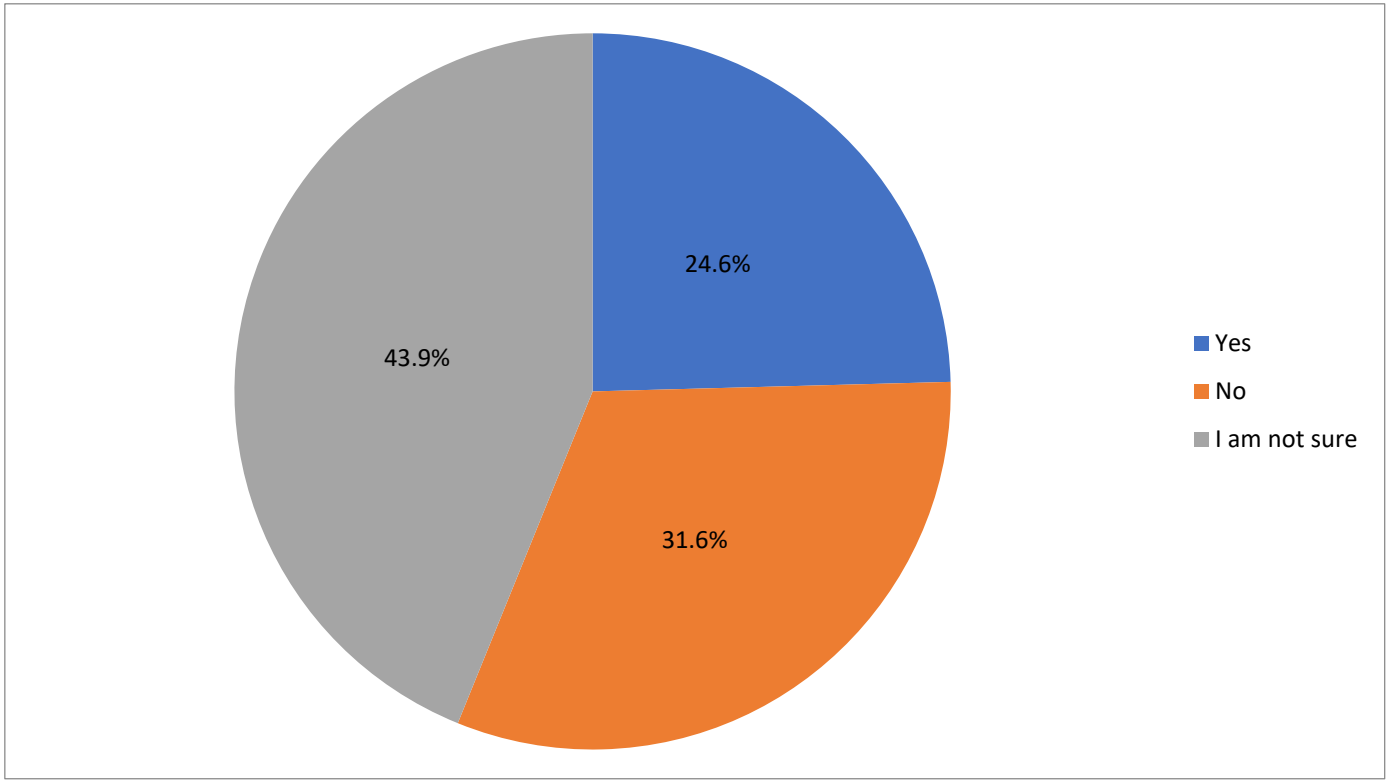

Figure 11

When the participants asked if they know how to integrate STEM learning into their lessons, 32,1% answered negatively, while most of them (44,6%) they are unsure.

In which of the following ways do you consider you incorporate STEM Training into your lessons?

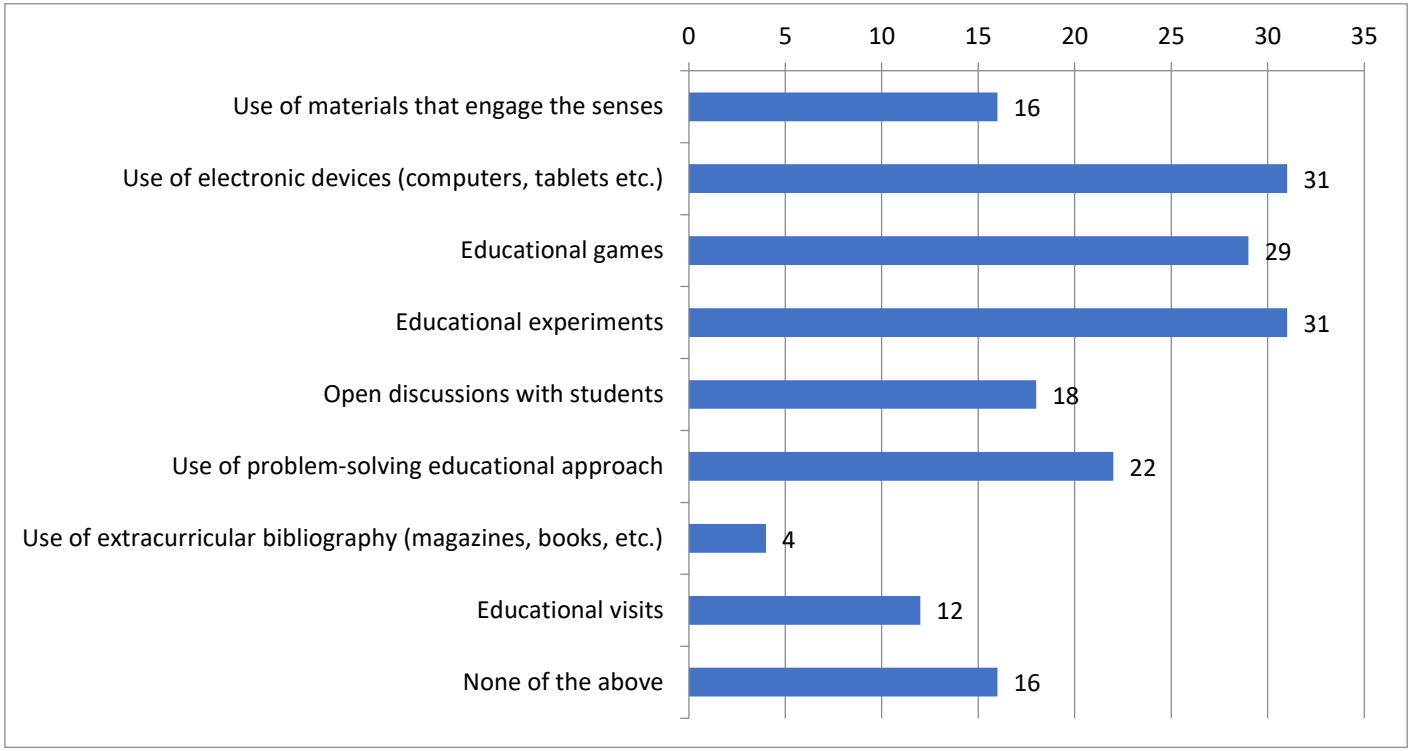

Figure 12

Figure 12 presents the possible ways of integrating STEM learning into education; the use of electronic devices, educational games and experiments have rated as the most popular ways.

INTEGRATION OF EDUCATIONAL ROBOTICS IN THE CLASSROOM

Have you ever used educational robotics in your lesson?

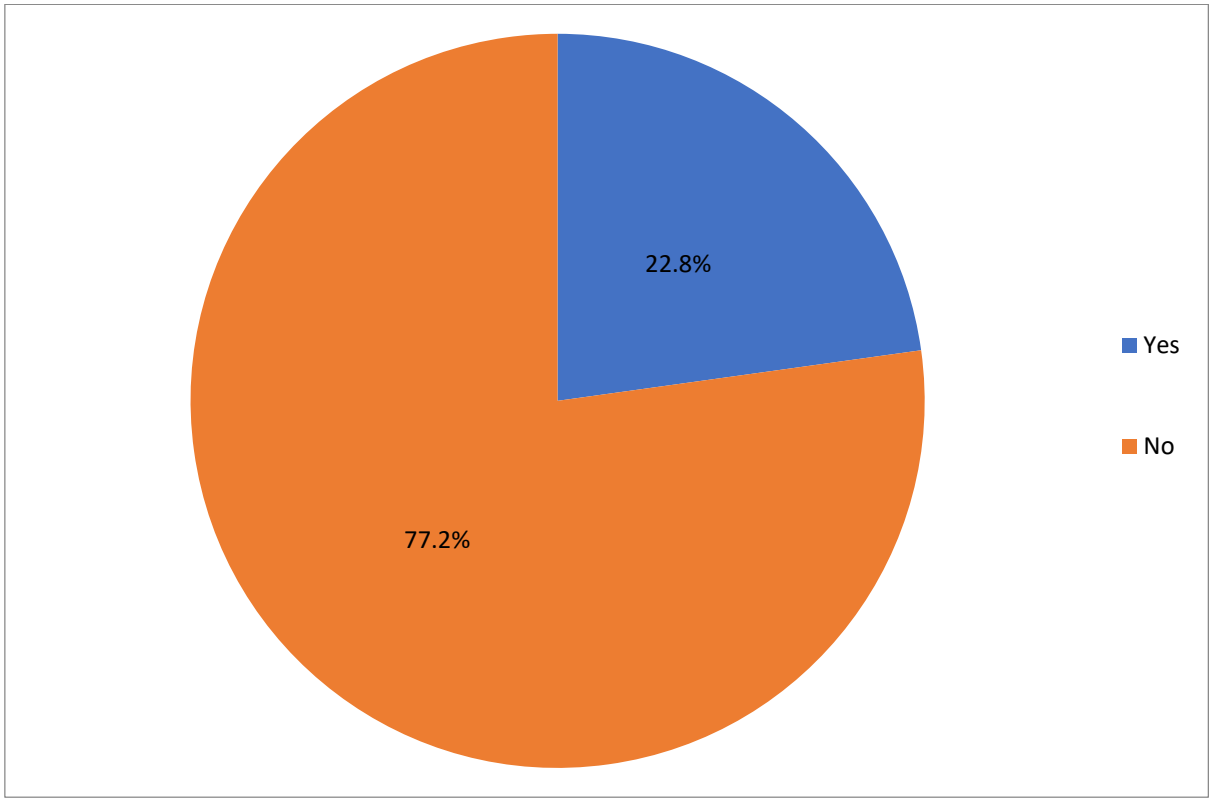

Figure 13

The above graph (Figure 13) shows that only 22.8% of the participants have used educational robotics in their lessons.

At what age do you think it is appropriate to introduce Educational Robotics?

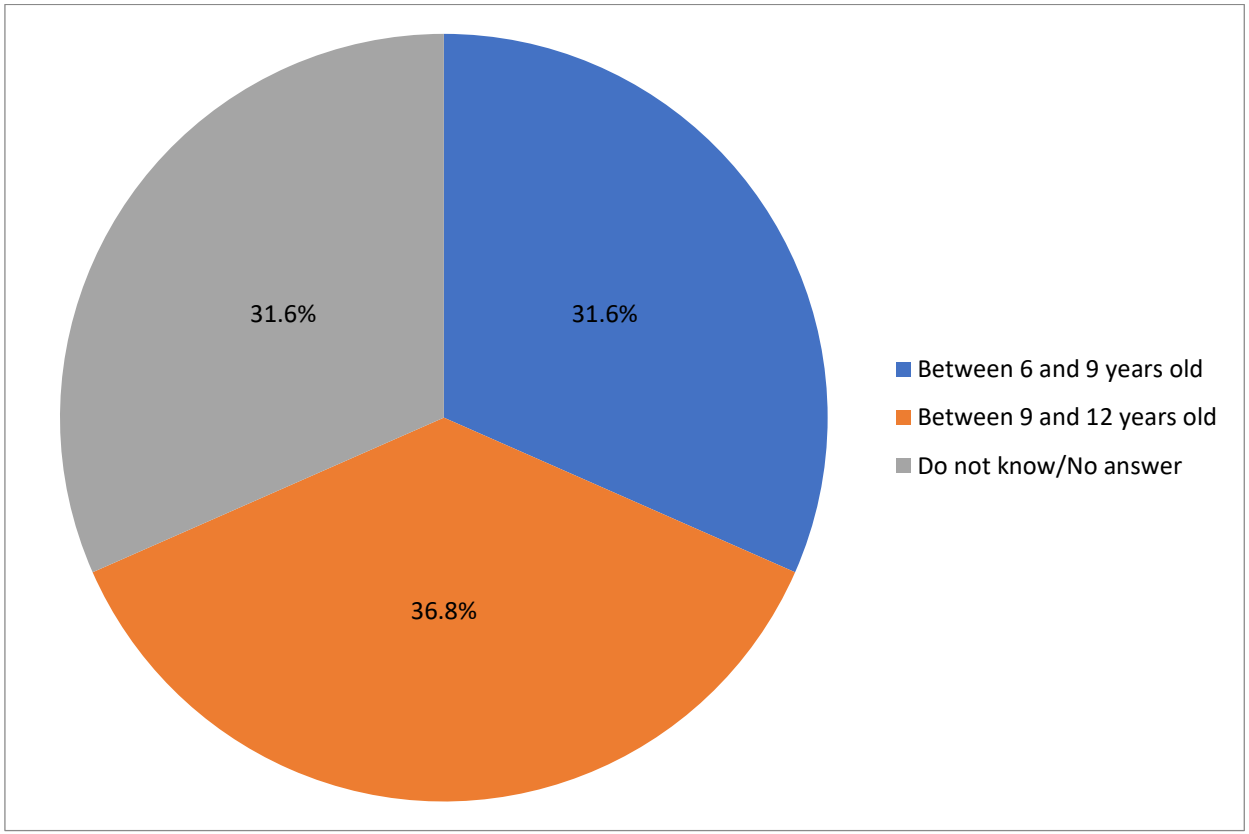

Figure 14

When asked the most suitable age of students for introducing them Educational Robotics, the most of the participants indicated the ages between 9-12 years old.

