KIDS INSPIRING KIDS IN STEAM (KIKS)

Erasmus+ Project

FINAL REPORT FROM FINLAND

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Abstract

The Kids Inspiring Kids in STEAM (KIKS) Erasmus+ project was based on a three-stage process. The first stage was Hothousing, to creatively develop ideas, on the second stage we have organized the Local Challenges, to develop those ideas into projects and deliver them to other students, and in the third stage, we have organized International Collaboration among the students and teachers. In Finland 5 teams from 5 schools was involved in the project, but we have managed to achieve impact in non-participating school communities as well. The project has positively contributed to the current processes related to the new Finnish National Core Curriculum's "multidisciplinary learning module", which requires the development of similar forms of learning like those, we have promoted in the KIKS project. Real success of the KIKS project was providing encouragement to the students and teachers to try new ways of collaborative, playful and project-based learning, to test new hands-on and digital tools; and the establishment of the community basis of the Finnish STEAM movement. The students, teachers and KIKS-researchers have developed several high quality and useful materials in the project and there were several different learning outcomes. All workshops designed and delivered and those produced by students had high levels of intellectual impact.

Key figures in Finland:

• 5 Schools

• 115 participating students (22 students from the Huhtasuo School, Jyväskylä; 20 students from the Laukaa School, Laukaa; 15 students from the Mankola School, Jyväskylä; 21 students from the Palokka School, Jyväskylä; 27 students from the Viitaniemi School, Jyväskylä.)

• 10 Hothousing Project Activities developed by FINLAND KIKS project team

• 5 Local Challenge Projects developed by FINNISH KIKS students

• 3 Projects for International Collaboration (Viitaniemi School – UK school; Laukaa School – Spanish School; Laukaa School – UK)

• Dissemination: KIKS project was introduced in 14 conference talks by the Finnish KIKS-team, including 2 special conference sessions devoted to the KIKS project: one Helsinki and one in Jyväskylä, both at international meetings. KIKS project has been part of the European Researchers' Night 2017 in Finland, which has hosted the closing multiplier event in Finland with a great success.

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1 Introduction

The goal of the ***Kids Inspiring Kids in STEAM (KIKS)*** project was to raise students' awareness towards the multi- and transdisciplinary connections between the **STEAM subjects (Science, Technology, Engineering, Arts & Mathematics)**, and make the learning about these fields more enjoyable. In order to achieve these goals, **KIKS** project has popularized the STEAM-concept by projects based on the **students inspiring other students-approach** and by utilizing **new technologies, tools, open educational resources**, and **everyday items and materials**.

Through the **students inspiring other students-approach,** we have aimed to get participating students developing STEAM activities for other students in their own local context and in a wider European physical and virtual community.

5 schools in Finland, 4 schools in Hungary, 10 schools in the UK and 9 schools in Spain were participating in the program. Each of the participating 28 schools were represented by minimum 1 team of minimum 4 students, facilitated by minimum 1 teacher, and there were several places, where complete school classes have joined to the KIKS-project. **In Finland 115 students and 7 teachers have joined to the KIKS project.**

2 KIKS Schools in Finland

- **Laukaa School:** Laukaa School has 418 pupils, 21 classes of 7th to 9th grade and 42 teachers in the academic year of 2016-2017. The school supports creative ideas and group work. They encourage students to participate in projects, and to interact with the community. **Teachers:** *Mirka Havinga* is a teacher of mathematics and arts. She ed the project in Laukaa School. *Henri Leinonen*, IT teacher has joined to lead micro:bit related activities.

- **Viitaniemi School:** Viitaniemi School is in the city of Jyväskylä offering education from 7th to 9th grade. There are 440 students in the school. The school has English classes for students with international background, as well as autism education and preparatory classes for immigrant children. The school offers English language A1, A2, Spanish and Russian languages, as well as B2 in German and Spanish. **Teachers:** *Merja Sinnemäki*, mathematics, physics, chemistry and English teacher, a leader of the English program was responsible for the STEM subjects and English language communication; *Leena Kuorikoski*, art teacher was responsible for the artistic and creative elements in the program.

- **Huhtasuo Comprehensive School:** Huhtasuo School has 740 students. Our teacher contact Ulla Koskiahde was already interested to join to an international art & science project and she has joined to this project with her own class of 13-years-old students. **Teachers:** *Ulla Koskiahde*, mathematics and physics teacher has led the KIKS

collaboration and *Mari Itkonen*, English teacher has supported the English language communication throughout the KIKS project.

- **Palokka School:** Palokka's new school center has been opened in August 2012. The school includes Palokka comprehensive school (grades 1-9) Palokka Regional Library, manufacturing and cooking facilities, civic facilities and sports hall. In the academic year of 2016-2017 Palokka school has about 510 pupils and 42 teachers. The community respects diversity: different cultures and viewpoints are equally valuable. The school is not based on already given values, but to create an open atmosphere in which children and young people can actually build their own values. Pupils are taught to the acceptance of differences, as well as a critical and holistic thinking. **Teachers:** *Talja Annukka,* mathematics teacher and principal, and *Jarmo Laaksonen,* art teacher have supported KIKS-related collaborations.

- **Mankola School:** Mankola school is a comprehensive school (classes 1-9), which was opened in 2013. The school has around 580 students. The staff at the school is 55. Mankola's aim is to develop self-reliance, feeling of prosperity, advanced study skills dominated by children and young people who are coming to terms with a changing world as different people and trying to influence the society. **Teacher:** *Tapani Aaltonen*, physics and chemistry teacher has led KIKS-related activities in the school.

3 Hothousing in Finland

The hothousing process in Finland has benefited a lot from the UK KIKS-team's hothousing concept and knowledge and experiences. The Finnish KIKS-team has studied the UK approach and combined it with the methods of the **Experience Workshop International Math-Art Movement** (www.experienceworkshop.org), which is an international STEAM community of teachers of mathematics and sciences, artists, researchers and parents from Finland and from other countries in the world. KIKS-Finland researcher **Kristóf Fenyvesi** leads the Experience Workshop community, therefore he was responsible for supporting STEAM-related innovations in the KIKS project. **Markus Hähkiöniemi**, who is a specialist of mathematics education research and technology in mathematics education, as member of KIKS-Finland team, has been taken care about methodological organization and technology-related questions in the project.

In addition to the involvement of Experience Workshop's resources, such as a large collection of various STEAM education toolkits and an international collection of mathematical artworks, the Finnish KIKS-team has been looking for opportunities to set up collaborations between the KIKS-activities and various local and international STEAM

projects. Our goal was to introduce KIKS approach to the participating Finnish schools in the context of a colorful selection of STEAM-programs, provided on different venues.

In parallel with the launching of KIKS, the Finnish KIKS-coordinators were working on the preparation of a conference at the KIKS consortium member University of Jyväskylä, in collaboration with the world's largest math-art-education community, the Bridges Organization. The Bridges Finland 2016 conference (http://bridgesmathart.org/bridges-2016) had several STEAM education events, which we could implement in connection with the hothousing process of KIKS project.

