The **MAKEITREAL** project

Addressing underachievement in STEAM education through real product design and making practices

MakeITReal project aims at engaging school students (13-17 years old) that demonstrate low performance in STEM education and keep distance from STEM related disciplines in innovative product design and making practices following the Maker Movement trend in education, a global drive that encourages young people to be creative with technology. MakeITReal puts also emphasis on teachers' professional development and aims at supporting them in developing the skills needed in order to facilitate the learning process, to tailor their teaching to students' needs and finally to design their own engaging activities in STEAM (Science, Technology, Engineering, Arts and Maths). We argue that 3D printing and design can electrify various literacies and creative capacities of students with low performance in STEM and can help them realise that STEM subjects open the door to endless creative possibilities related to real life.

Pilot studies will take place in secondary schools in Poland, Greece and Turkey.

MakeITReal will develop:

- A technical reference guide that details practical and technical issues related to 3D modelling and 3D printing
- The MakeITReal curriculum with Open Educational Resources for teachers and students
- 10 interdisciplinary projects in the area of Science, Technology, Engineering, Arts and Maths that will result in the creation of 3-dimensional physical objects
- A pilot protocol that will guide the pedagogical implementation of the learning intervention
- A validation report that will present evaluation results
- Policy recommendations for the wide adoption of the proposed learning interventions into school structures.

Though MakeITReal is focused on a practical objective and is not in itself a research project, the activities that we organise will provide a rich educational context for introducing interdisciplinary 3D projects in the class and engaging underachievers in meaningful and creative STEM projects.

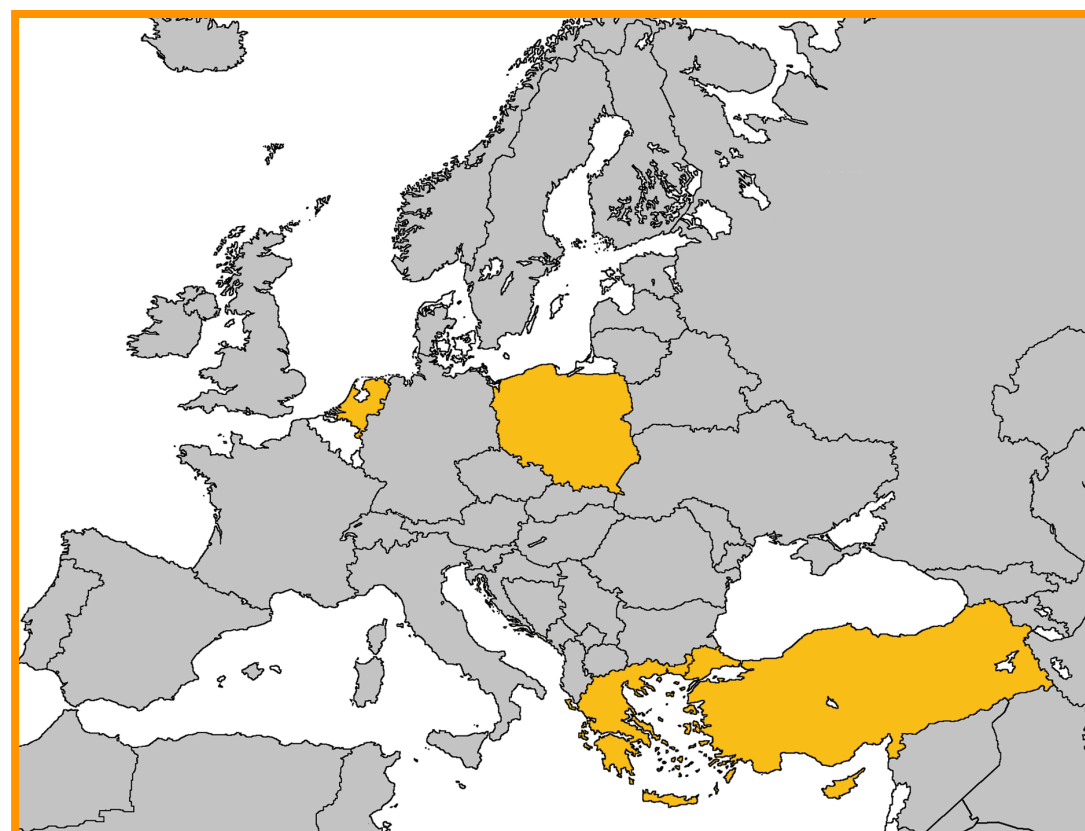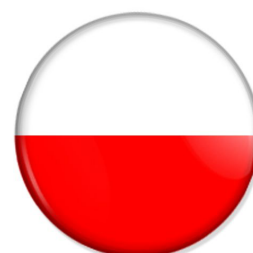The project started in October 2016 and runs for 2 years.