Which of the following reasons prevent you from using Educational Robotics in your lessons?

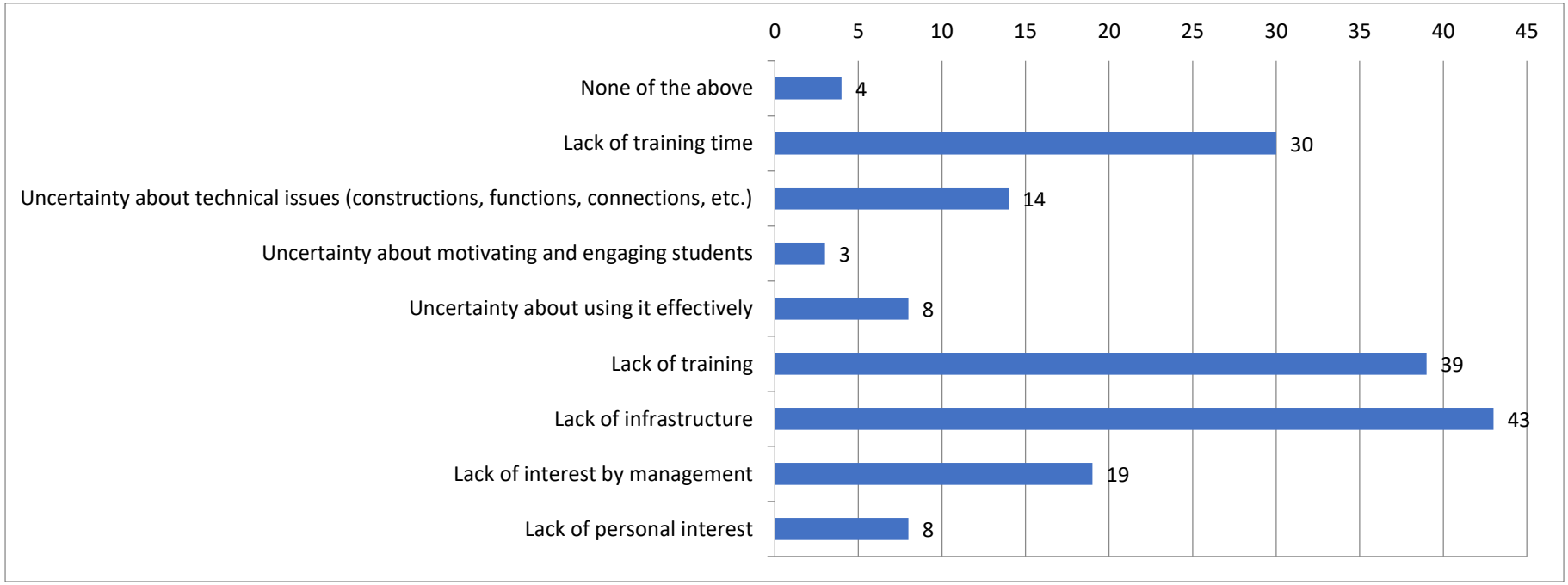

Figure 15

Answering the question about the main reason preventing teachers form using Educational Robotics in their lessons, the respondents claimed the lack of infrastructure (75.4%) in their schools and the lack of training (68.4%).

To what extent do you think that the use of Educational Robotics can help teach the following lessons?

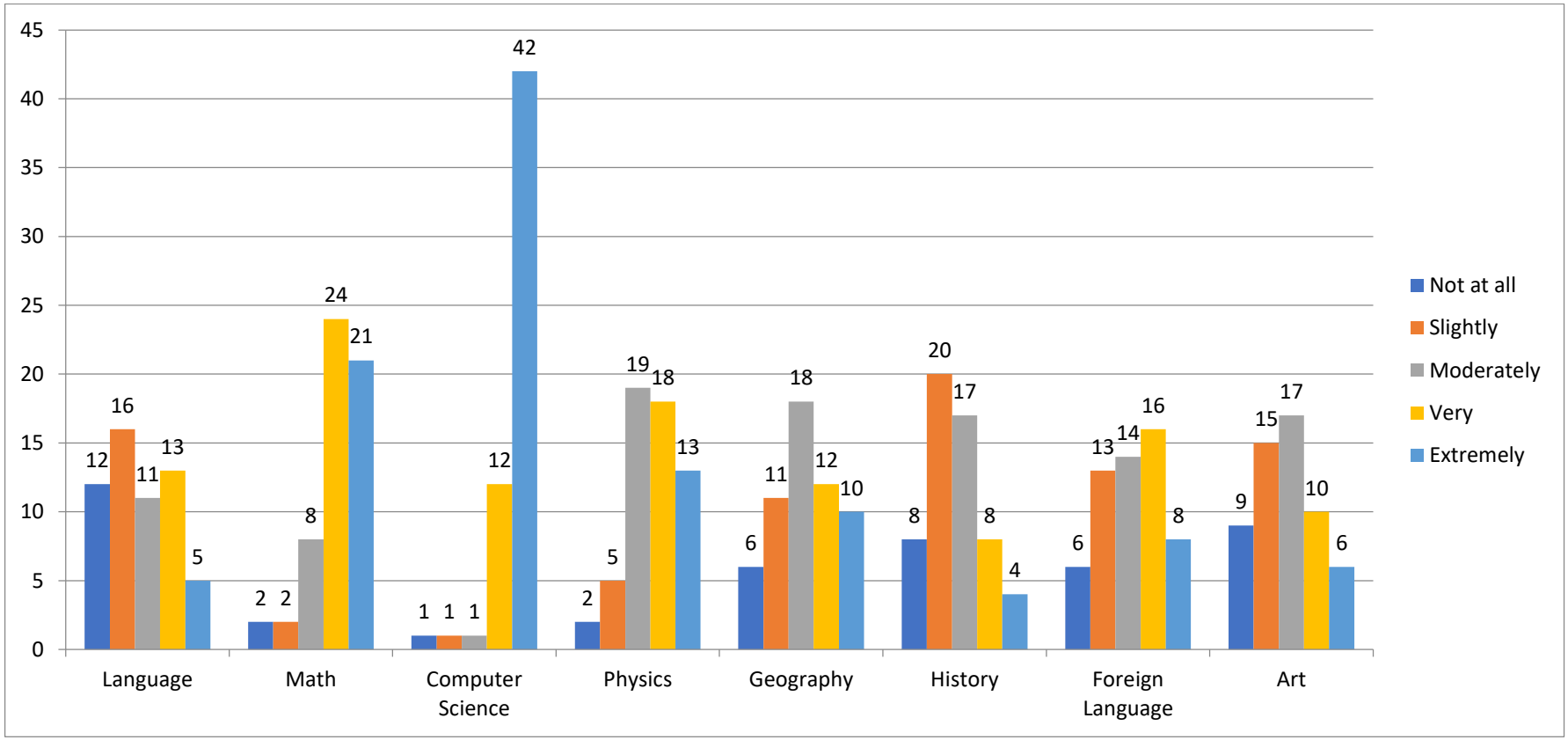

Figure 16

Figure 16 presents the lessons in which the Educational Robotics can be integrated in order to facilitate the teaching procedure.

The higher rate was given into Computer Science lesson and Mathematics, while the lowest is for language and art.

To what extent do you think that the use of Educational Robotics can help students in the following areas?

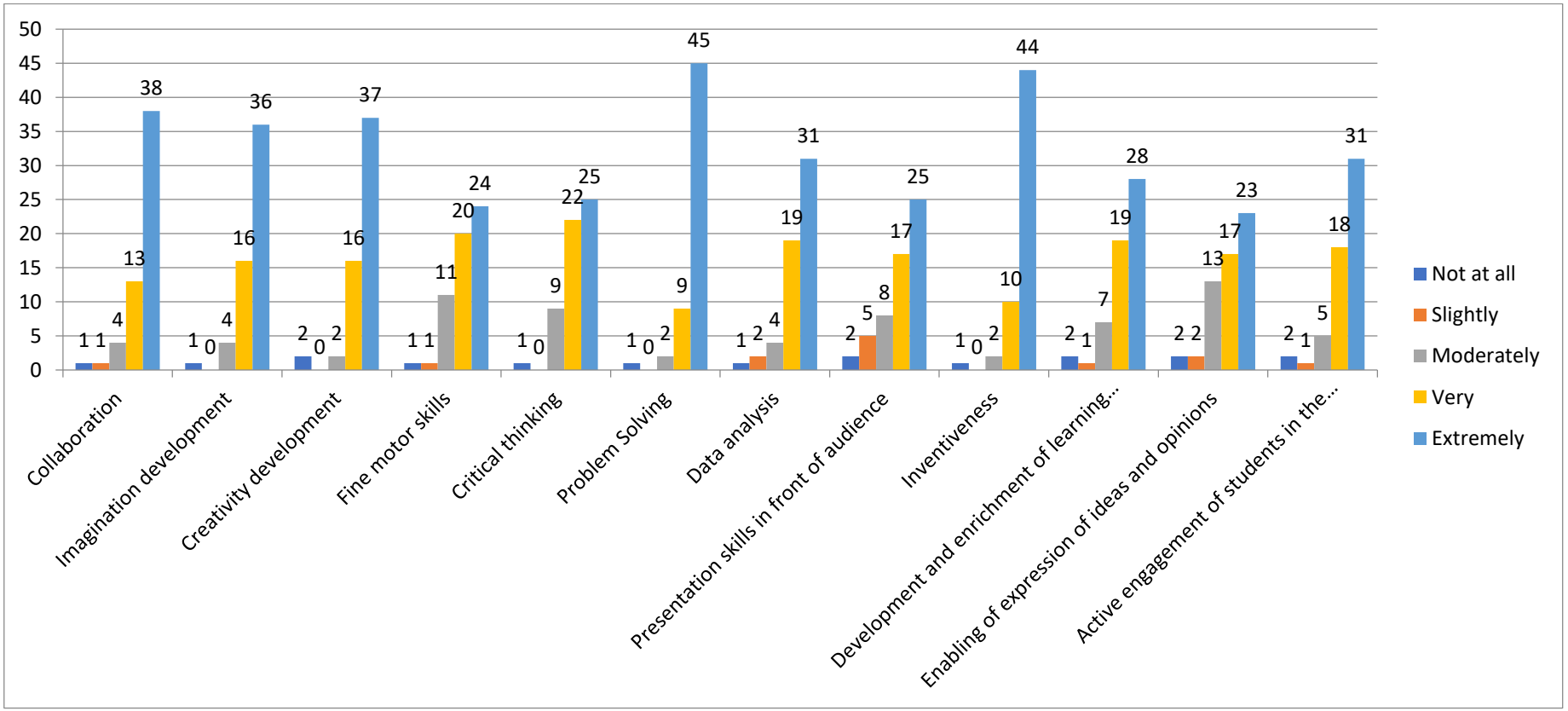

Figure 17

Figure 17 presents the areas in which the use of Educational robotics can help students. Problem solving and inventiveness have been considered as the highest from the teachers' perspective. Collaboration, imagination, creativity, data analysis and active engagement of students in learning process have been also rated as important.