3.1 Hothousing Partners, Venues and Contents

In this chapter, we introduce Finnish KIKS project's main partners, venues, contents and results, which have played important role in the Finnish hothousing process.

3.1.1 Experience Workshop

University of Jyväskylä has developed **Kids Inspiring Kids in STEAM Hothousing Activities** in collaboration with **Experience Workshop International Math-Art Movement (www.experienceworkshop.org)** and its international partners. All activities are based on the **4Dframe modelling kit,** but can serve basis and inspiration for projects realized with other modelling equipment as well.

"KIDS INSPIRING KIDS IN STEAM" HOTHOUSING MATERIALS FOR DOWNLOAD

The Finnish KIKS Team has developed STEAM activities in 10 different topics. The KIKS activities have been offered to the participating schools as Kick-off Programs. All activities are based on collaborative problem-solving and introducing multi- and transdisciplinary STEAM learning in a playful, active form. All activities have been made available on the project's homepage: http://www.kiks.unican.es/en/activities-roadshows/

01- Bridge Building Challenge
Who makes the strongest, the most efficient, or the most beautifully designed bridge?

02- Snowflake Science
The beautiful symmetries of snowflakes, not only for the wintertime…

03- Football and Basketball with Giant Molecules
Did you know that the black and white patterned, 'classic' soccer ball and a Fullerene (Carbon-60) molecule has the same structure? Let's see if you can build it and let's play the game!

04- Let's Build a Small Geodesic Dome!
Geodesic domes have a simple, but fascinating structure. Explore the hidden symmetries and let's try to put together some!

05- Let's Build a GIGANTIC Geodesic Dome!
Think big and build a 5 meters wide and 3 meters high geodesic dome!

06- 4Dframe Warka Water
How to harvest water from the thin air? Geometry and art might can help to find the solution. Warka Water is the creation of the Italian architect, Arturo Vittori and to study its' geometrical structure and the way that it works, is a perfect way to develop water & environmental awareness.

07- 4Dframe Wind & Water Power
How to transform wind and water power into kinetic energy?

08- 4Dframe Mechanical Instruments
Are you interested in how a music box works? Would you like to make an automatic drum or a mechanical xylophone?

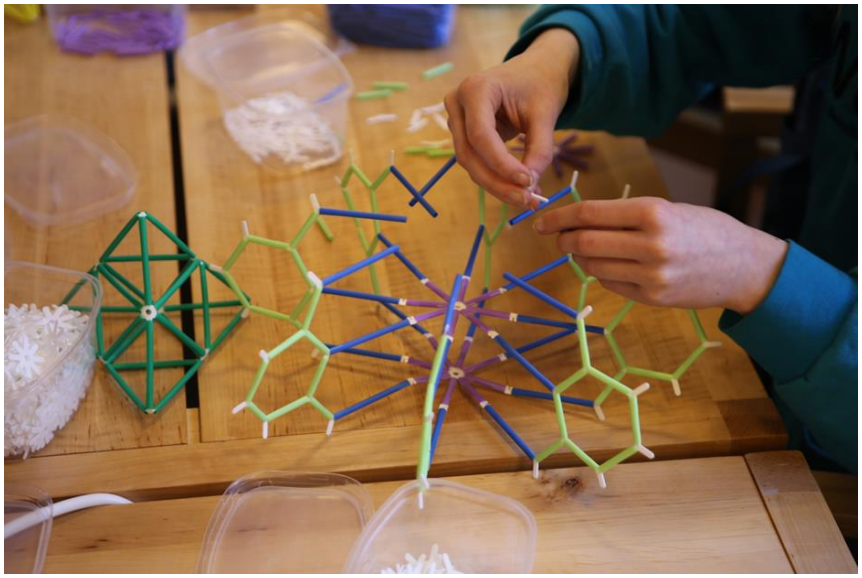
09- 4Dframe Sierpinski Tetrahedron
Let's put together a huge fractal!

10- 4Dframe "Bubbleology"
Blow some scientific bubbles and enjoy their beauty, while we are learning about the Fermat point and optimal surfaces.

3.1.2 TANGRAM: Discover the Art of Maths! Interactive exhibition and 4Dframe workshop

The **'Discover the Art of Maths!'** was an interactive exhibition in the **Soihtu Exhibition Center at University of Jyväskylä.**

The exhibition was created in co-operation with the Innovatum Science Centre and the Museum of Technology (Tekniska Museet) in Sweden, the Z(in)oo Science Centre in Latvia, the Energy Discovery Centre in Estonia, the Department of Teacher Education of the University of Helsinki in Finland, and the educational support to the 4Dframe workshops has been provided by the Experience Workshop.



The exhibition was developed in close collaboration with the Finnish KIKS team and served as an important venue for the KIKS Kick-Off events for the Viitaniemi and Palokka KIKS-schools.

3.1.3 Bridges Finland 2016 Conference's Public Day

In 2016, the KIKS-consortium member, University of Jyväskylä, Finland, hosted the Bridges Conference, the largest mathematics and art interdisciplinary conference in the world. On August 12, 2016 we have opened the gates of the ivory tower of mathematics wider than ever and **involved our KIKS partner schools to browse among the rich collection of artistic and scientific workshops and fun programs:** http://www.familyday.hu/past-events/bridges-jyvaskyla-2016/

Our goal was to offer a math-art-experience, an on-site immersion into the fun-world of mathematics and arts. The participants of the Bridges Conference, including artists, scholars and educators offered interesting community activities, games, workshops, interactive demonstrations, presentations and a mathematical expo to provide the opportunity for everybody to enjoy various activities related to the STEAM idea.

Students and teachers of the KIKS partner schools Huhtasuo and Viitaniemi and teachers from the Laukaa school have been participated in the program.

3.2 Hothousing Events in Finland

3.2.1 KIKS Kick-Off Events in Finland

Huhtasuo, Mankola, Palokka, Laukaa, and Viitaniemi schools from Central-Finland participated in KIKS project's kick-off in Finland. The kick-off programs were led by Kristóf

Fenyvesi, Markus Hähkiöniemi (University of Jyväskylä's KIKS Team) and Pirjo Häkkinen, PhD-student of science education from University of Jyväskylä. The participating students have been working on bridge designs, studied and built various constructions, like Fullerenes, nanotubes, and many more… The largest construction was a 3 meters high and 5 diameters wide geodesic dome – a structurally similar construction, which served as a wireframe basis of the world largest ice dome realized in Finland in 2014 by Arno Pronk Dutch architect and his international team (http://www.structuralice.com/pykrete-dome.html). Some of the constructions were implemented in small artistic projects as well.