The MAKE**IT**REAL project

KICK OFF MEETING - 1
8 - 9 NOVEMBER 2016
WARSAW
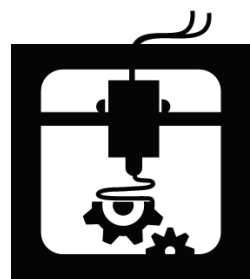
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The Kick Off Meeting of the Erasmus+ EU Project MakeITReal (contract No. 2016-1-PL01-KA201-026492) was held in Warsaw, at the Faculty of Physics of the Warsaw University of Technology. It had two-day duration (from the 8th of December 2016 to the 9th of December 2016 (inclusive)). The meeting was attended by 13 consortium members from all project beneficiaries. The meeting started with a welcome address given by the Authority of the Faculty of Physics Warsaw University of Technology. Afterwards, the consortium members' representatives presented their organisations, their background and expertise in educational activities, motivation to join the project, their roles in MakeITReal and their respective expectations. The next point in the agenda was covered by Rene Alimisi (Edumotiva) who provided general overview of the projects, presented the project objectives, main results, project plan, timetable and dependences between different project activities. Then project intellectual outputs were respectively presented. During the whole meeting, active discussions took place. The participants were deeply engaged in discussing and reflecting as well as in consulting each other. Particular attention was paid to the details of the upcoming training event (C1), selection of 10 projects for student involving 3D printing and the issue of 3D printer specification for schools.

The **MAKE**IT**REAL** project

TEACHER TRAINING - 1
13 - 17 MARCH 2017
ARISTOTLE UNIVERSITY OF THESSALONIKI

The opening session included an introductory presentation on the organising committee of the seminar, welcome addresses from representatives of the Aristotle University Thessaloniki and International Hellenic University, as well as presentation of the time schedule of the event. Prof. Gabriel Mansour afterwards welcomed all the participants and talked on the challenges, difficulties and opportunities when learning computer aided design and 3D printing technologies. Dr. Dimitrios Tzetzis presented initially Aristotle University and the Department of Mechanical Engineering, its research facilities and its participation to European projects. He then presented various university level student projects in product design from the International Hellenic University in order the participants to be inspired for their own projects during the C1 meeting and overall for the Makeitreal project. Projects with professional design software and manufacturing systems such as CNC, 3D printing and laser cutting were presented and discussed with the participants. Dr. Konstantinos Tsoggas offered an introduction to CAD/CAM systems, explaining the types of different software and their characteristics, the workflow from design to production and the preparation of a file for 3D printing.
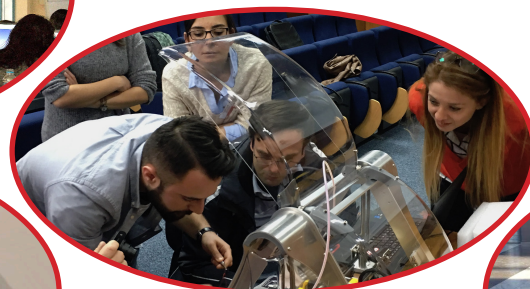
Dr. Ioanna Symeonidou initiated the actual hands-on training with FreeCAD software, explained the user interface and the underlying logic of parametric design software. The software training was structured in such a way, so as to learn the basics of three-dimensional modelling and practice with specific exercises and variations, to produce 3D models that are suitable for 3D printing. There were alternating lectures and working sessions disambiguating terms such as constraint based modelling, primitives, curved profiles and Boolean operations and practicing with design exercises.