In what way do you think that the Educational Robotics course could be included in your school?

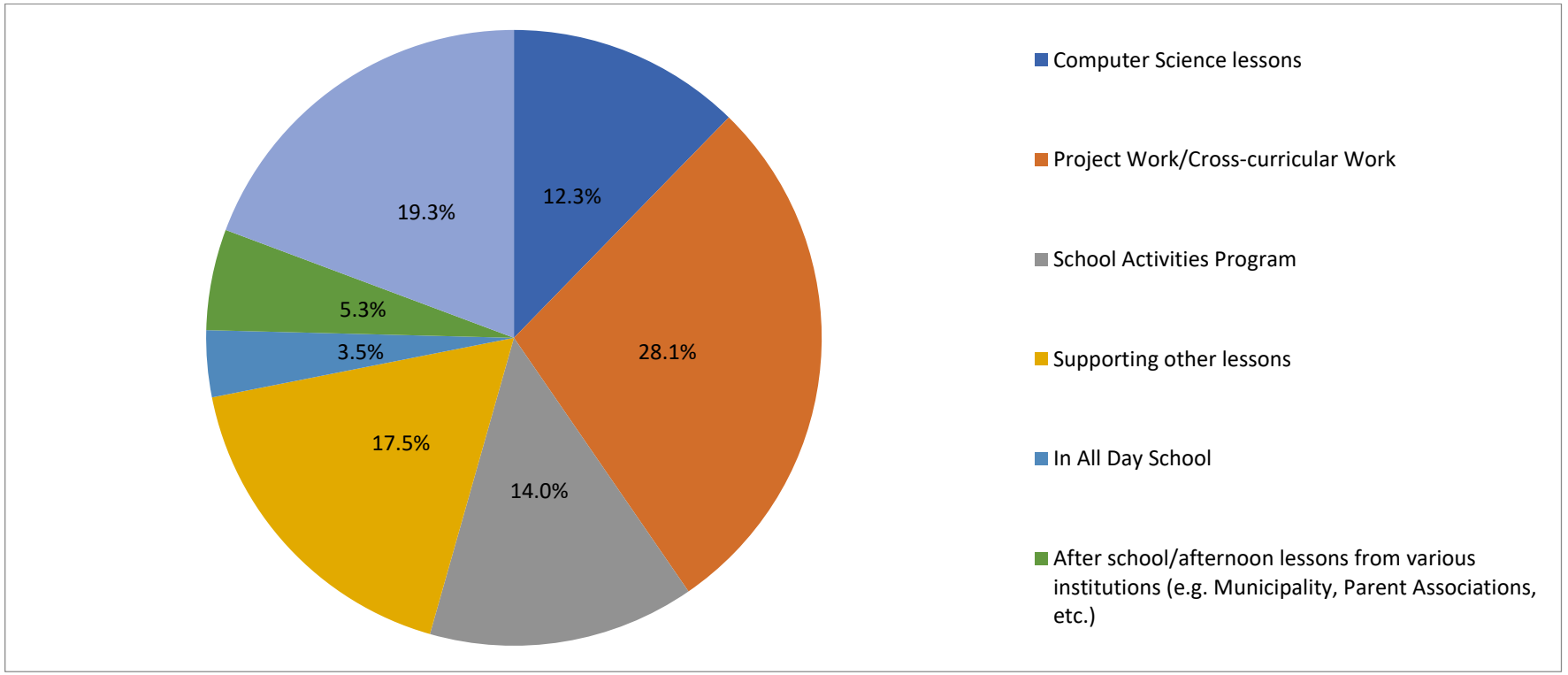

Figure 18

Figure 18 shows that Educational Robotics can be included in schools through project work and cross-curricular work mostly, as the most of the participants claimed. Additional ways mentioned by the participants are in all day school, though supporting lessons or school activities program.

Who do you think would be suitable to teach Educational Robotics at your school?

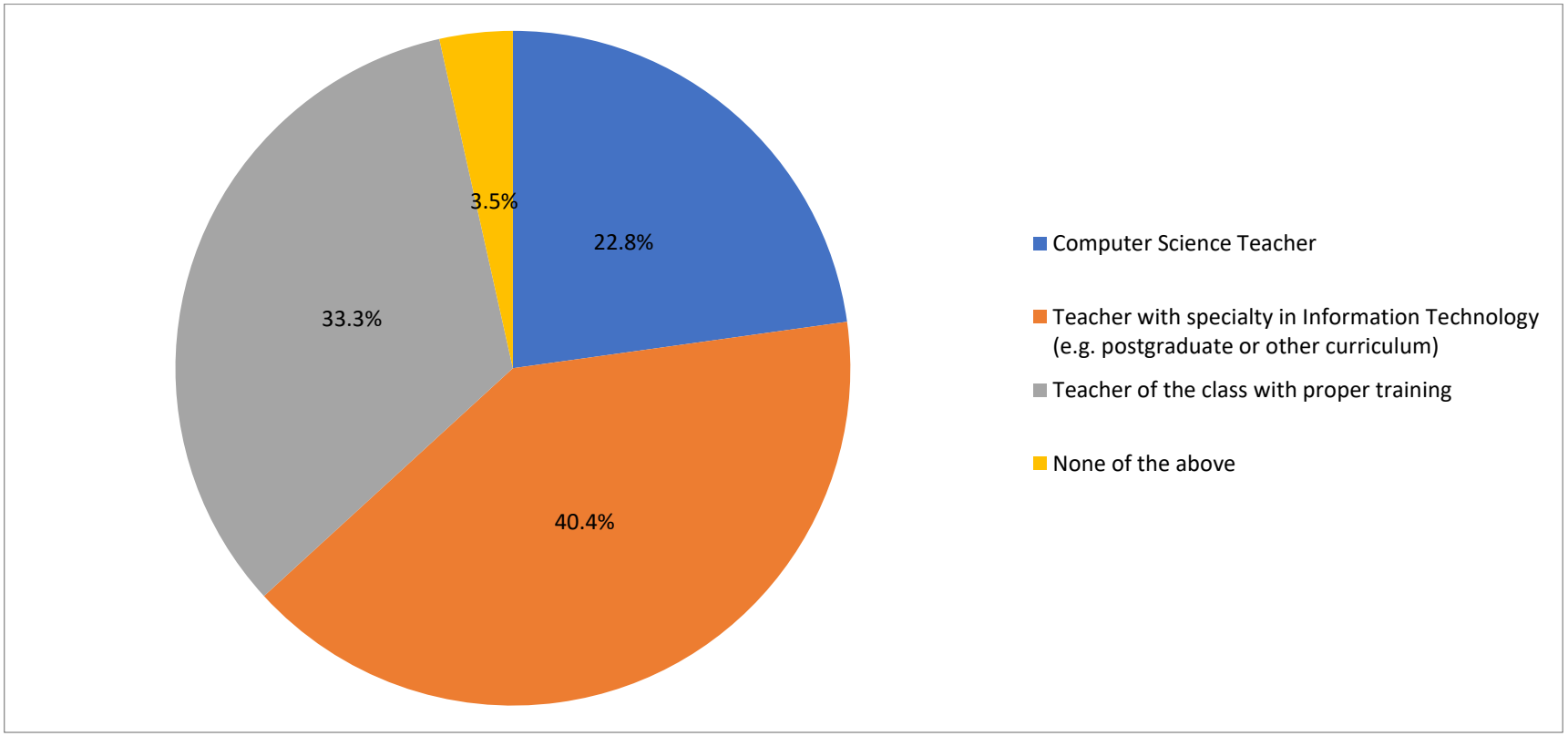

Figure 19

When asked about participants' opinion regarding the suitable person to teach Educational Robotics, the most of the answers was given to: (a)any teacher with speciality in Information Technology (40.4%), (b)a teacher of the class with proper training (33.3%) and (c) a computer science teacher (22.8%).

Would you like to use Educational Robotics to teach STEM skills?

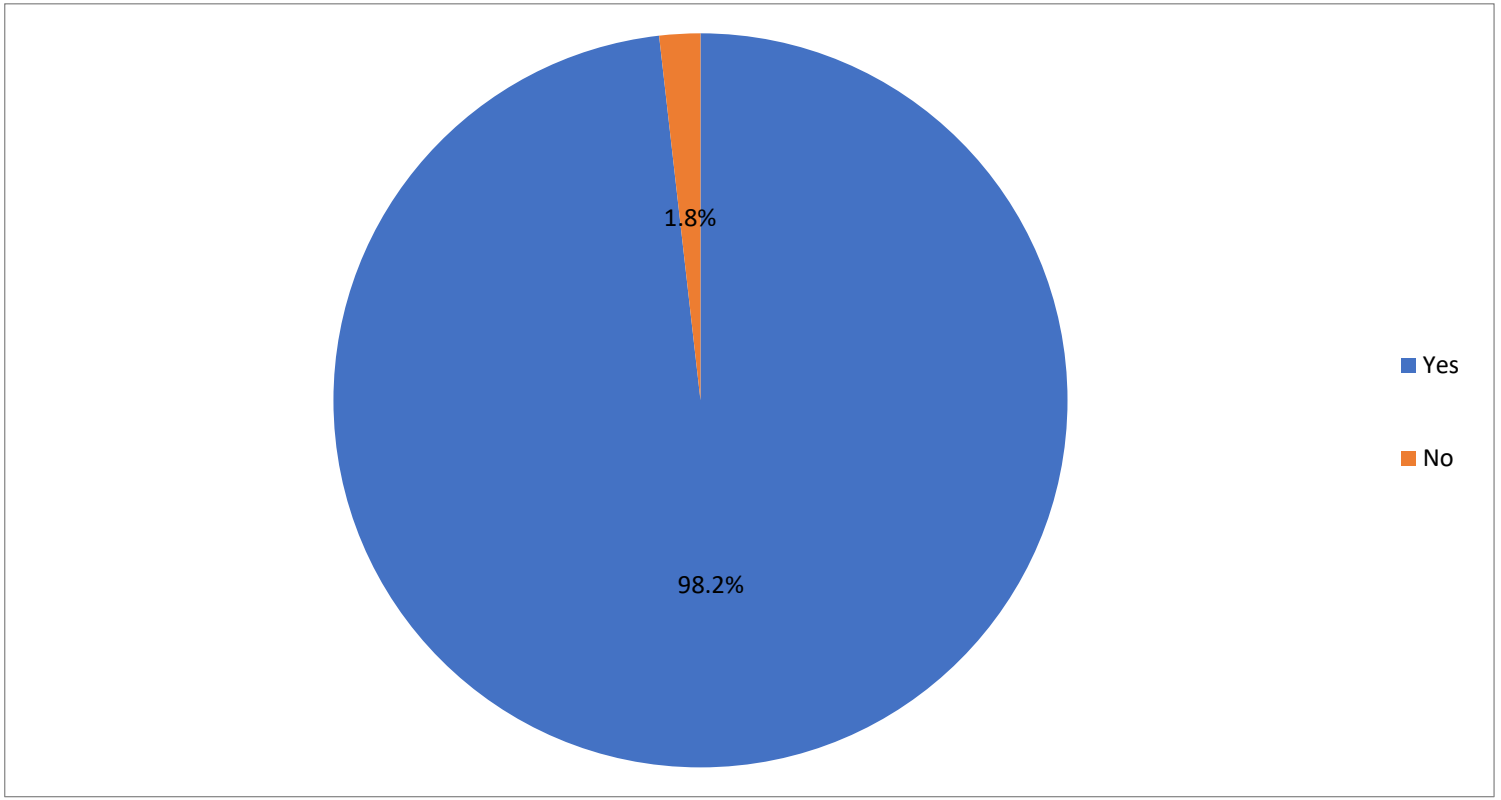

Figure 20

A vast majority of respondents (56) would like to use Educational Robotics to teach STEM skills.

ANNEX B: Survey for Students

Do you know what Educational Robotics is?