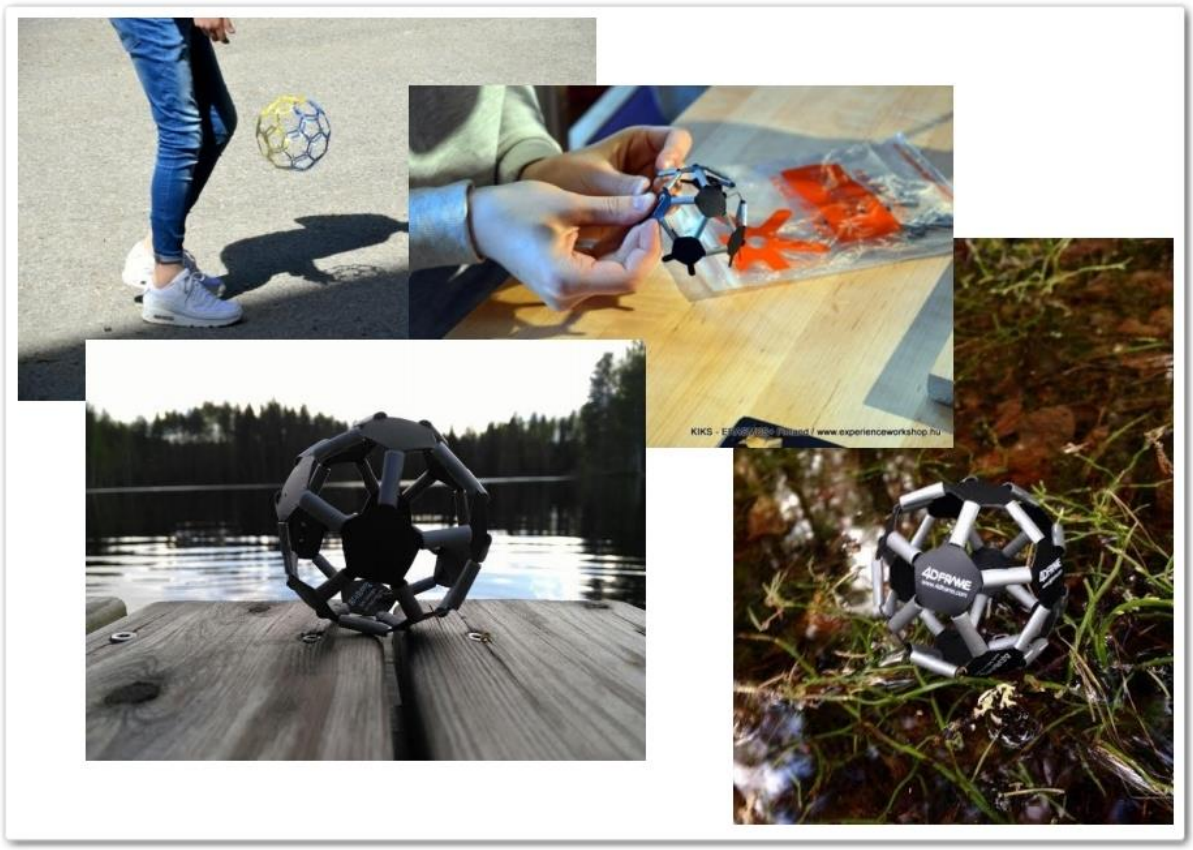
The KIKS Kick-off events have been organized on the following dates and venues:

- May 10, 2016, 18.00: Laukaa School. Program: KIKS introduction and Fullerene workshop.
- May 12, 2016, 10.35-11.25: Viitaniemi School was visiting the SOIHTU Exhibition Center. Program: Visiting the Tangram – Art of Maths Exhibit, KIKS introduction and Fullerene & nanotubes workshop.
- May 23, 2016, 10.15-11.00 Huhtasuo school was visited by Kristof Fenyvesi and Pirjo Häkkinen and they have conducted a Fullerene & nanotubes workshop.
- May 31, 2016, 11.30-14.00 Palokka School was visiting the SOIHTU Exhibition Center. Program: Visiting the Tangram – Art of Maths Exhibit, KIKS introduction and Fullerene & nanotubes workshop.

- June 1, 2016, 9-13.00 Mankola School was visited by Kristof Fenyvesi and Pirjo Häkkinen and they have conducted a giant dome, fullerene & nanotubes, and a bridge-building workshop.

Photo material on the hothousing activities:

https://www.youtube.com/watch?v=9bsSZIWZFIY



3.2.2 1st Finnish 4Dframe Challenge

THE 1ST FINNISH 4DFRAME CHALLENGE was certainly the highlight of the Bridges Finland 2016 Conference's Public Day for the participating KIKS students. The program was realized in cooperation with Korean and Nordic 4Dframe workgroup and the Experience Workshop. Participating KIKS teams' experiences just made even more special because of the personal participation of 4Dframe's inventor, Hogul Park and his wonderful team from Korea and Ms. Mariana Back, the head of Nordic 4Dframe, Sweden. We have learnt a lot from them.

2-person teams of 11-15 year-old-students could register to the challenge to solve creative challenges with the popular 4Dframe construction kit. All participants got a gift and the best teams have won valuable prizes, sponsored by 4Dframe.

Three KIKS project teams have won in different categories the main awards of the 1st Finnish 4Dframe Challenge. The students and teachers from Viitaniemi and Huhtasuo KIKS-schools have got their big packages of 4Dframe on 30 September, 2016 in the opening ceremony of the European Researchs' Night in Jyväskylä in Finland.

The Viitaniemi KIKS Team of HASEEB SHAIKH, ANDREA CARUSO and MATIAS MAHLAMÄKI created a Special Windmill and a Clockwork's Prototype.

OLIVER PELTOLA & ARTTO SARALAINEN from Huhtaso KIKS school experimented with complex mobile structures.

From Viitaniemi KIKS school, the team of SIDRA SHAIKH & EMERALD KANANEN designed a funny mobile composition about the encounter between the Alien Man and a turbine.

KIKS-students were accompanying with their teachers at the Researchers' Night: Merja Sinnemäki & Leena Kuorikoski from Viitaniemi and Ulla Koskiahde from Huhtasuo. The Chair of our jury, the researcher and teacher Pirjo Häkkinen gave the valuable prizes of 4Dframe.