The MAKEITREAL project

TEACHER TRAINING - 1
13 - 17 MARCH 2017
ARISTOTLE UNIVERSITY OF THESSALONIKI

The team of Dr Symeonidou, Dr Tsoggas, Mr Tzikas and Mr Tzimtzimis, altered roles in the instruction of FreeCAD software and aiding MakeITReal participants in the creation of their projects. Each day included sets of input session, hands-on working session and 3D printing, steadily raising the difficulty and level of complexity of each task. The participants practiced under the guidance of the teaching team and created a puzzle piece, a key holder, 3D letters and amigrams, chess pieces, pencil holders, gears, mugs and image based extrusions. The exercises were structured in such a way, to cover a big variety of computer aided design tools. The lectures and examples covered the main tools for the creation of geometry such as extrusion, revolve, loft, array, sweep, spline and operations to modify geometry such as cut, fillet, pocket, fusion, among others. The participants visited the 3D Laboratory of the International Hellenic University where Dr Tzetzis, Dr Symeonidou and Mr Tzimtzimis presented the digital manufacturing technologies and reverse engineering methods. There were demonstrations of Laser cutting (cutting, scoring, folding), CNC milling and 3D scanning of objects and people. The main program was complemented with lectures by 3D Printing Professionals and Companies. Dr Tsakiris from the Aristotle University of Thessaloniki, Department of Mechanical Engineering, Lab. of Machine Elements & Machine Design. Dr Tsakiris presented his current research and the case study of the Antikythera Mechanism.

The last day of the training event included the evaluation and the meeting with Partners, the discussion of O1 and preparation for O2. The participants discussed their plans regarding their Educational Activities and Dissemination of MakeITReal project. In the afternoon all MakeITReal participants visited the NOESIS Thessaloniki Science Centre and Technology Museum, where the director of the museum offered a guided tour to the exhibition of Ancient Greek Technology and a documentary screening at the Planetarium.
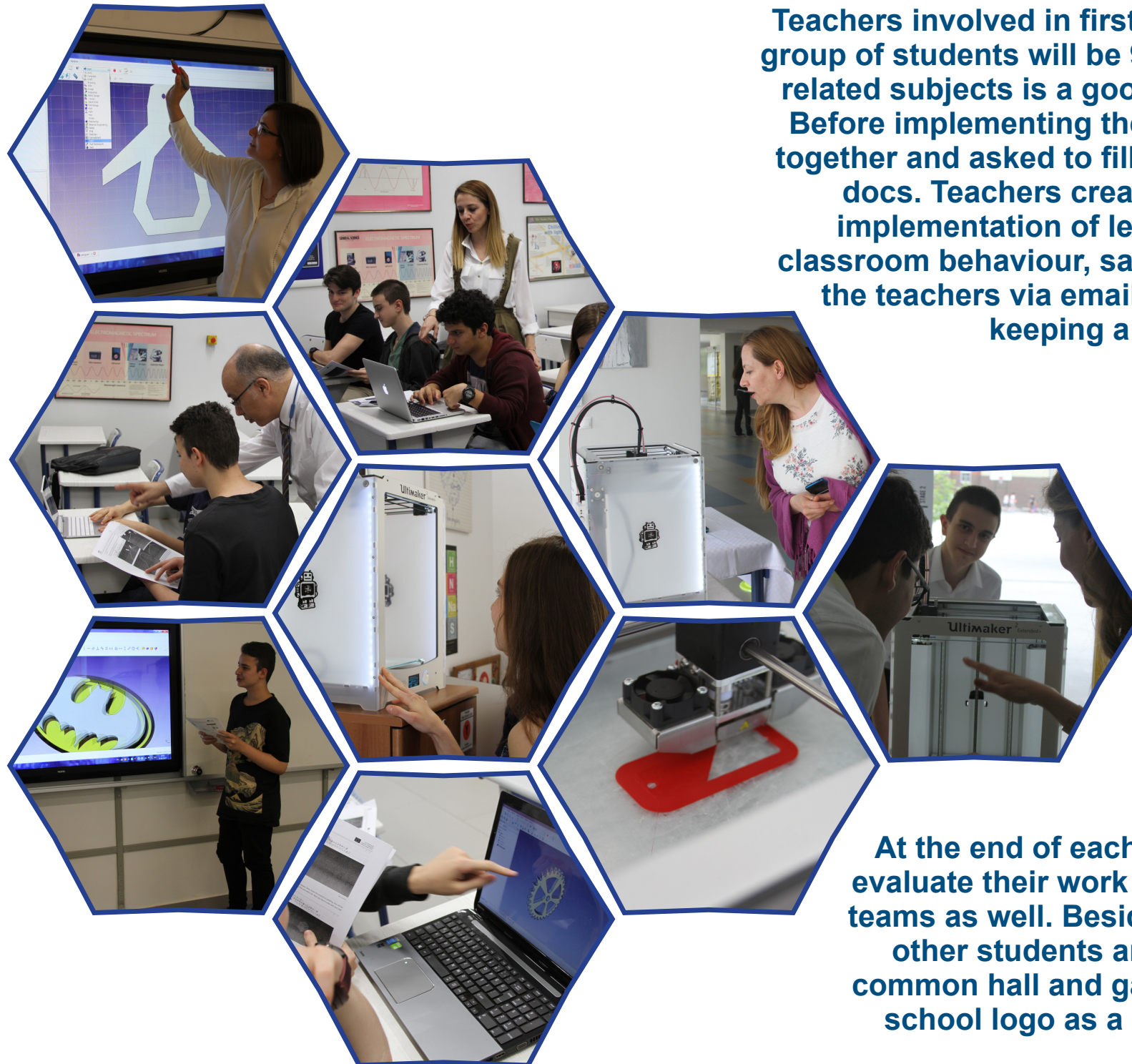
The MAKEITREAL project