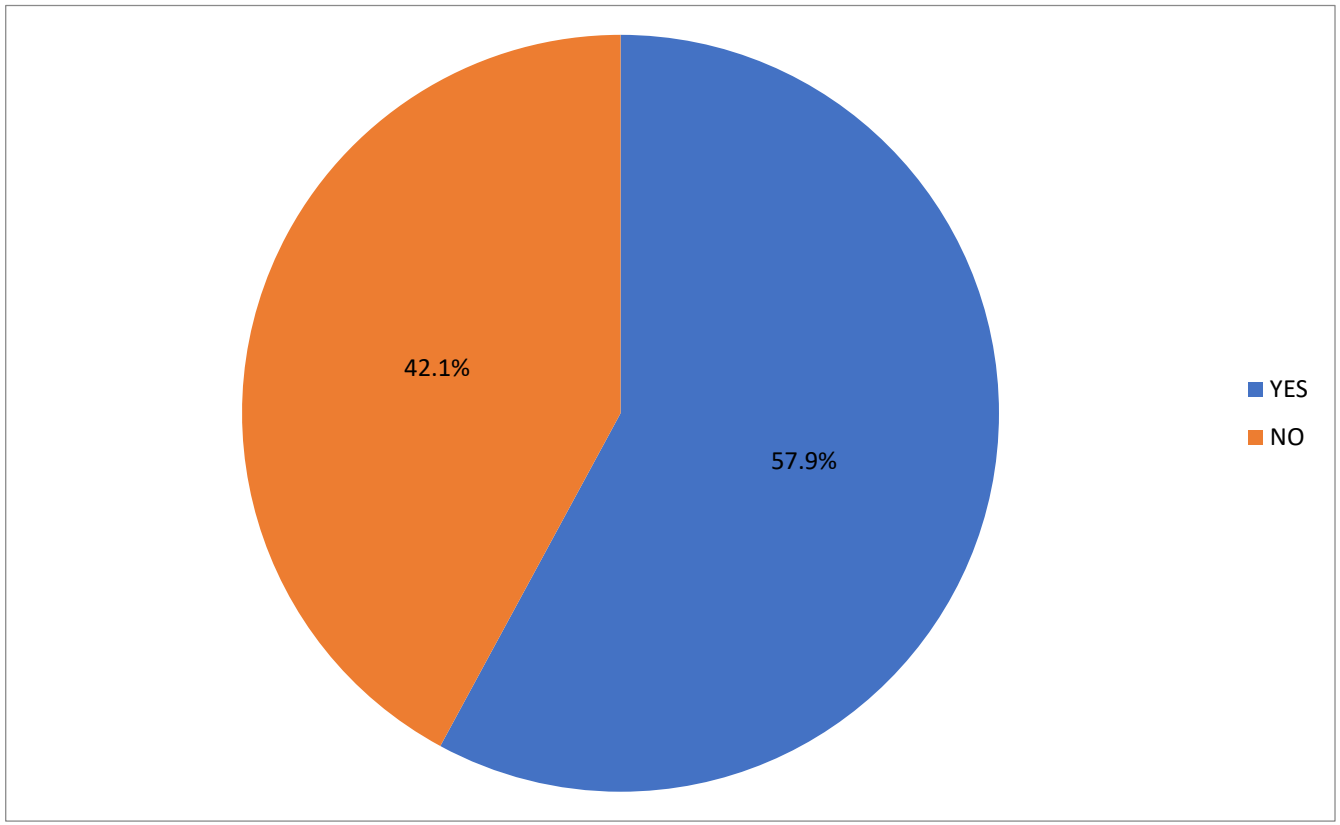

Figure 21

Over a half of students (57.9%) know what Educational Robotics is.

How did you get informed about Educational Robotics?

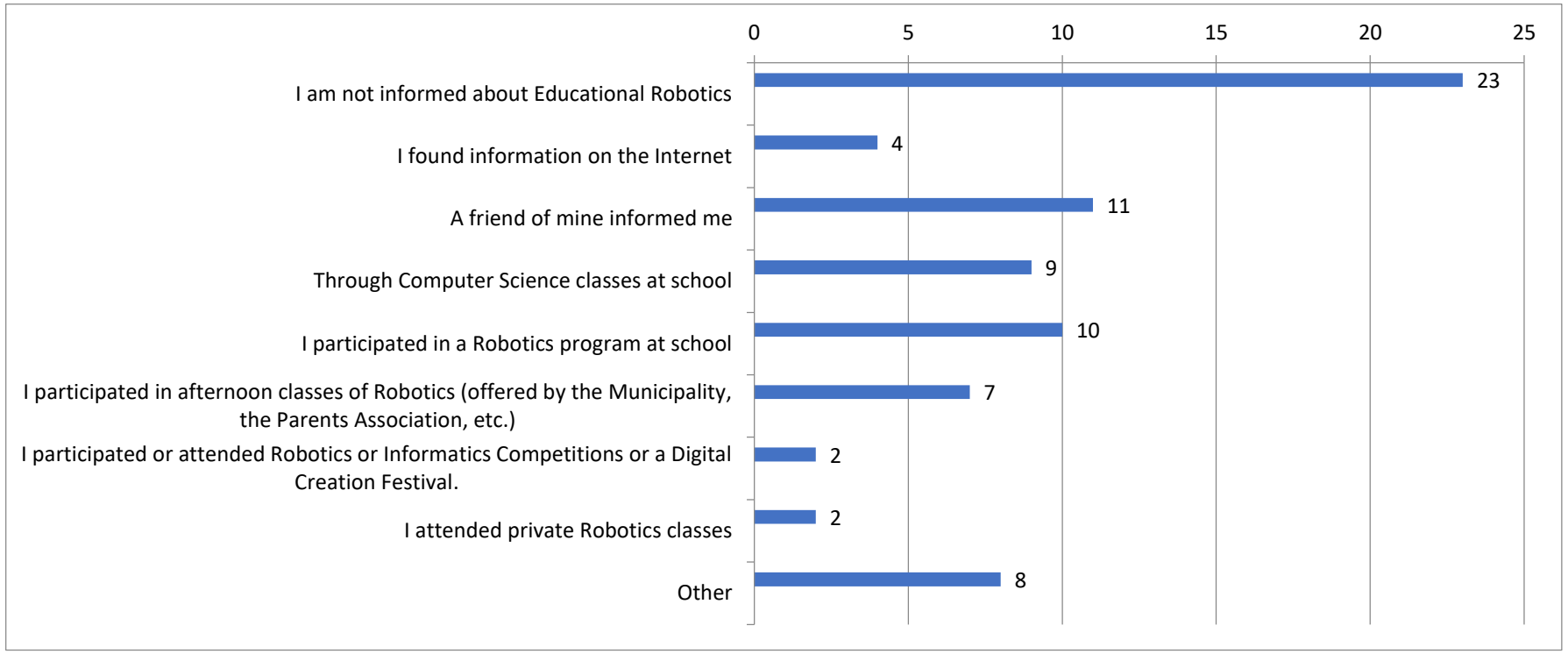

Figure 22

Participants that answered positively to the previous question, have been informed about Educational Robotics by their friends (11), students have participated in a Robotics program at school (10), through computer science classes at school (9) and 7 students have participated in afternoon classes of Robotics. 23 out of 57 students have never been informed about Educational Robotics.

Are you interested in Robotics?

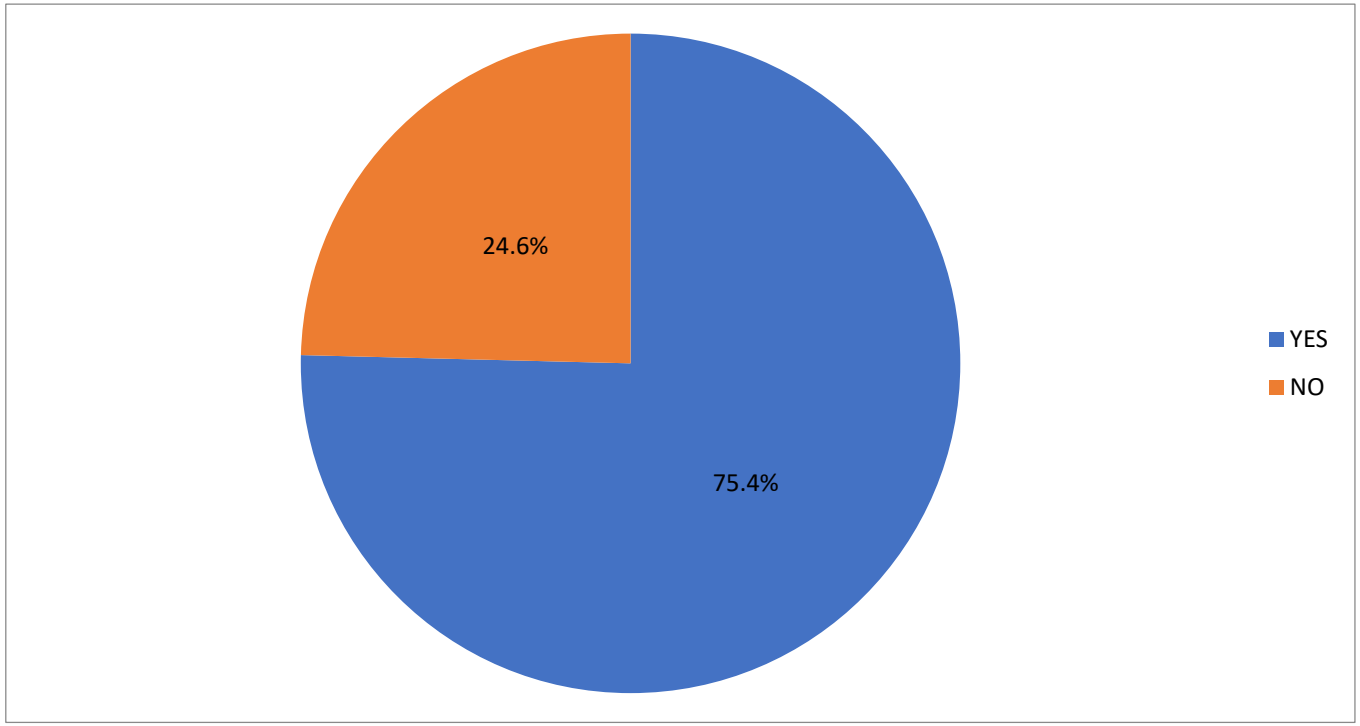

Figure 23

A majority of students (75.4%) participated in this survey are interested in Robotics, while 24.6% are not.

Would you like to get a robot?

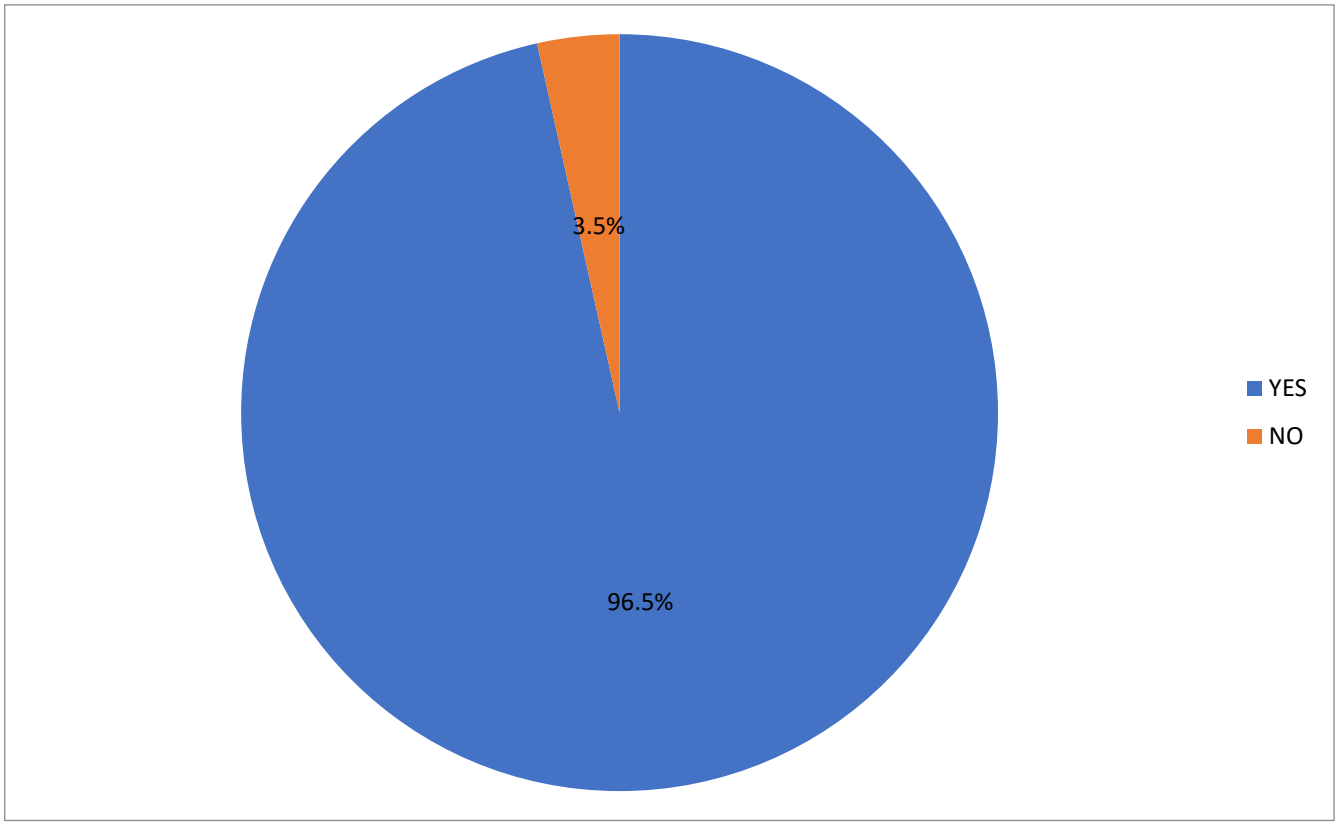

Figure 24

Figure 24 shows that 96.5% of students participated in this survey would like to get a robot.