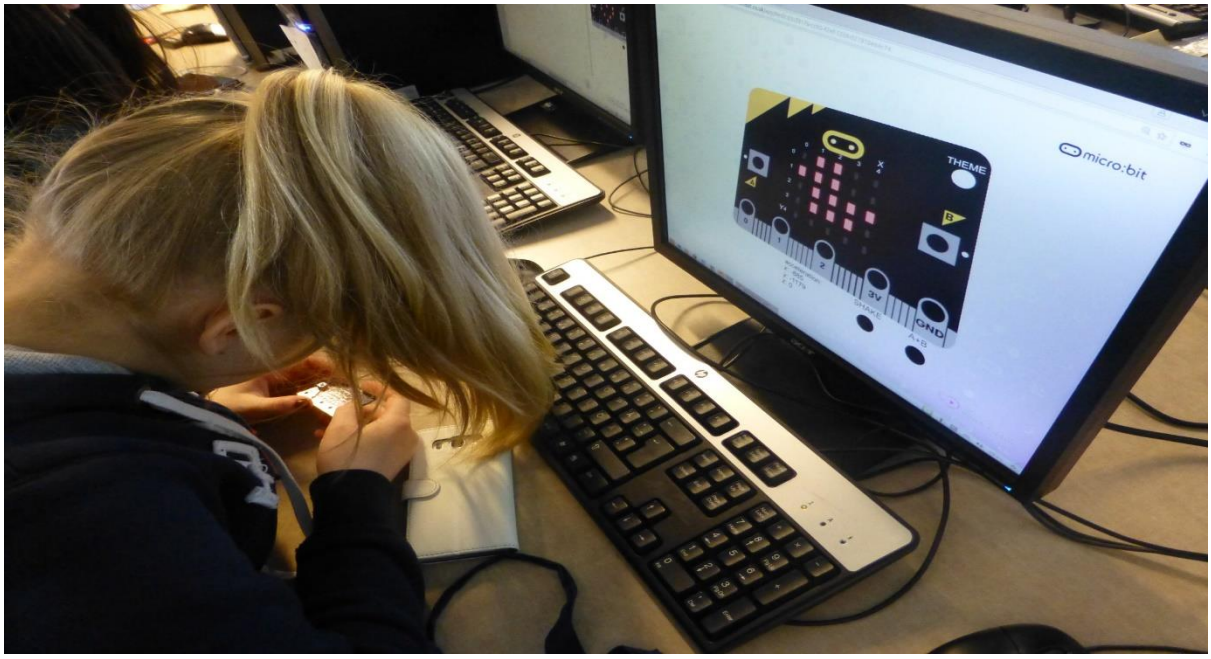
All KIKS results of the 1st Finnish 4Dframe Challenge were on exhibition in the University of Jyväskylä Museum's Soihtu Exhibition Center for a full month after the challenge.

More information on the challenge with photos:

http://www.elmenymuhely.hu/kiks-iskolak-a-szinpadon-a-bridges-vilagkonferencian-megrendezett-1-finnorszagi-4dframe-verseny-eredmenyei/?lang=en

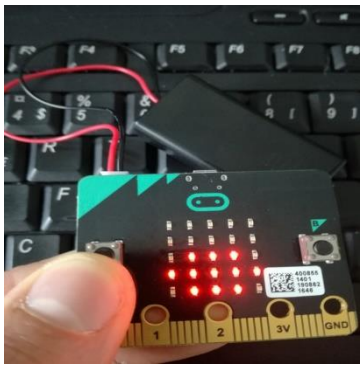
3.2.3 micro:bit Activities in Viitaniemi School and in Laukaa

Based on the UK KIKS team's contacts with BBC micro:bit Foundation, KIKS Finland got several micro:bit coding toolkits for free. Two of our KIKS schools and several other of our partner schools have started to use the toolkits with very positive results.



A student of Viitaniemi School, Jyväskylä. Finland working on micro:bit

Viitaniemi School's KIKS students started to work with micro:bit in March 2017. It was a real Kids-Inspiring-Kids experience as Jyväskylä Christian School students, who has already a lot of experience with micro:bit, have introduced the tool in action to the Viitaniemi students. That was a fun way to get started and soon the students of Viitaniemi School were able to create different images and texts by coding. Once the students got the idea, they were able to create more advanced things e.g. little games. In April 2017 Viitaniemi School had an open public day in which the parents and the school neighbourhood were invited. The Viitaniemi School students had their own micro:bit session where they were introducing the micro:bit to the visiting parents and children and the visitors also got an opportunity to try the coding with micro:bit.



In May 2017 Laukaa School students tried coding with micro:bit. Students started programming with small examples, which were represented on the micro:bit's website in English. Every group of students first made a program and then tried to implement that example into Finnish. The collaboration between the students has implemented Google Docs, so the students practised using Google tools at the same time. These examples were quite easy for the pupils and it was nice to see how they managed to do those practices. After seven examples the pupils tried to come up with their own ideas or find some other ideas from the Internet. When they found something useful they tried to make it. Many groups found nice ideas, but not so many managed to come up with an idea of their own. However, pupils were quite motivated to code with micro:bit and it was also fun. They have described their experiences with the

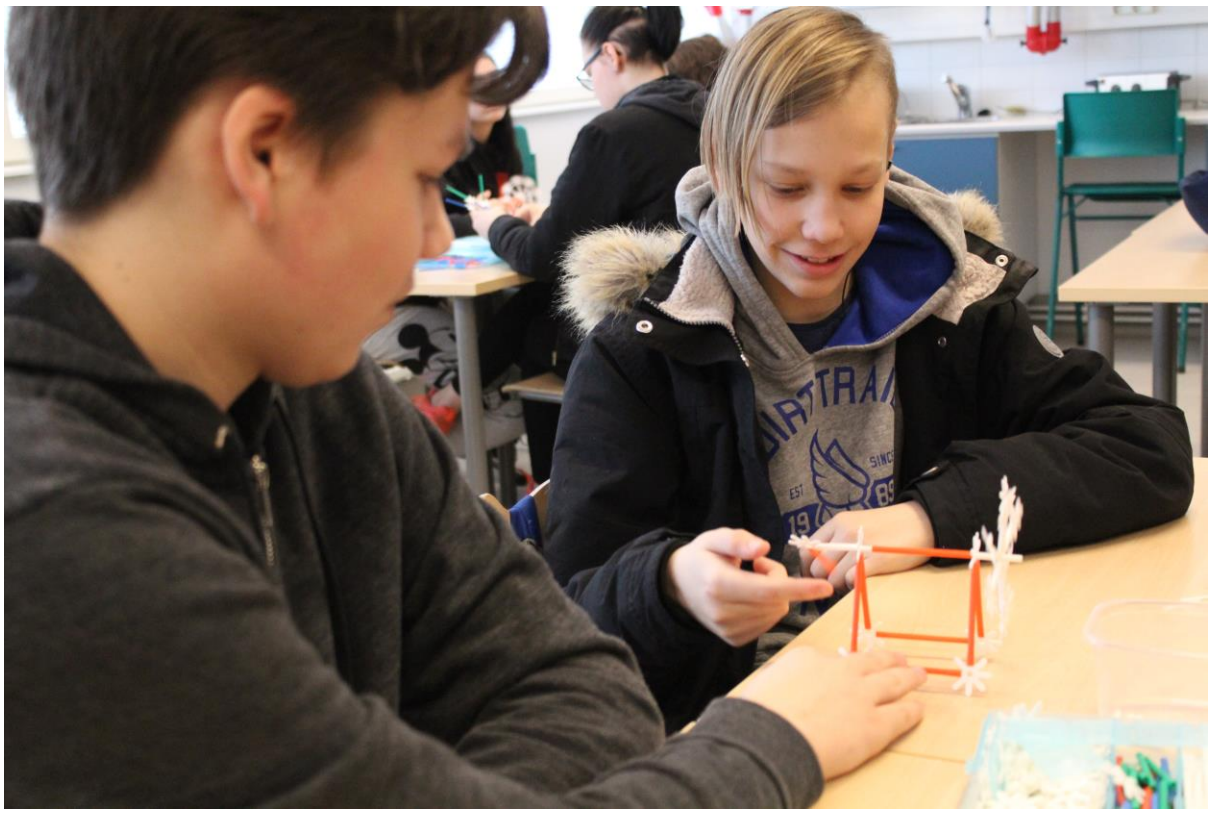
following words: “This is cool!” / “It is nice to see some real tool is responding to my code!” / “Where can I buy these?”

