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Learn STEM

Innovative Model of learning STEM in secondary schools

School Education ERASMUS+
KA220-SCH -
Cooperation partnerships in school education

Overview on existing practices in teaching STEM through innovative pedagogical approaches for Türkiye

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Content

1 The importance of STEM in Educational contexts

STEM education has been accepted as an interdisciplinary approach covering the entire educational process from pre-school to higher education. The advocates of STEM education say that students' interest, success and motivation can be increased, especially with real-world problems; they argue that as a result, it will help increase the number of students who make careers in the fields of science in a holistic way (Honey, Pearson, & Schweingruber, 2014). STEM education is an education that supports mental process development, entrepreneurship and product development skills.

TÜBİTAK's (Scientific and Technological Research Council of Turkey) 2011-2016 Science and Technology Development Plan includes some activities that support STEM education of students (Baran, Canbazoğlu-Bilici, & Mesutoğlu, 2015). According to this strategy, it is desired to support science education with science fairs at primary and secondary school level, and activities to be held in the fields of space sciences, mathematics, science and technology for young people.

In order to reveal successful students and teachers in STEM education, TÜBİTAK conducts project studies and organizes competitions. In addition, regarding STEM education in our country, science centers have started to be opened in various provinces by TUBITAK. Science centers aim to eliminate prejudices against science in society by making students love science and scientists. In the science centers established for this purpose, STEM activities are held with students during extracurricular times (STEM Academy, 2013).

Since 2014, the General Directorate of Innovation and Educational Technologies has been included as a national support point in the Scientix Project conducted by the European Schoolnet on STEM education.

The Scientix Project (community project for science education in Europe), managed by the European Schoolnet (EUN) representing the European Commission, started in December 2009 and the Scientix Project website is “http:// http://www.scientix.eu/ ” It was put into use in May 2010. Scientix is a community of 30 European countries that aims to promote the use of technology and good practices in Science education in Europe.

2 Presentation of examples for existing practices in teaching STEM in Türkiye

2.1 Presentation of best practice 1: I MEET ENGINEERING

This project was held in June in 2018 in Kırşehir and supported by TÜBİTAK. The project coordinator was Yusuf Demir Science and Art Center. The students from 12 till 14 years old took part in the project. The aim of the project was to create an opportunity for successful students in rural areas, to introduce them to engineering education at a young age and to attract their interest and attention to the professions in these fields.

Due to the need for qualified workforce in the fields of Science, Technology, Engineering and Mathematics (STEM), STEM education approach from pre-school to university has come to the fore in recent years. Integration of engineering with the education process increases the demand for professions in these fields.

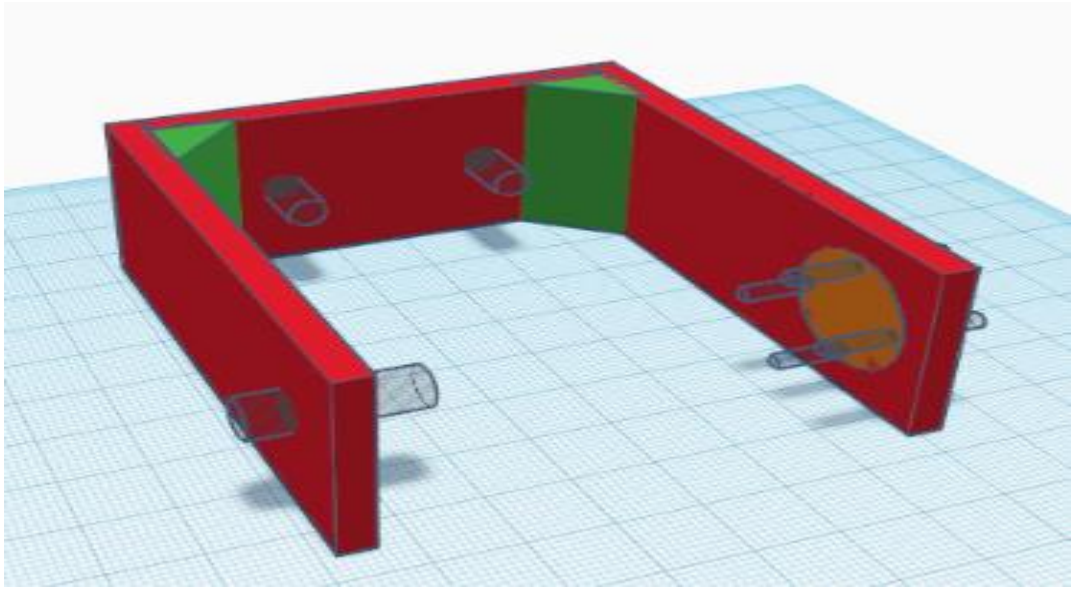
With the activities of the project, students were provided to understand the engineering design process. The students met with agricultural engineering by practicing in the field or garden environment, stepped into computer, software and electrical-electronic engineering with robotic applications, met with chemical engineering by making soap and natural markers, understood the basics of mechanical and civil engineering with STEM activities and had the opportunity to design with a 3D printer.