Are you afraid of robots?

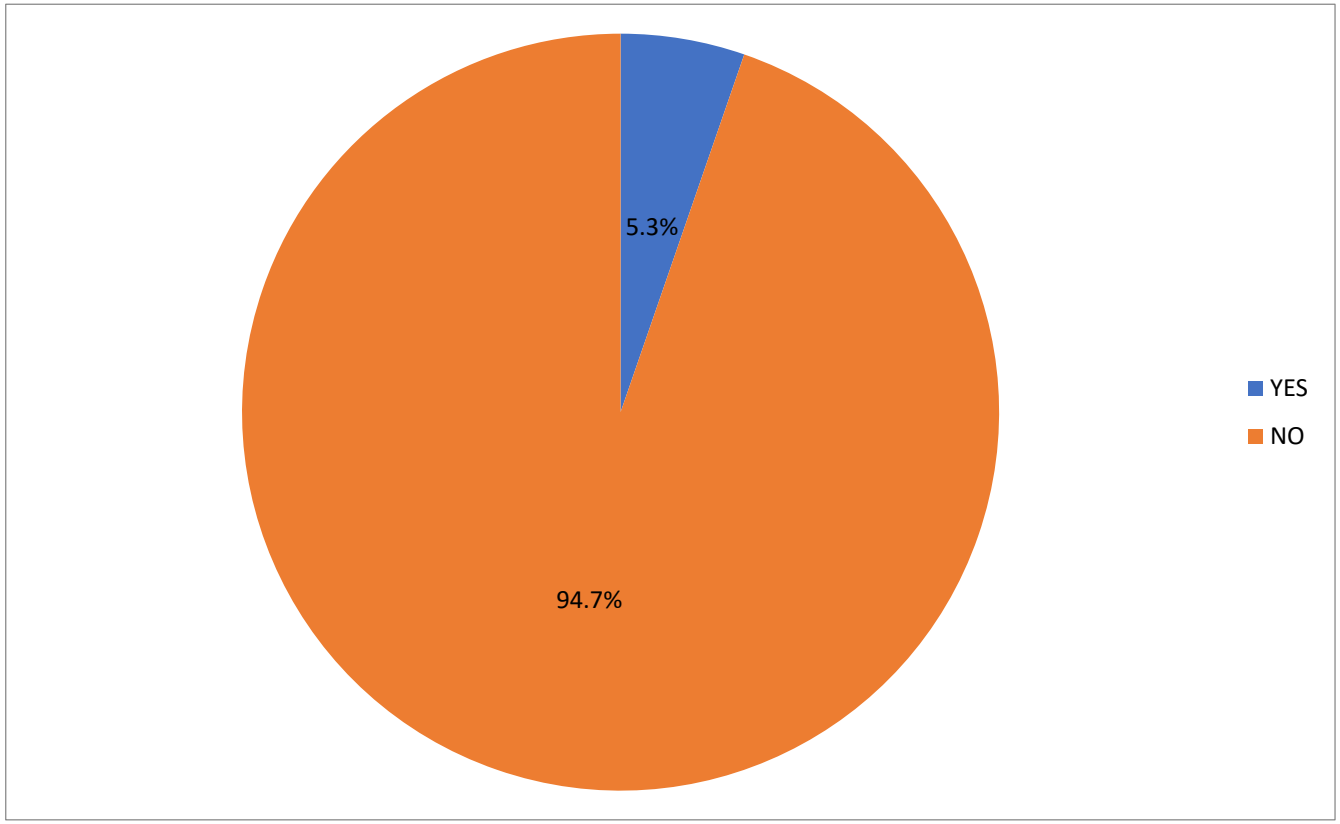

Figure 25

Almost all the respondents (94.7%) are not afraid of robots.

In your opinion, could a robot have feelings?

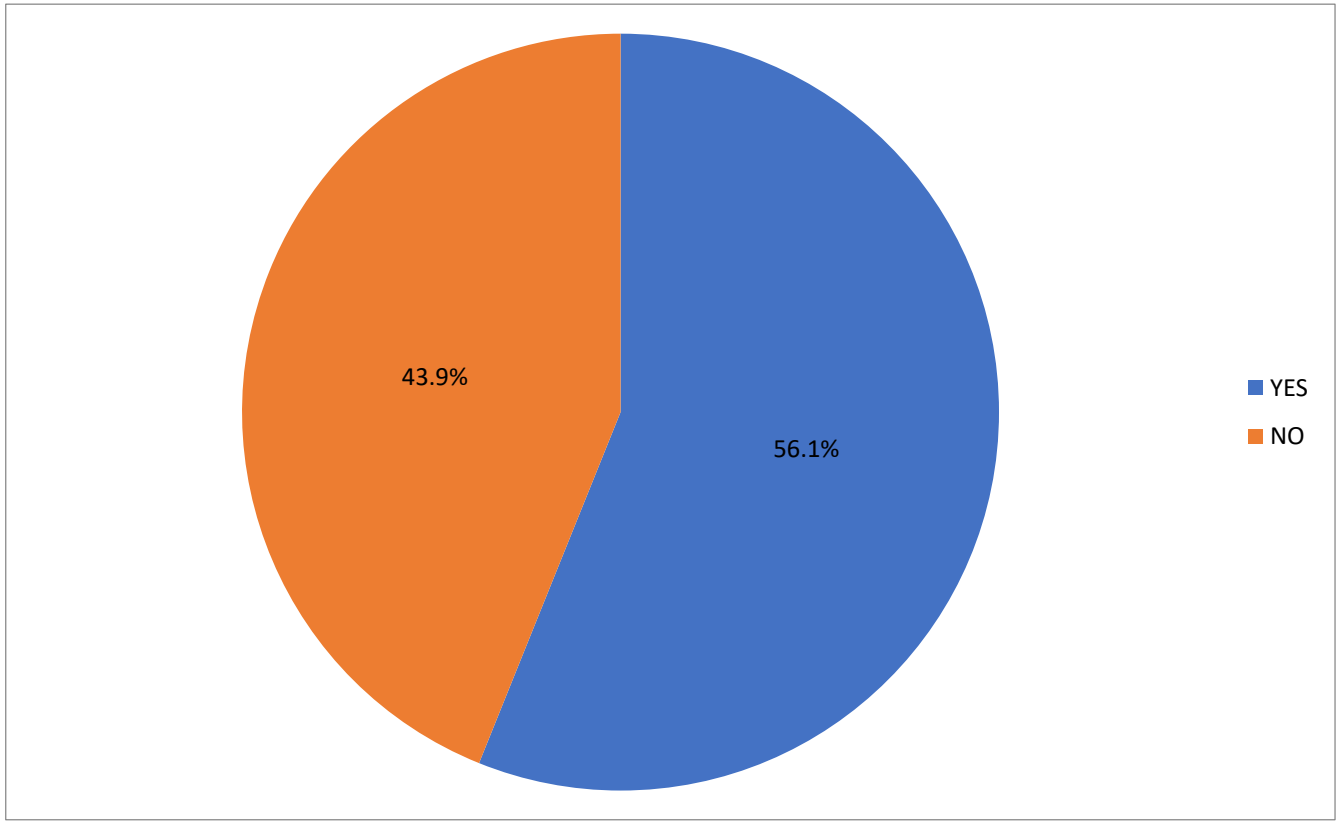

Figure 26

Over a half of the students (56.1%) believe that a robot could have feelings.

Do you think the robots are smarter than humans?

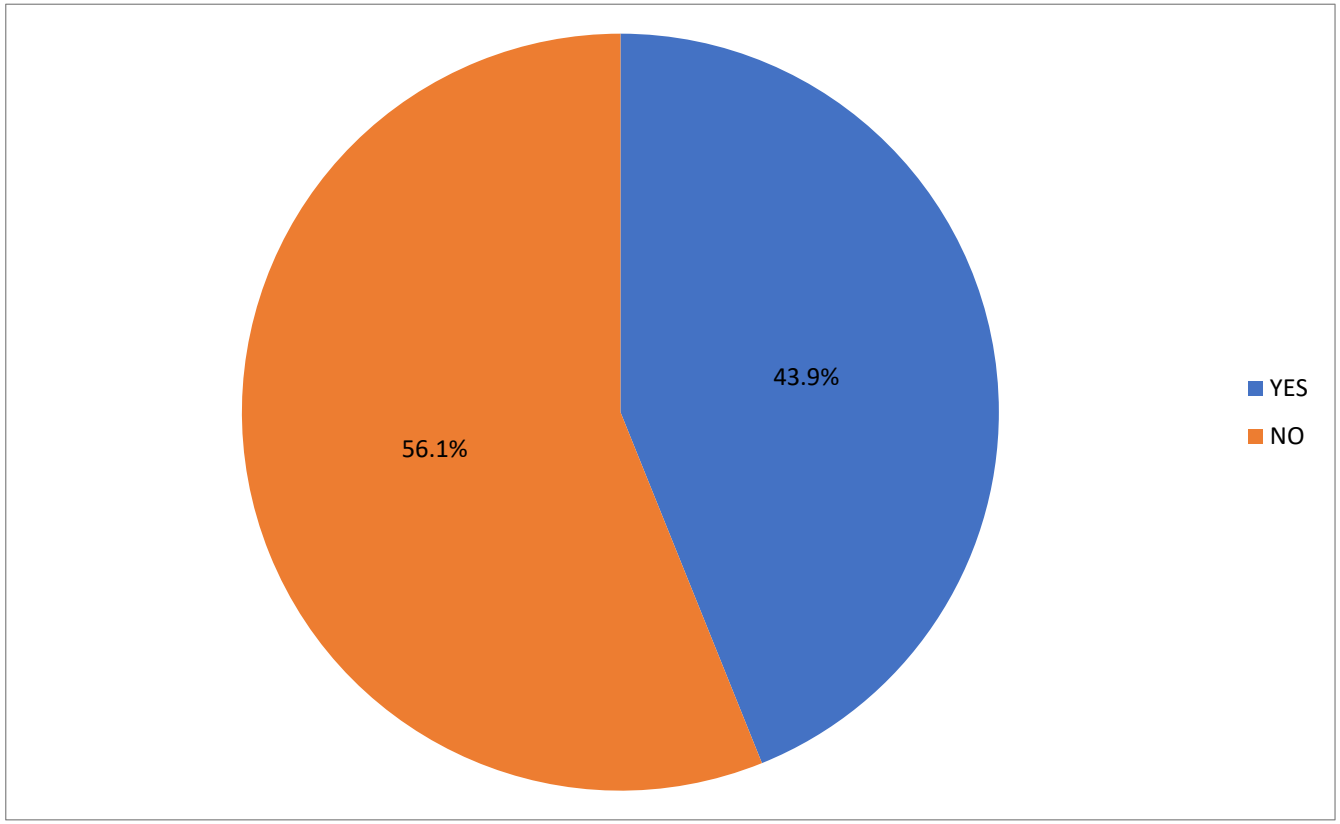

Figure 27

When respondents asked if the robots are smarter than human, 43.9% of students answered positively.

Have you tried, alone or within a group, to build or program a robot?