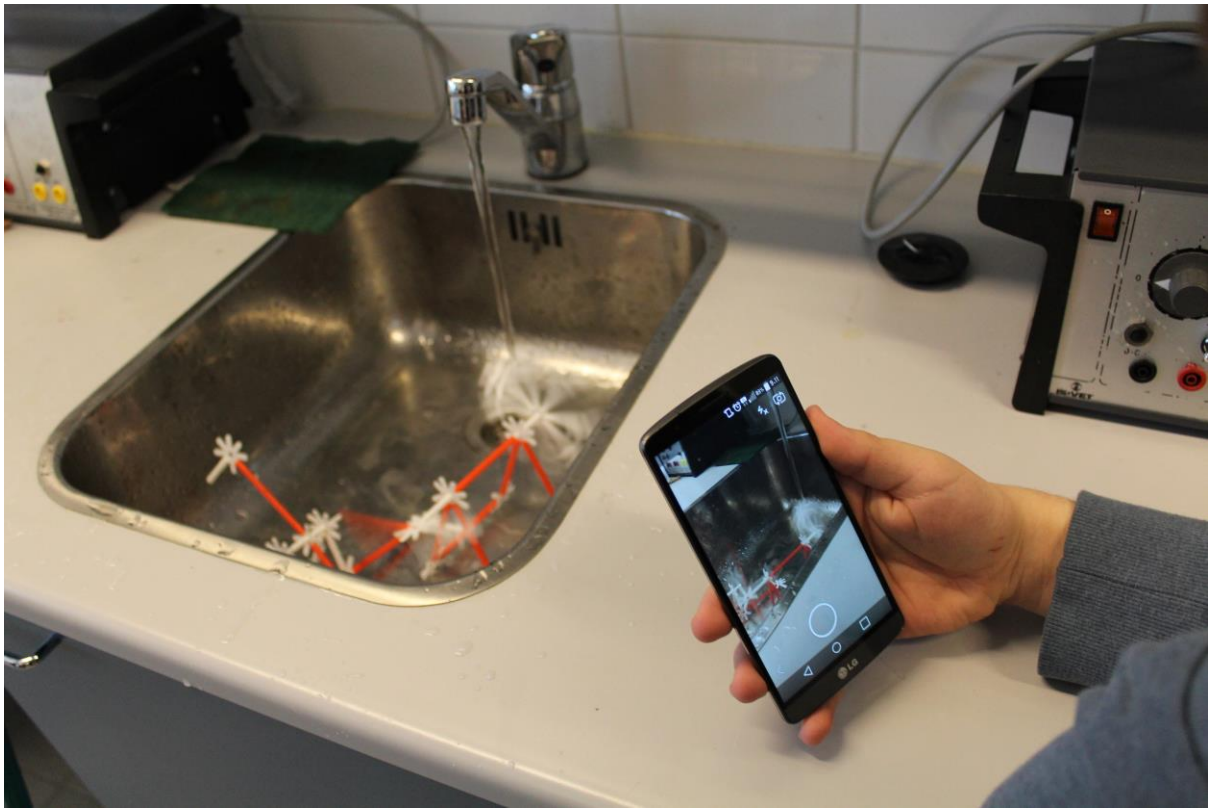
Micro:bit was also among the main highlights of the program of our closing **Multiplier Event of the KIDS INSPIRING KIDS IN STEAM Erasmus+ project in Finland**. On **September 29, 2017,** in the framework of the **European Researchers’ Night, Zach Shelby, Micro:bit Education Foundation’s CEO** has met and worked together with the micro:bit programmer children of the Finnish KIKS project and his talk was also included in the KIKS Multiplier Session for professionals on the same day. Please find more information and images related to this event in **Chapter 6.2.1 KIKS Closing Multiplier Event in Finland.**

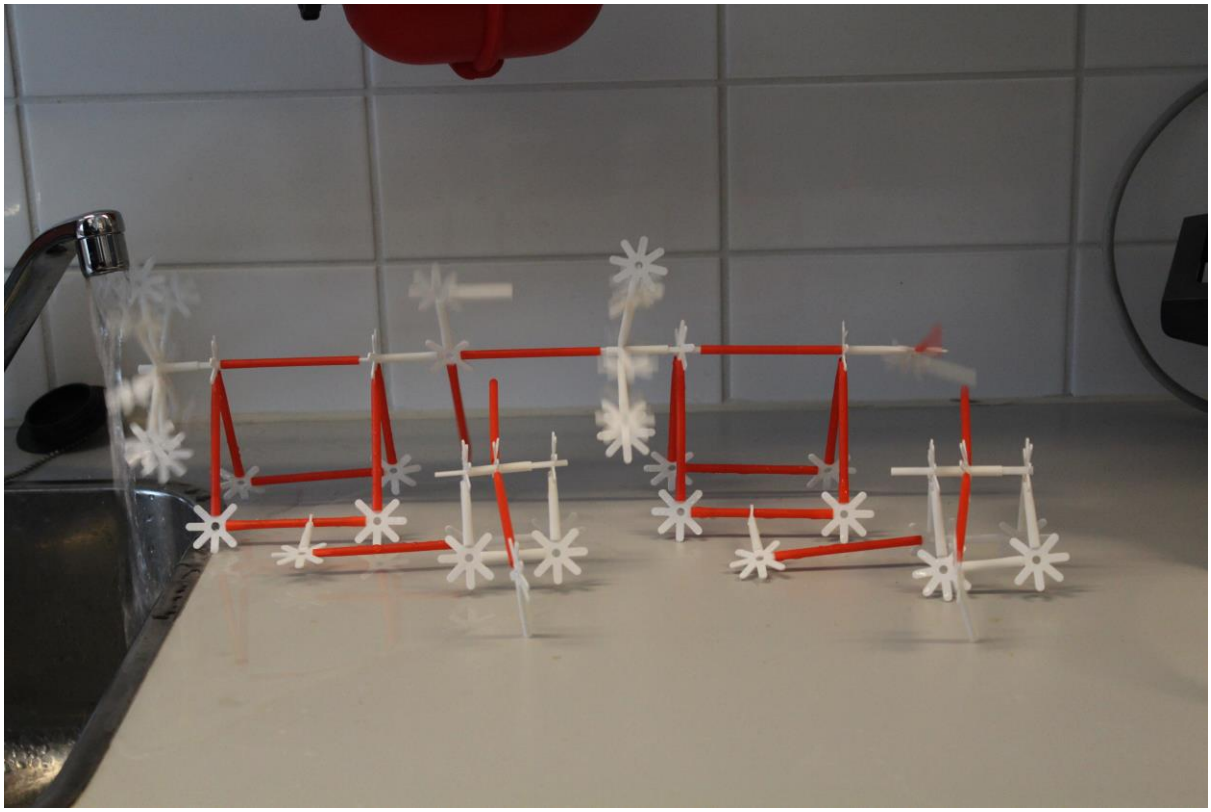
3.2.4 UN’s World Water Day in Laukaa School

On United Nations World Water Day, March 22 and March 23, 2017, several KIKS workshops took place in the Laukaa School to prepare the school’s upcoming thematic ‘Water Week’. **4Dframe Warka Water** and **4Dframe Wind & Water Power** workshops have been organized to the school’s students to develop water & environmental awareness in the STEAM context. More than 100 students took part in the program, including the school’s KIKS team members.