PILOT - 1

MARCH 2017 - JUNE 2017
ODTÜ GELİŞTİRME VAKFI ÖZEL LİSESİ

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

P I L O T   1

Teachers involved in first pilot decided that the most appropriate group of students will be 9th graders as their performance in STEM related subjects is a good indicator of their future achievement. Before implementing the projects of first pilot, the group came together and asked to fill in pre-test questions online via Google docs. Teachers created a set of rules that helped better implementation of learning intervention, which included classroom behaviour, safety rules and submission of designs to the teachers via email. Students were also informed about keeping a record of entire process.

When the designing and printing process of pre-determined tasks (cube, keychain and penguin) has finished, some students were encouraged to design the BATMAN logo and some tried to design gear models.

At the end of each project teams were encouraged to evaluate their work and to provide feedback to the other teams as well. Besides, students presented their work to other students and teachers in an exhibition at the common hall and gave each teacher a keychain with the school logo as a present for the end of school year.

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The **MAKE**IT**REAL** project

TEACHER TRAINING - 2
19 - 23 JUNE 2017
CYRIC NICOSIA CYPRUS

MakeITReal is an Erasmus+ KA2 project (2016-1-PL01-KA201-026492) that engages secondary school students (13-17 years old) that underperform in STEAM (Science, Technology, Engineering, Arts and Maths) education and keep distance from STEM related disciplines in creative product design and making practices. Special focus is placed on teachers' professional development and on building the pedagogical and technical skills needed in order to facilitate the learning process, to support students' in 3D modelling and 3D printing and to make connections across STEAM disciplines.

Towards this end, the 2nd MakeITReal training activity (C2) for teachers and project partners took place in Nicosia (Cyprus) on June 19-23, 2017. It was organised by Cy.R.I.C Cyprus Research and Innovation Centre Ltd and hosted at the Gravity, a Venture Building Incubator that recently opened to the public. The workshop started with experience sharing among the participant teachers and the project partners. The participant teachers talk about the 1st MakeITReal pilot, the deployment of the 3D projects in the class, the students' reactions and the challenges that they encounter.

The activity continued with the "Ideation with Creative and Entrepreneurial Thinking" workshop: How will the future "learning process", "training" and "desk" be? Answers to these intriguing questions were presented by three working groups after a process that involved brainstorming, experience exchange, creative discus-sions, drafting, re-drafting and prototyping. Through various presentations, MakeITReal partners moved from "conceptualisation" to "an object that can enter the market". Presentations like the Wi-Shoe project, IrisPhone Story, RampCo project, the ARC Bicycle project, the first 3D printed bridge in Amsterdam, the Fluid-glass project were great sources of inspiration! At the same time they were clear examples of how challenging it is to move from concept to a design and straight down to the market. MakeITReal team has now a great momentum on bringing closer educational intervention with the world of business, industry and research.

The MAKEITREAL project

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