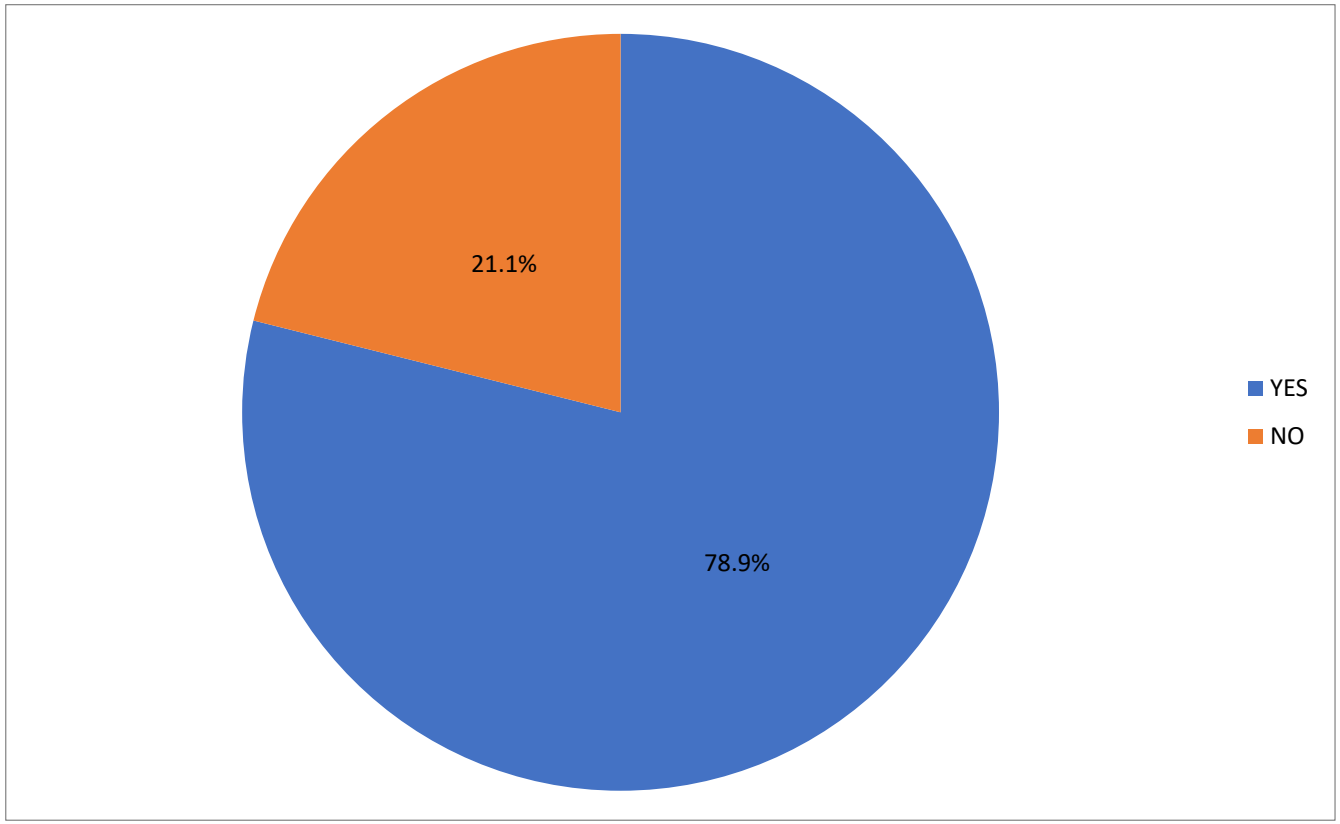

Figure 28

Figure 28 shows that 78.9% of students participated in this survey have tried to build or program a robot before.

Which of the following verbs express your relationship with robotics?

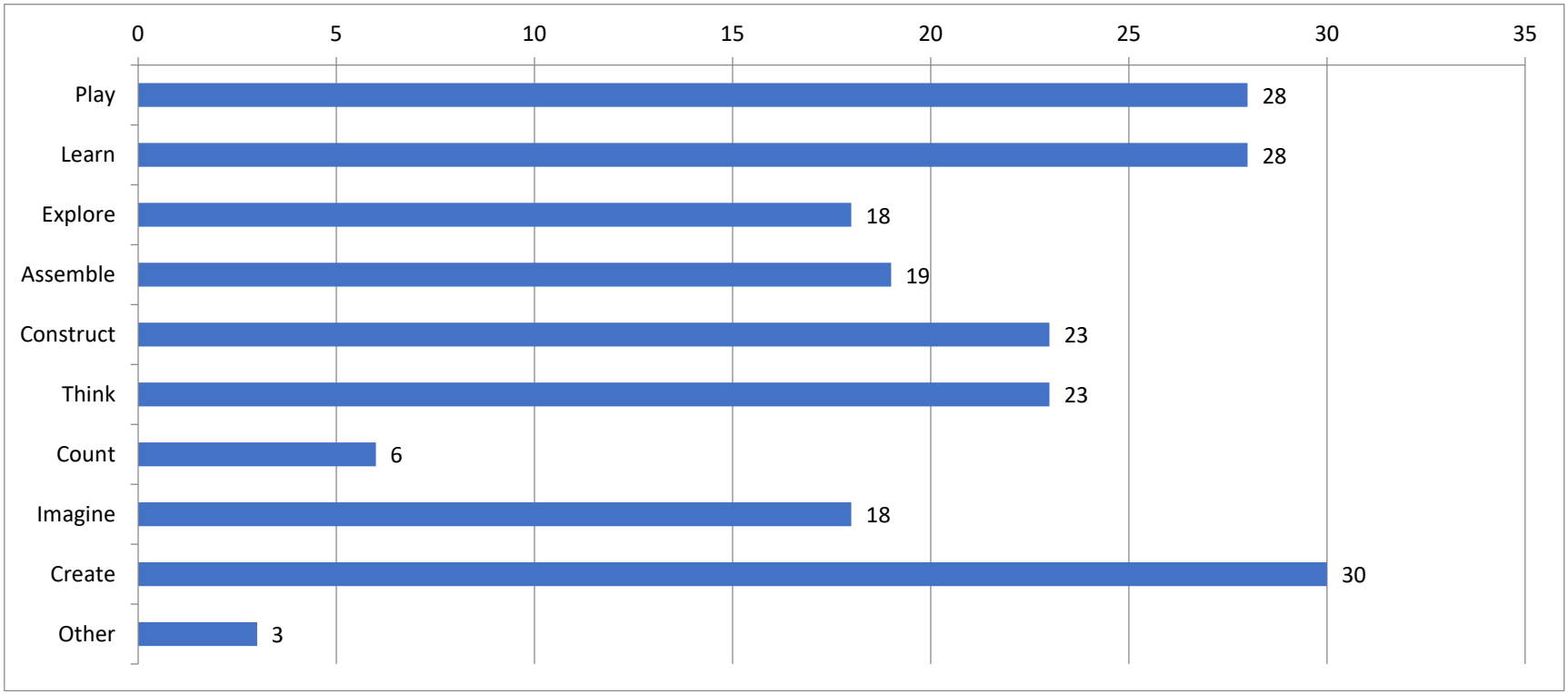

Figure 29

Respondents were asked which verbs can use to express their relationship with robotics. Figure 29 shows the number of answers on the following verbs: create (30), play (28), learn (28), construct (23), think (23), assemble (19), imagine (18) and explore (18), etc.

Which of the following sciences are, in your view, linked to robotics?

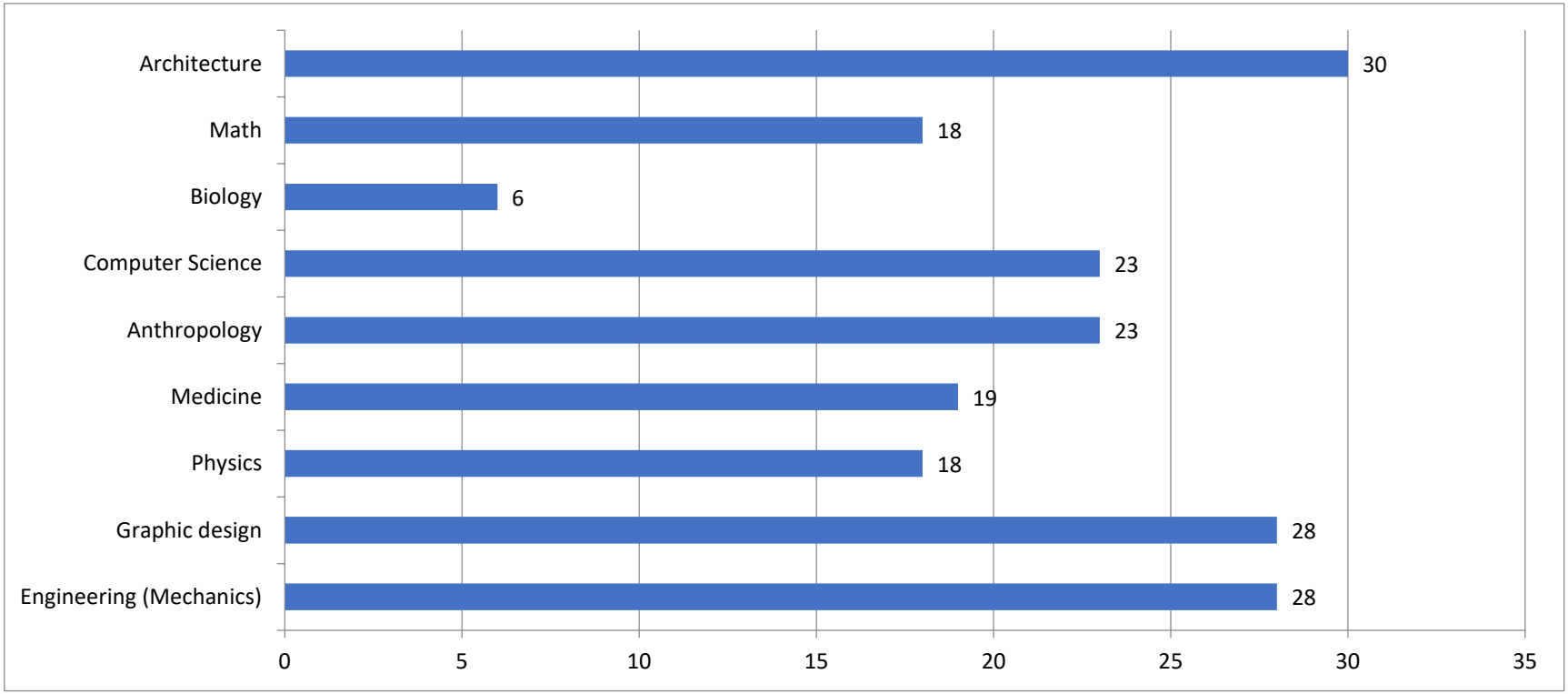

Figure 30

Respondents were asked which science can be considered as related to robotics. Figure 30 presents the following answers: Architecture (30), Graphic Design (28), Engineering (28)m Computer Science (23), Anthropoogy (23), medicine (19), Physics (18), Maths (18) and Biology (6).

For which of the following reasons would you suggest to your friends to engage on robotics?