Photos of the activity:





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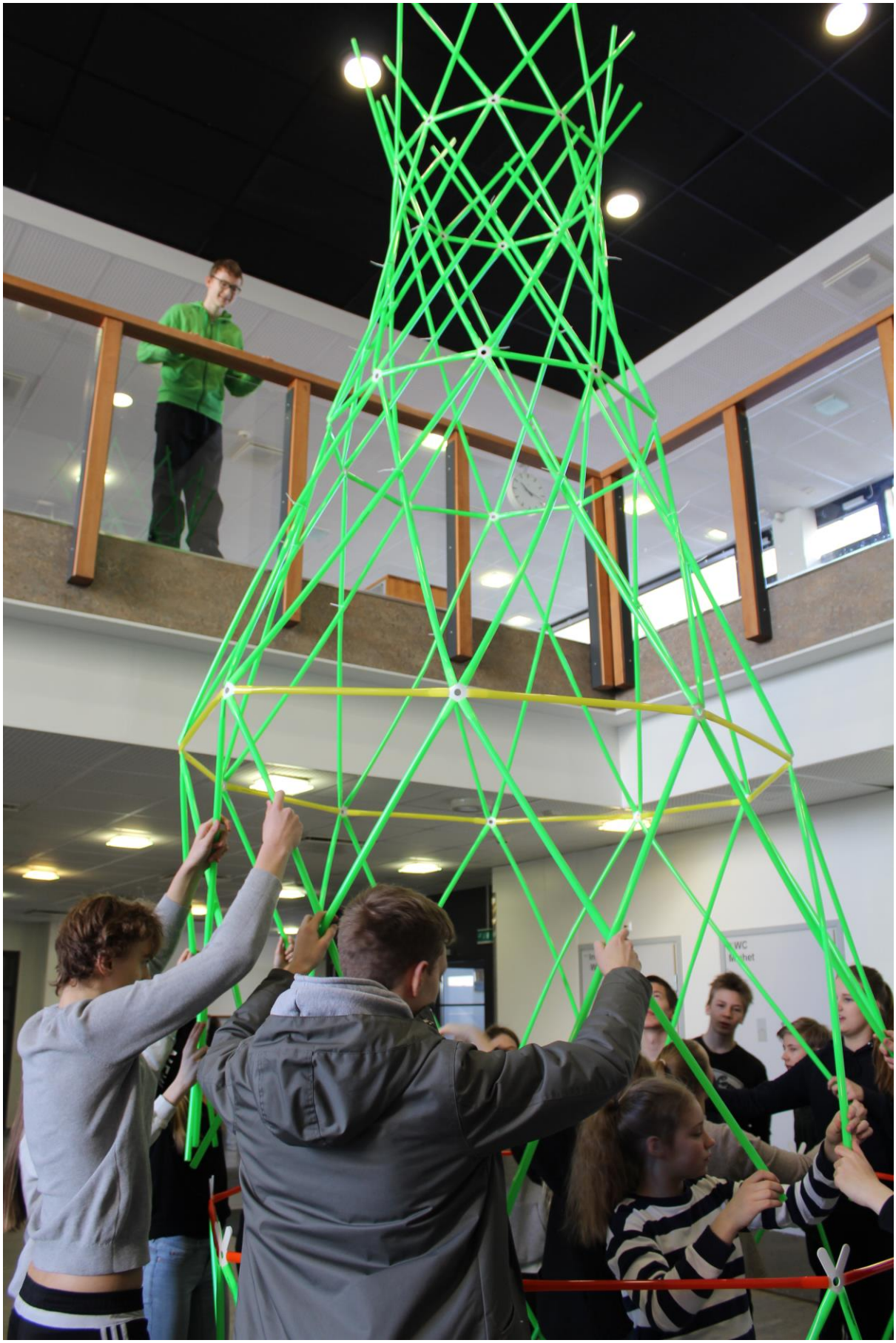


3.2.5 TeenTech Awards, UK

Based on the UK team's contacts that has been established with the **TeenTech Awards, UK** (http://www.teentech.com/teentech-awards/) and the Skype discussions with the TeenTech award winner Lauren Shea, in the framework KIKS International Challenge, students of Viitaniemi school formed 2 groups and entered into TeenTech Awards from Finland. One of the 2 groups have made it into the finals and have been invited to London.

Merja Sinnemäki, KIKS teacher from Viitaniemi, announces the invitation of the Viitaniemi team to the Teentech Awards.

4 Local Challenges

Local team activities were based by posing an open-ended complex challenge to the students asking them: ***"How would you get YOUR SCHOOLMATE to get interested to learn about a phenomenon or a topic in STEAM?"*** In the phase of local team activities of the project, local student teams were working on planning and realizing their own STEAM-popularization projects to involve their own class- and schoolmates into their local project and into KIKS' on-line community (https://www.facebook.com/groups/KidsInSTEM/ ; http://www.kiks.unican.es/en/). The working language of the groups in local communication was usually Finnish, but in international communication, it was always English. KIKS Researchers and teachers were working as "coaches" to help the local groups' work.

During April-May 2016, KIKS project's local coordinators contacted the schools and local groups were formed in all participating countries. Many of the local groups' members and their teachers have entered the closed **KIKS Facebook Group** (https://www.facebook.com/groups/817572248375180/). The **KIKS Facebook Group** has currently more than 120 members and it was the main platform of on-line work throughout the project. Team-members, teachers and local KIKS-coordinators were encouraged time by time to post regularly in the KIKS Facebook-group about their progress in their own STEAM inspiration project. Most of the individual posts and comments on each other's post related to STEAM were made by the teachers and international KIKS-project members.