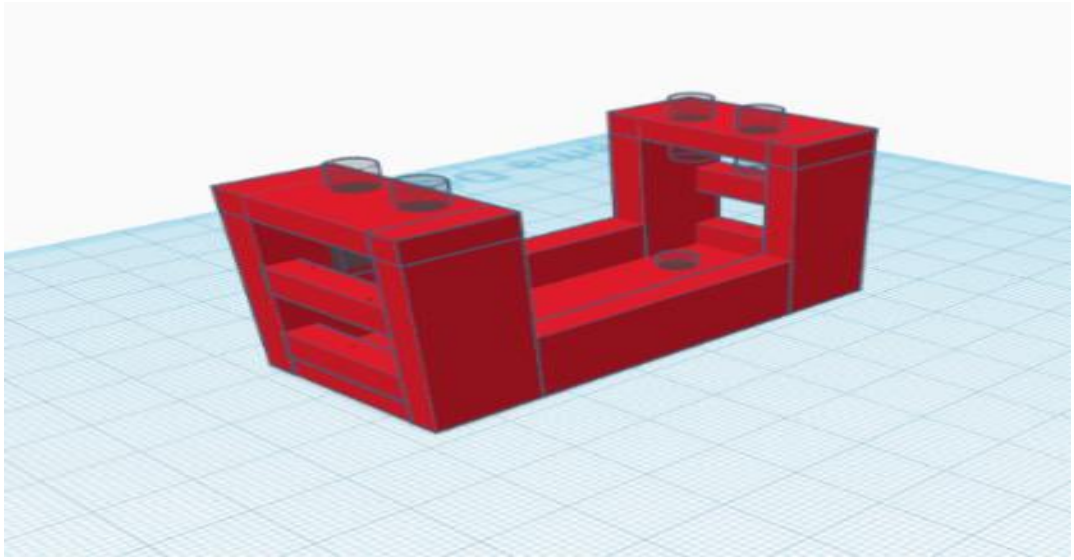
2.2 Presentation of best practice 2: HUMANOID ROBOTIC ARM

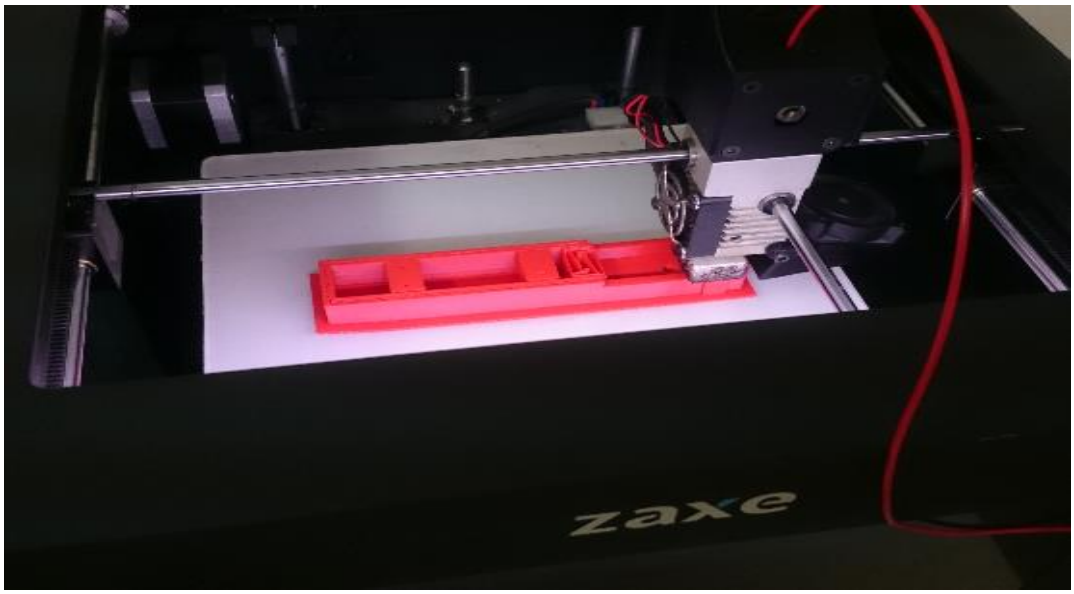
The project was supported by TÜBİTAK and held in March in 2019. The project coordinator was Yusuf Demir SAC and secondary school students took part in the project.

The aim of the project is to design a humanoid robot arm and control this robot arm with the movement of a human.

- In the project, it was examined in which axes and angles a human arm has the ability to move.
- Afterwards, previous robotic arm studies were examined.
- A robotic arm design was drafted, similar to the mobility of a human arm.
- Based on the draft prepared for the robotic arm design, the materials to be used in the project were determined.
- Tinkercad program was used for 3D drawings. The parts drawn in Tinkercad were printed out on the 3D printer.
- Servo motors and connections of the printed parts with each other were made. Finally, the necessary codes were written on the Arduino.
- The robotic arm can do the opening and closing movements of a human with the same arm movement.



