Inspiring Engineering: From Nature to Community

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Inspiring Engineering: From Nature to Community

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Abstract

In this project, middle school students in Israel (ages 12-15) developed accessories for people with special needs and for the community in general. The project was conducted over the course of two years – first as a pilot and then in a larger scope. This project is run in collaboration with community shareholders: the municipality and local high-tech industry, the zoo, student mentors from the community, people from Home for special needs, and Maker spaces for students to create the products.

Keywords: Accessibility; Technology; Engineer Design Process (EDP); Hackathon; PBL; Active Learning; Mentors, Inventive Thinking.

Introduction

The project's objectives were first to help people with special needs from the school's community, second to get inspired by nature for solutions that lead to the design of tech products and finally to experience the design process that engineers go through in product development.

The number of students who were involved was 100 students in the 1st year aged 12-15 and about 900 students in the 2nd year aged 11-15 from several schools.

The project created partnerships: with parents, other local schools, the local science centre (Eshkol Pa'is), mentors from the community and from technology high school students, an institution for people with physical disabilities.

The students met people with special needs (disabilities) from their community, learned about their everyday lives, and together they found a problem they wished to solve. The students worked in groups. They planned and designed a product according to the engineering design

process. The product to be developed was aimed to solve the specific problem that was identified. The final products were presented to the community during a peak event in which everyone involved in the project and representatives from the municipality and from the Ministry of Education participated.

Methodology

Before finding the solutions for the challenges posed by this project, it was necessary for students to know the social and technological context which society of the 21st century is moving towards. For this, the FEEL phase raised the needs to firstly, meet with people with special needs in order to understand their problems, and secondly to know how technology and engineering has helped solve challenges in recent decades. In addition, the students observed animals in the zoo and gained knowledge on biomimicry, learning about natural solutions for human problems. In this phase the students participated in lectures (given by parents and experts from the local high-tech industry), got acquainted with new thinking and learning techniques, and participated in a workshop for innovative and inventive thinking.

Concept

The students worked in groups in order to find creative solutions for the problems that were identified in the FEEL phase. The students exerted inventive thinking, honing their research-conducting skills and experimenting with different thinking techniques. Some of the creative solutions were inspired by nature, using principles from biomimicry.

Implementation

In the 1st year a Hackathon event was held, during which the students created models of their inventions. They were assisted by parents and professional mentors from the community. Following a reflection process on this activity it was decided to strengthen the students' and teachers' technological skills in order to improve the quality of the models. For that, a teachers' training was conducted, focusing on the Makers methodology, which includes soft technological skills or "hands-on learning".

Picture 1: Students in a Maker Space

The title of the project in the 2nd year was "Ra'anana – Accessible City", aiming to evoke solutions in all aspects of accessibility – from transportation to information. The Hackathon event in the 2nd year was a joint effort of several middle schools in Ra'anana, led by the Alon School. Prior to the event the students in all schools studied the subject. Then there was a preliminary event in which students and designated mentors participated in lectures on the subject by experts from the municipality.

Lastly, the Hackathon event was held: 12 hours of students' work, honing their ideas and creating models, using both low-tech and high-tech tools (e.g., 3D printers) and practicing their Makers skills.

Following the Hackathon, some of the participating students spoke about what the event and the project as a whole meant to them: one of the students, Alon, said he experienced a very meaningful and interesting learning and that he would like to continue to develop new products. Maya said: "When I grow up, I want to be an engineer!" Another student, Yuval, said he was happy to share his newly acquired knowledge with the rest of his classmates. Amnon spoke about the interesting meet-ups the students have had with a variety community shareholders. Ido referred to the opportunity to meet people with special needs: "Now I look at people with special needs in a new way, I'm happy I had the chance to get to know some of them and I'm glad I had the privilege to help them."

Conclusions

Students presented their inventions using multiple forms of media: the local newspapers, schools' internet websites, municipality website, Facebook, and Instagram. Schools set up local exhibitions. In addition selected models were sent to the local conference that took place in the "Eshkol Pa'is" (the local science centre). The students participated in the local conference, presenting their inventions with posters and models. A committee recommended the products that would move on to national contests. Parents and people with special needs were invited to take part in this event and view the chosen inventions. Posters and products remained exhibited to citizens for two weeks after the event. The final products will be handed to people with special needs – after building and improving them.

A short video summarizing the project and the hackathon event can be found here: https://youtu.be/TRW53JjnEDQ

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