Until the end of 2016 May, local groups have posted at least once in the KIKS Facebook Group to introduce their group and their school. Most of the Facebook-posts were short videos, in which (1) the group-members told who they are, (2) where they are studying, (3) what do they find interesting about STEAM, and (4) what kind of KIKS project they have in their mind or what are their expectations about the KIKS project. These videos can be accessed on KIKS-project's YouTube-channel: https://www.youtube.com/channel/UCwZk4KpeHtJOUg5LtugyVaw

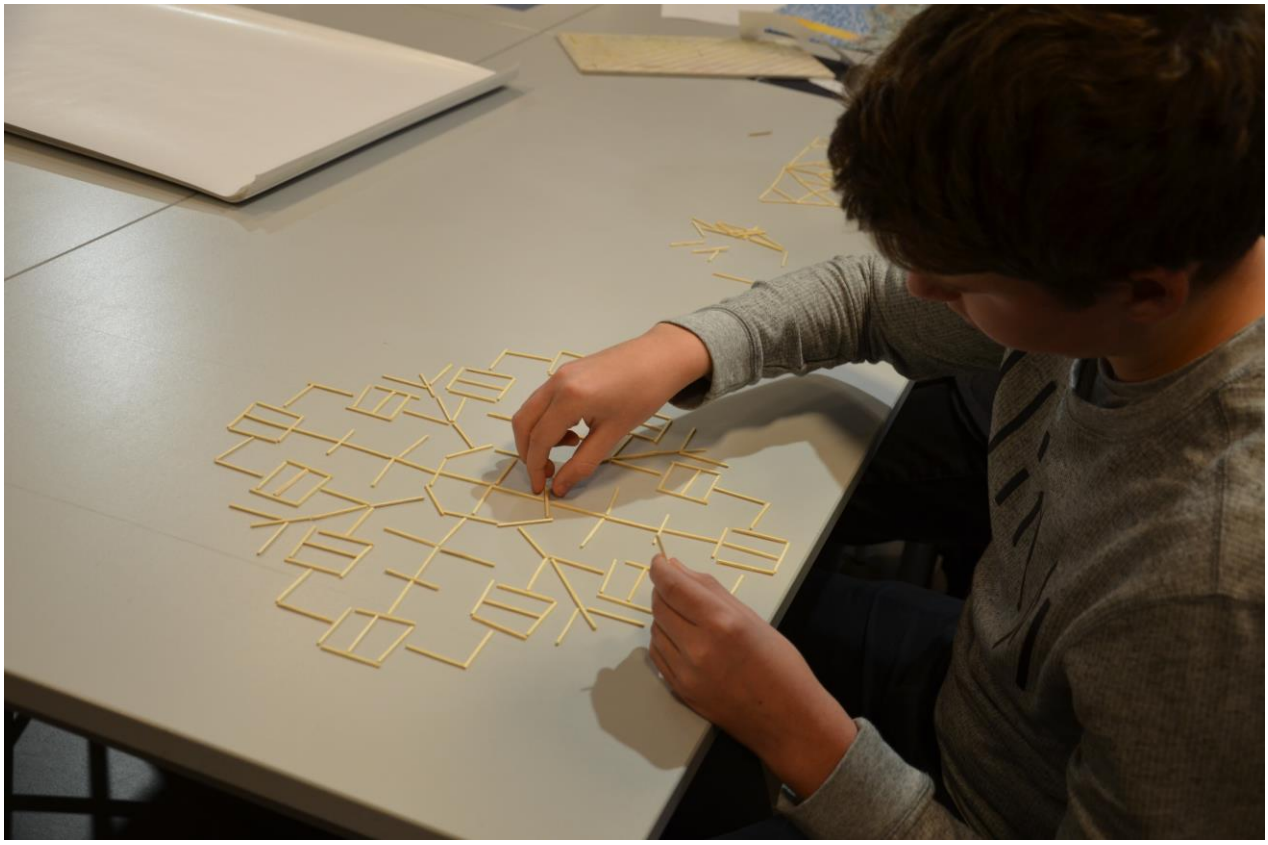
Between September 2016 – 2017 February, teams have worked on their project about making their school and local environment inspired about STEAM. All teams have prepared and published on the KIKS-website their e-portfolio, which documented their work (see Developed Activities on http://www.kiks.unican.es/en/). Many of the e-portfolios contains several kind of on-line material – like a short video, a photo-album, and textual summaries –, which serves as an introduction of the local project.

Starting from November 2016 each local team shared their full e-portfolio, which documented their STEAM inspiration project and local teams. They have collected likes and comments in the KIKS Facebook group too. Each local team was expected to invite their peers, teachers and members of their local community to see and give a "like" to their and to other groups' e-portfolio. All e-portfolios were collected and re-presented on KIKS-project's homepage as well. During this process, 5 local activities have been developed by the Finnish KIKS teams.

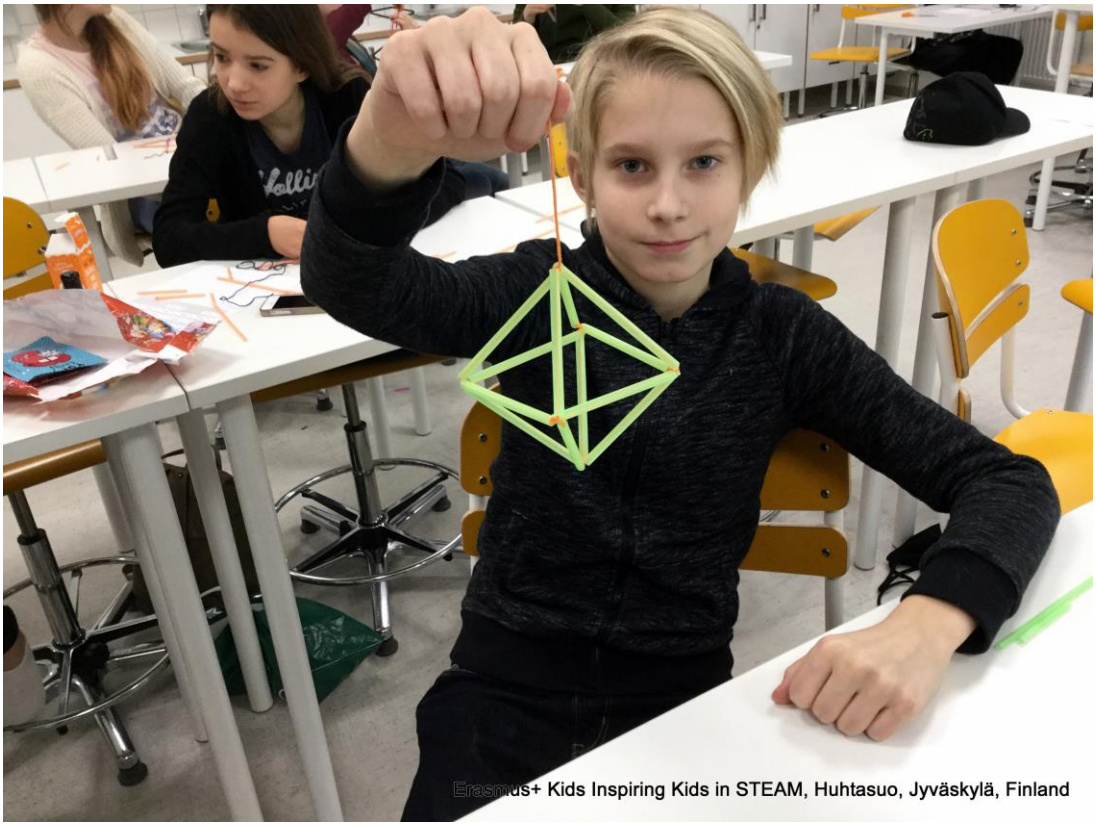
4.1 Science as an artistic tool! Local KIKS projects from Finland

Finnish KIKS teams have mostly concentrated to find ways in implementing scientific research and methods in artistic projects with various STEAM learning opportunities. Creating visual effects, such as colorful shadows in a theater performance; extending artistic methods by algorithmic thinking; discovering geometrical properties of traditional Finnish Christmas decoration art, called Himmeli; designing funny geometrical hats; or making an interesting video and artistic photograph, which is based on a scientific experiment in thermodynamics, were all unique ways to go beyond learning subjects and to make new connections between subjects of learning and between the learners in the KIKS spirit.