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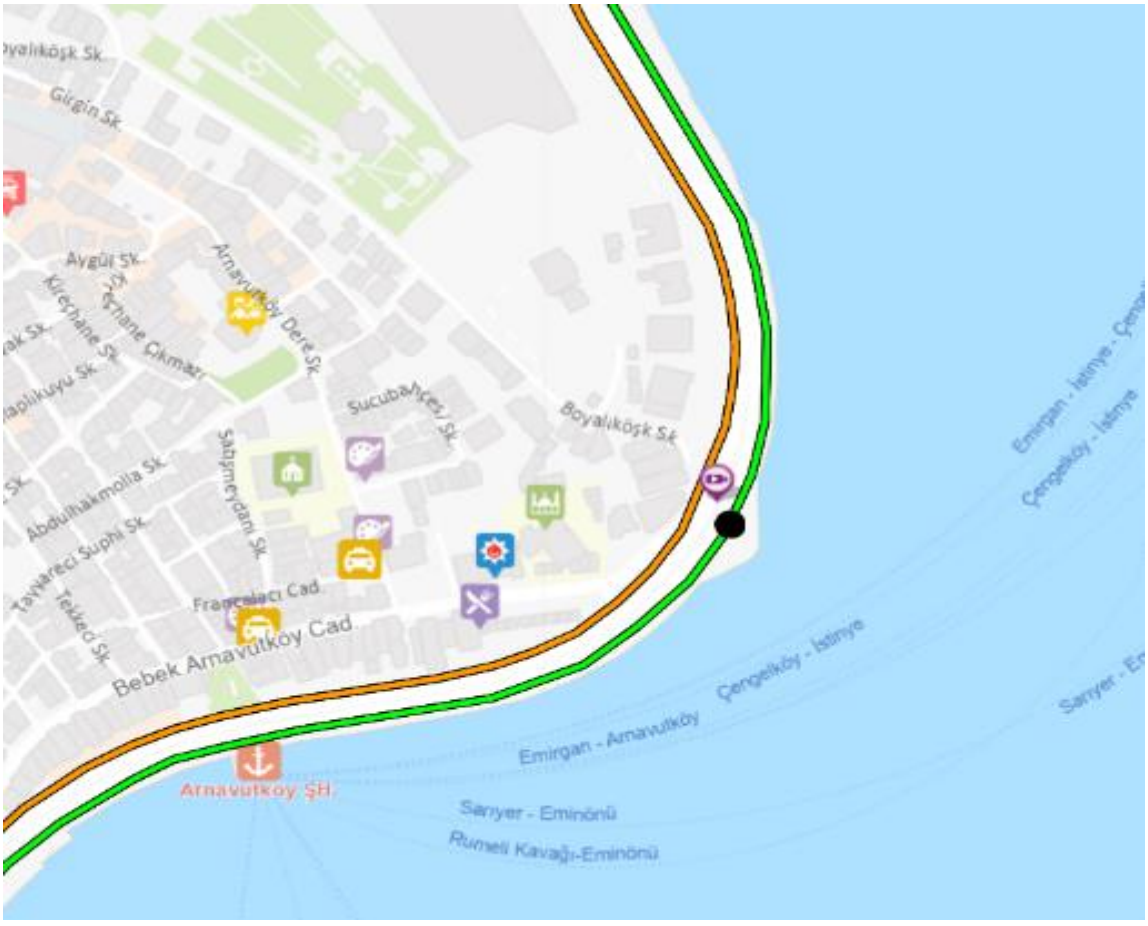
2.3 Presentation of best practice 3:

PREDICTING TRAFFIC DENSITY WITH MACHINE LEARNING

It is a TUBİTAK project carried out by Yusuf Demir SAC. It was held in March 2022. The aim of the project is to predict the traffic density with the Naive Bayes algorithm, which is a machine learning method.

- In order to determine the factors affecting traffic density and flow, previous studies on this subject were examined.
- In this study, weather conditions, weekday-weekend status, and time of day were used as factors. These factors express the characteristics in the research model.
- The traffic density, which is tried to be predicted as a result of the research, expresses the class variable.
- In the research, Bebek-Arnavutköy Street in Istanbul has been determined as the way of application.



- The data of the study were collected by 3 researchers for about 2 months, paying attention to the fact that there are different times of the day and different weather conditions on weekdays and weekends.
- The researchers then wrote the codes based on the Naive Bayes algorithm.
- With the written program, when the weather, weekdays/weekends and the time interval of the day are entered, the probability percentage of the traffic density and non-busy situation is calculated.
- As a result, it is seen that the program we developed based on the Naive Bayes algorithm has a 78% accuracy rate in predicting traffic density.

2.4 Presentation of best practice 4: YOUNG INTELLIGENCES ON THE PATH TO MATHEMATICS

The project was held in May 2009 and supported by National Agengy Youth for Europe Sub-Action. Gifted students from 13 till 15 years old took part in the project

The main purpose of the project is to ensure the socialization of students and to reach students at schools with low socio-economic level. In this direction, it is aimed for students to socialize, communicate, be tolerant towards society, participate in social activities, strengthen their creativity and entrepreneurship by sharing the mathematical materials they have prepared with their peers.