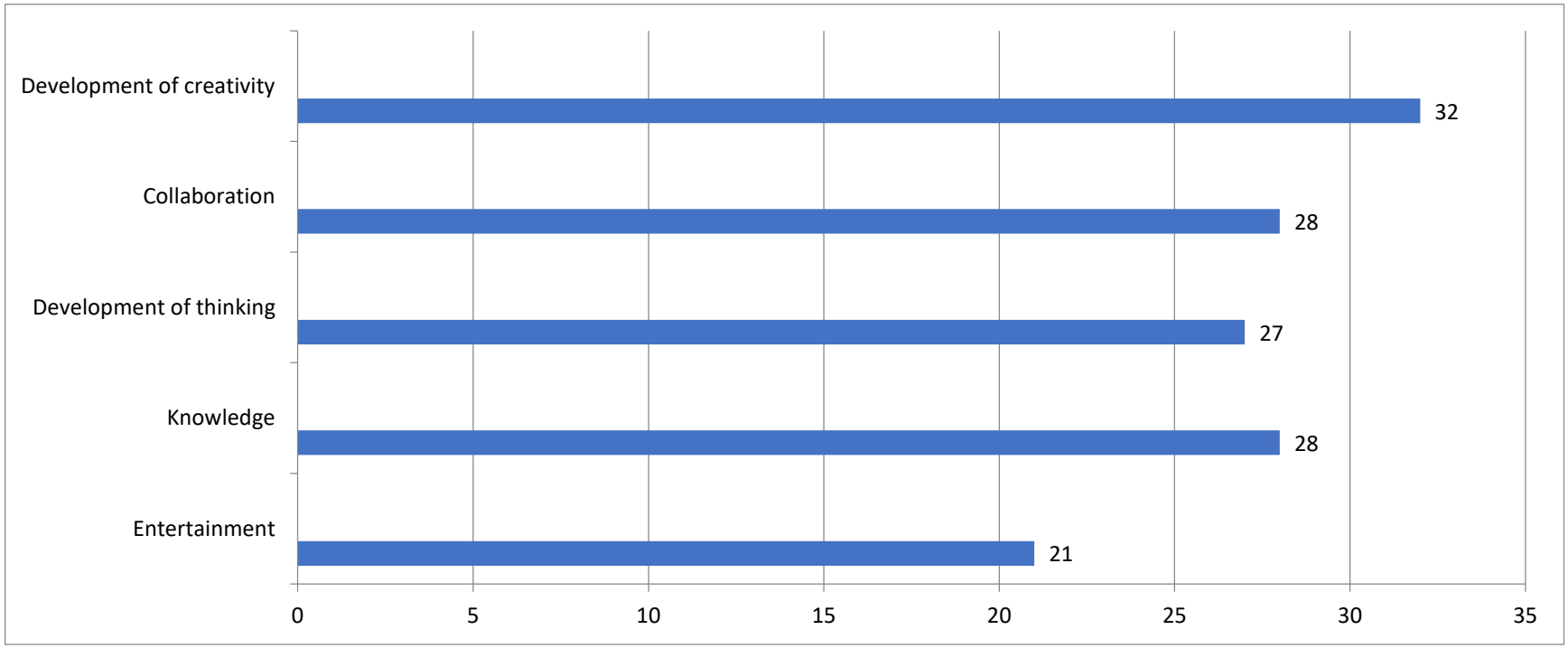

Figure 31

Figure 31 presents the reasons why students would suggest robotics to friends. 32 students voted for the development of creativity, 28 for collaboration and knowledge, 27 for the development of thinking and 21 for entertainment.

EDUCATIONAL ROBOTICS AND SCHOOL

Do you attend Robotics classes at your school?

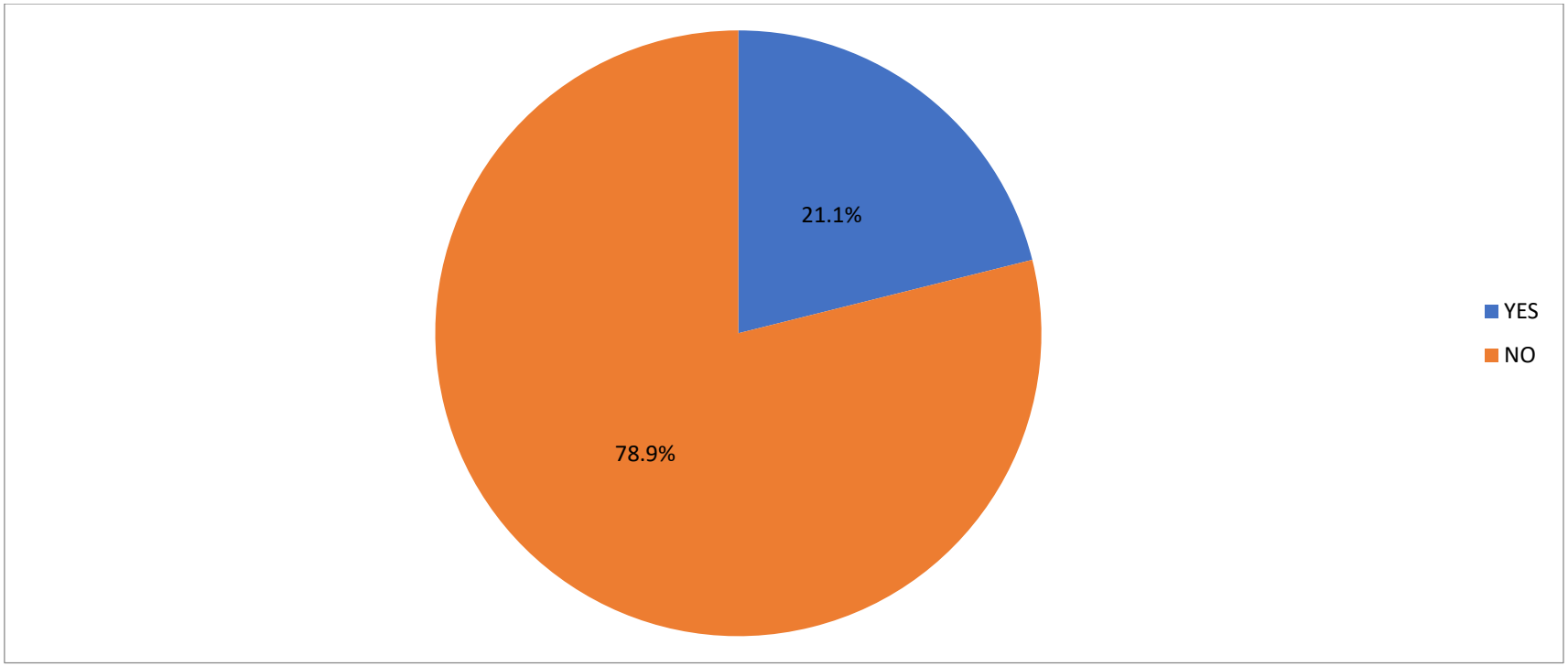

Figure 32

78.9% of students who participated in this survey do not attend any robotics classes at their school, while only 21.1% are attending robotics in their school.

Who teaches the Robotics classes?

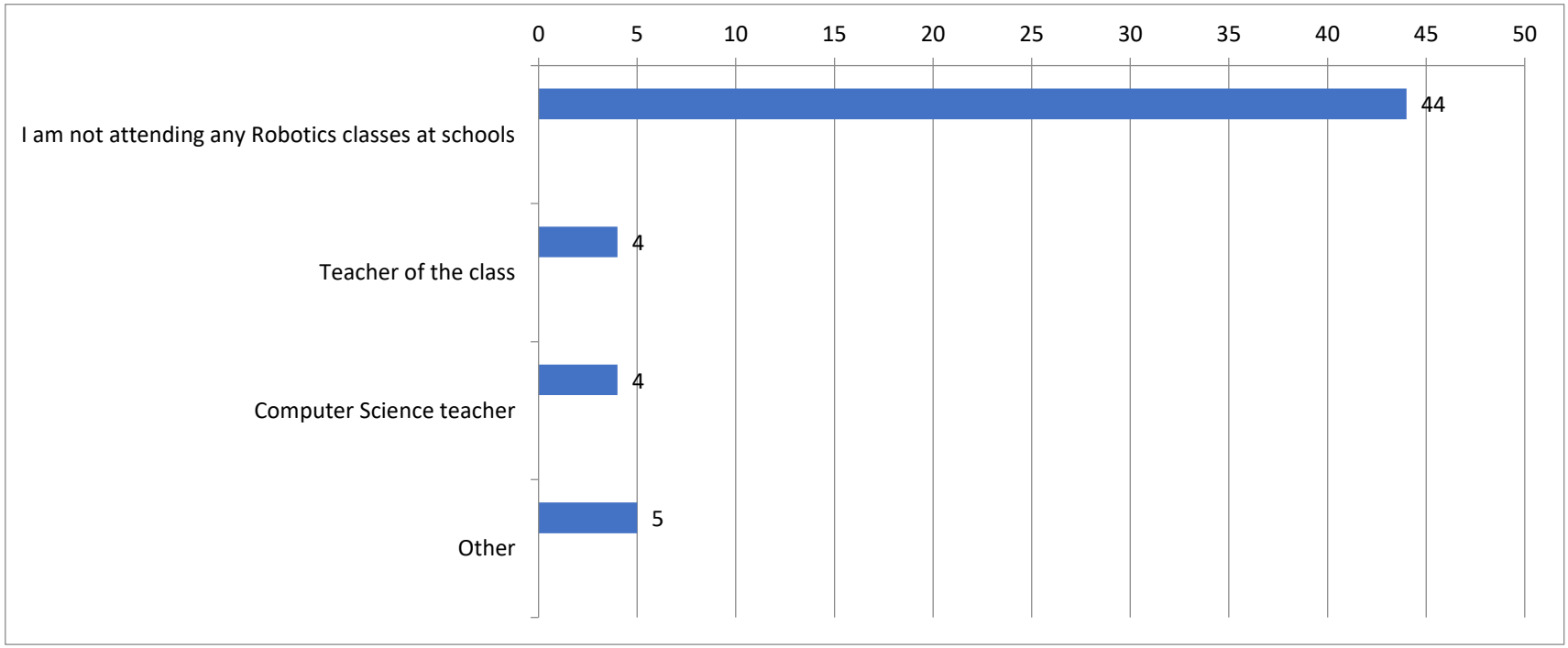

Figure 33

These respondents indicated who is teaching robotics classes who is either their teacher or the computer science teacher.

How often do you attend Robotics classes at school?

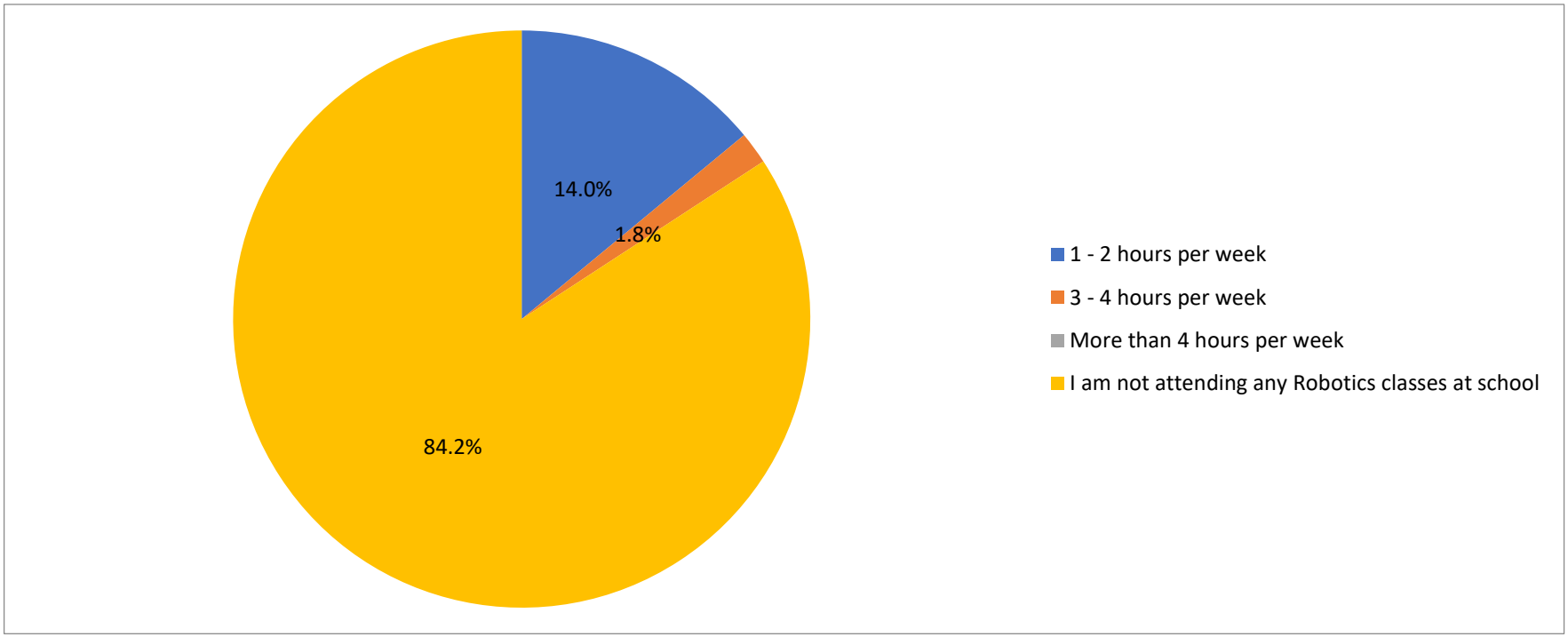

Figure 34

Respondents who answered positively in the previous question, indicated that robotics classes occur 1-2 hours per week (14%) and 3-4 hours per week (1.8%). 84.2% are not attending any robotics classes at their school.

In which of the following courses do you use Robotics?

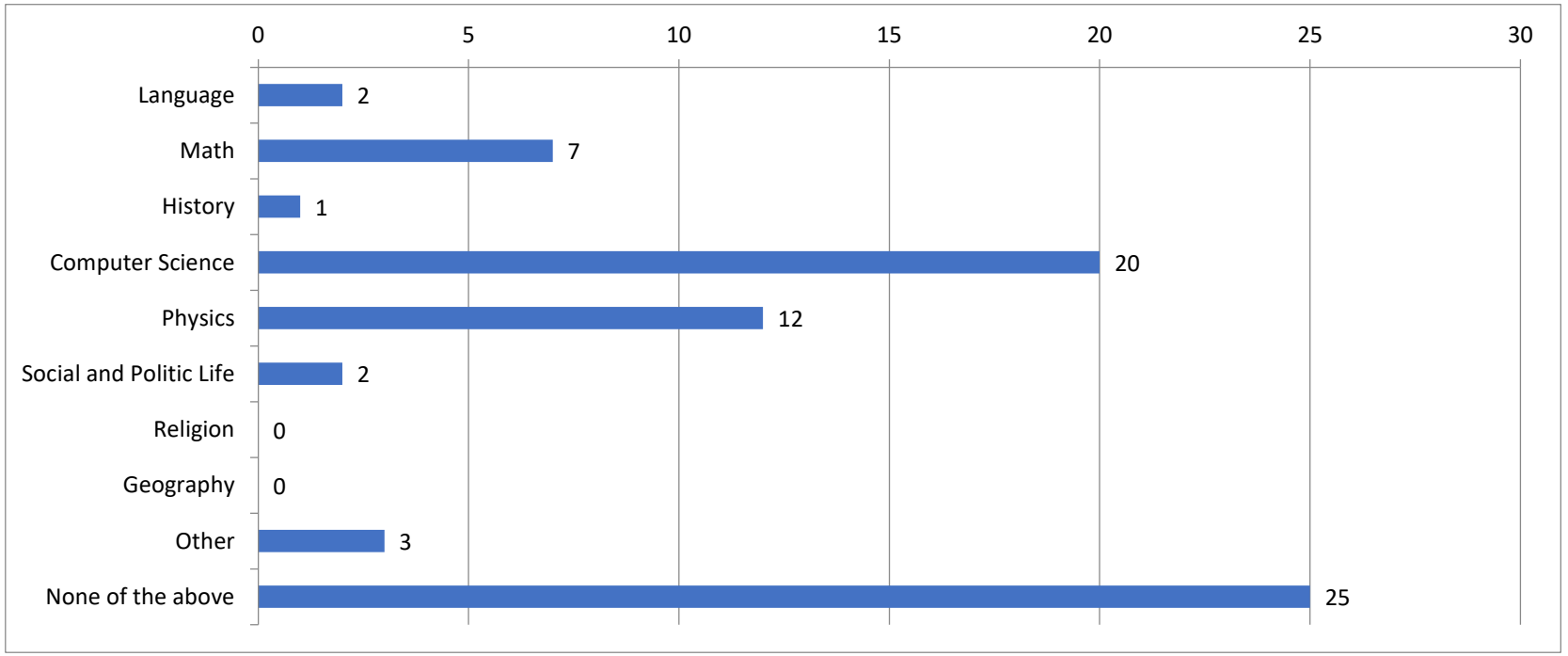

Figure 35

Figure 35 shows that robotics are used in the courses of Computer Science (20), physics (12), math (7), language (2), social and politic life (2) and history (3).

Why would you attend a Robotics class at school?

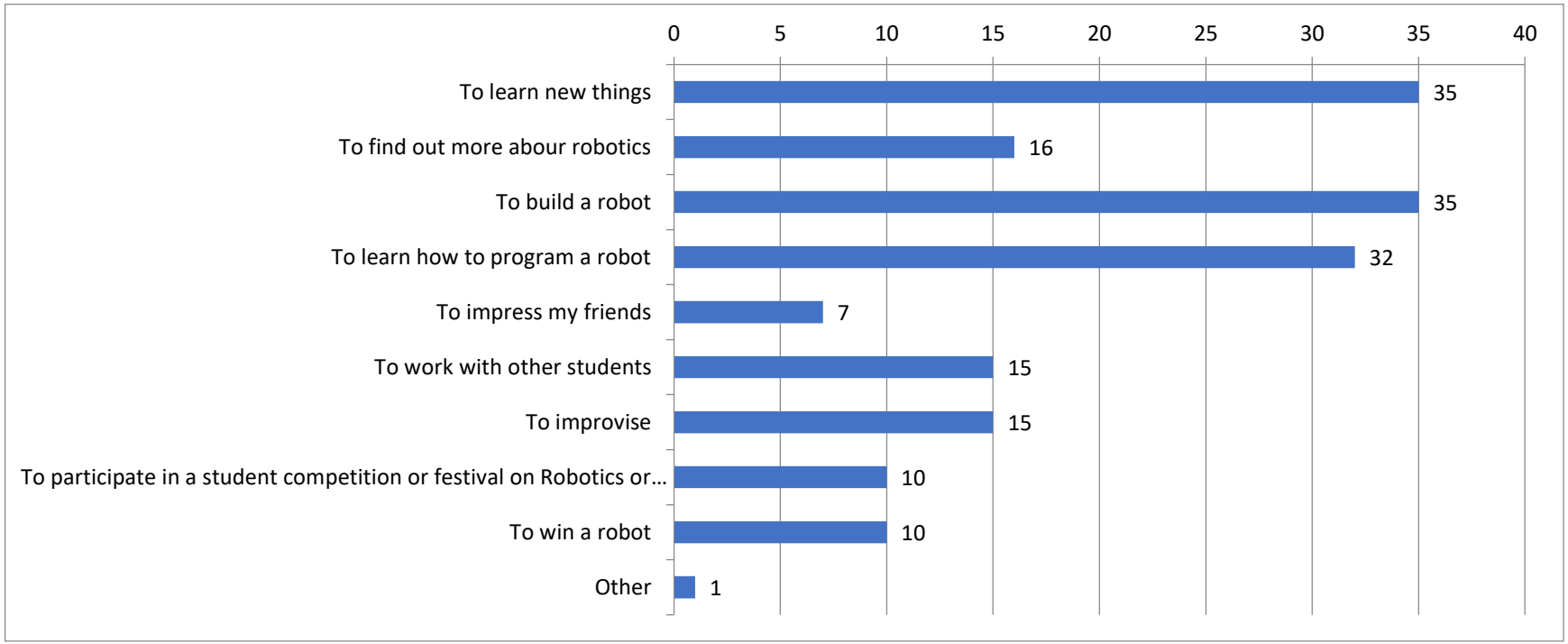

Figure 36

Figure 36 shows the reasons why students attend robotics classes at school. 35 out of 57 students attend robotics to learn new things and to build a robot, 32 students to learn how to program a robot, 16 students to find out more about robotics, 15 students to work with other students and to improvise, 10 students to participate in a student competition/festival on Robotics/Informatics and to win a robot and 7 students to impress their friends.

Annex C – Online Questionnaires

Teachers Questionnaire:

https://forms.gle/XbugiKDJyB9fLMz17

Students Questionnaire:

https://forms.gle/JPfLmteSb1rc3ouUA

Annex D – Screenshots of Results

Teachers

Questions Responses 57

Section 1 of 5

Ερωτηματολόγιο Εκπαιδευτικής Ρομποτικής για Δασκάλους

Η παρούσα έρευνα πραγματοποιείται στα πλαίσια του Erasmus+ έργου "Promoting Coding and STEM Skills through Robotics: Supporting Primary Schools to develop inclusive Digital Strategies for all (CODESKILLS4ROBOTICS)". Το έργο χρηματοδοτείται από την Ευρωπαϊκή Ένωση και έχει διάρκεια 28 μήνες (Σεπτέμβριος 2018 - Δεκέμβριος 2020). Στο έργο συμμετέχουν έξι εταίροι από την Ελλάδα, το Βέλγιο, την Κύπρο και τη Σουηδία.

Σκοπός του έργου είναι η σχεδίαση και η υλοποίηση ενός καινοτόμου προγράμματος εκπαίδευσης για μαθητές και δασκάλους της πρωτοβάθμιας εκπαίδευσης, με στόχο την εισαγωγή της εκπαιδευτικής ρομποτικής και των απαραίτητων εννοιών προγραμματισμού στα σχολεία. Τα αποτελέσματα του παραπάνω έργου αναμένεται να ενισχύσουν την ικανότητα των μαθητών στην ανάπτυξη αναλυτικής και αλγοριθμικής σκέψης για την επίλυση προβλημάτων καλλιεργώντας παράλληλα δεξιότητες όπως η εφευρετικότητα και η συνεργασία.

Το παρόν ερωτηματολόγιο στοχεύει στην διερεύνηση της υπάρχουσας κατάστασης στα σχολεία όσον αφορά στις υποδομές, στις γνώσεις των εκπαιδευτικών, στην κουλτούρα, κλπ. σε σχέση με την εκπαιδευτική ρομποτική και την αξιοποίηση της για εκπαιδευτικούς σκοπούς.

Το ερωτηματολόγιο απευθύνεται αποκλειστικά σε εν ενεργεία εκπαιδευτικούς πρωτοβάθμιας εκπαίδευσης.

Η συμβολή σας στην συμπλήρωση του ερωτηματολογίου είναι πολύ σημαντική για την επιτυχή και αποτελεσματική υλοποίηση του παραπάνω έργου με τα μέγιστα δυνατά οφέλη για τους μαθητές και τους δασκάλους της πρωτοβάθμιας εκπαίδευσης.

After section 1 Continue to next section

Section 2 of 5

ΔΗΜΟΓΡΑΦΙΚΑ ΣΤΟΙΧΕΙΑ

Description (optional)

Φύλο *

Students

Questions Responses 57

Section 1 of 4

Ερωτηματολόγιο Εκπαιδευτικής Ρομποτικής για μαθητές

Η παρούσα έρευνα πραγματοποιείται στα πλαίσια του Erasmus+ έργου Promoting Coding and STEM Skills through Robotics: Supporting Primary Schools to develop inclusive Digital Strategies for all (CODESKILLS4ROBOTICS). Το έργο χρηματοδοτείται από την Ευρωπαϊκή Ένωση και έχει διάρκεια 28 μήνες (Σεπτέμβριος 2018 - Δεκέμβριος 2020). Στο έργο συμμετέχουν έξι εταίροι από την Ελλάδα, το Βέλγιο, την Κύπρο και τη Σουηδία.

Σκοπός του έργου είναι η σχεδίαση και η υλοποίηση ενός καινοτόμου προγράμματος εκπαίδευσης για μαθητές και δασκάλους της πρωτοβάθμιας εκπαίδευσης, με στόχο την εισαγωγή της εκπαιδευτικής ρομποτικής και των απαραίτητων εννοιών προγραμματισμού στα σχολεία. Τα αποτελέσματα του παραπάνω έργου αναμένεται να ενισχύσουν την ικανότητα των μαθητών στην ανάπτυξη αναλυτικής και αλγοριθμικής σκέψης για την επίλυση προβλημάτων καλλιεργώντας παράλληλα δεξιότητες όπως η εφευρετικότητα και η συνεργασία.

Το παρόν ερωτηματολόγιο στοχεύει στην διερεύνηση των στάσεων και των αντιλήψεων των μαθητών σχετικά με την εκπαιδευτική ρομποτική στο σχολείο.

Το ερωτηματολόγιο απευθύνεται αποκλειστικά σε μαθητές πρωτοβάθμιας εκπαίδευσης ηλικίας 9 με 12 ετών. Προτείνουμε για την αποτελεσματικότερη συμπλήρωση του ερωτηματολογίου να είναι παρών ο γονέας ή ο εκπαιδευτικός.

Η συμβολή σας στην συμπλήρωση του ερωτηματολογίου είναι πολύ σημαντική για την επιτυχή και αποτελεσματική υλοποίηση του έργου με σκοπό τα μέγιστα δυνατά οφέλη για τους μαθητές και τους δασκάλους της πρωτοβάθμιας εκπαίδευσης.

After section 1 Continue to next section

Section 2 of 4

ΔΗΜΟΓΡΑΦΙΚΑ ΣΤΟΙΧΕΙΑ

Description (optional)

Φύλο *