Physics of Shadow Theater: The Pig "Number Six" theater play is written, directed and realized by the KIKS-students of Laukaa School, Finland. A whole class of 7th graders were participating in the KIKS-team and they all were involved in the creation of the play. To explore visual illusions and the physics of shadow theater, KIKS-team made a scientific research concerning the development of visual effects, which they have implemented in the play. University of Jyväskylä physics education PhD-student, Antti Lehtinen has helped the group's scientific research. Kristóf Fenyvesi, University of Jyväskylä's KIKS-coordinator has inspired the KIKS-team from cultural and artistic aspects. Theater director, Kirsi Sulonen from Laukaa was also helping with making the play ready. The team's teacher, Mirka Havinga has facilitated the whole project.



Systems in Art: Students of Palokka School, Jyväskylä, Finland have experimented to create artworks based on algorithmic thinking, systematic actions and various constraints. As an inspiration, art teacher Jarmo Laaksonen introduced scientific and artistic approaches to structures, logic, systems and processes. Students got familiar e.g. with the Finnish artist Matti Kujasalo´s art and the Hungarian-French artist, Victor Vasarely´s artworks and then created their own artistic systems and systematic art pieces on the way as playing logical games. Pirjo Häkkinen and Kristóf Fenyvesi researchers have supported the project.



Geometry for Christmas in Finland: the himmeli, a traditional Finnish Christmas decoration made from specially selected and prepared straw in an octahedron, an eight-sided polyhedron. Just before the winter holiday, Huhtasuo School, Jyväskylä, Finland have organized an ethnomathematical himmeli making workshop. When the KIKS-students were ready with the himmeli modules, they have decorated their scientific Christmas tree with the himmelis. Ulla Koskiahde and Mari Itkonen teacher, Pirjo Häkkinen and Kristóf Fenyvesi researchers have supported the project.

Scientific Halloween: how geometrical shapes can be turned into geometrical Halloween hats? Take a look into Viitaniemi School KIKS group´s project from Jyväskylä, Finland. The students wanted to practice the Pythagorean theorem on a different way, so they have organized a geometrical Halloween hat party for other students in their school. It was fun! Merja Sinnemäki, Leena Kuorikoski teachers and Kristóf Fenyvesi researcher have supported the project.

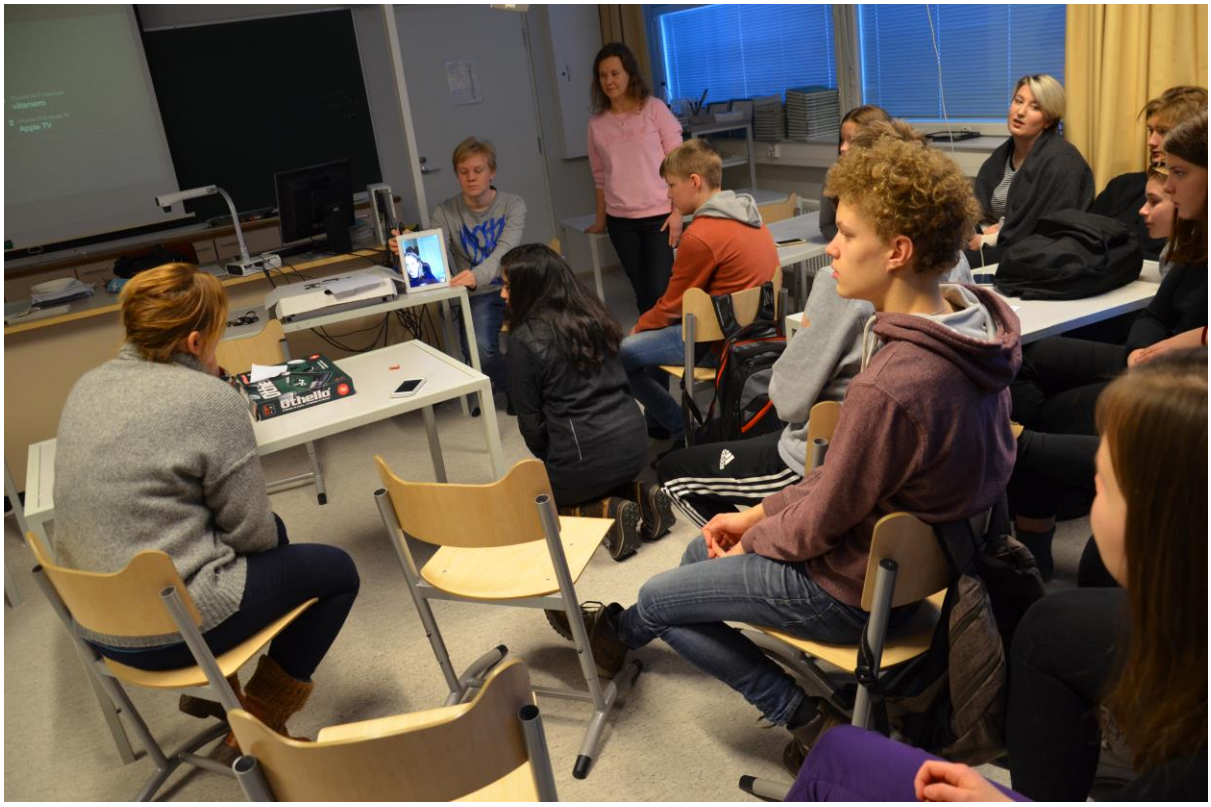
Frozen "STEAM-STORM" FROM FINLAND: Mankola school´s students with the support of their teacher Tapani Aaltonen made a physics experiment, in which they threw boiling water in to the air. As in the Finnish winter conditions it was -20°C, cold enough, the water evaporated in midair and created this beautiful pattern. Researchers Pirjo Häkkinen and Kristóf Fenyvesi have supported this project.

5 International Collaboration

KIKS project's integral part was international collaboration between the students of the participating countries to get familiar with each other and learn from each other's projects. Laukaa School and Viitaniemi School's students, almost 50 KIKS participants took part from Finland in the international collaborations.

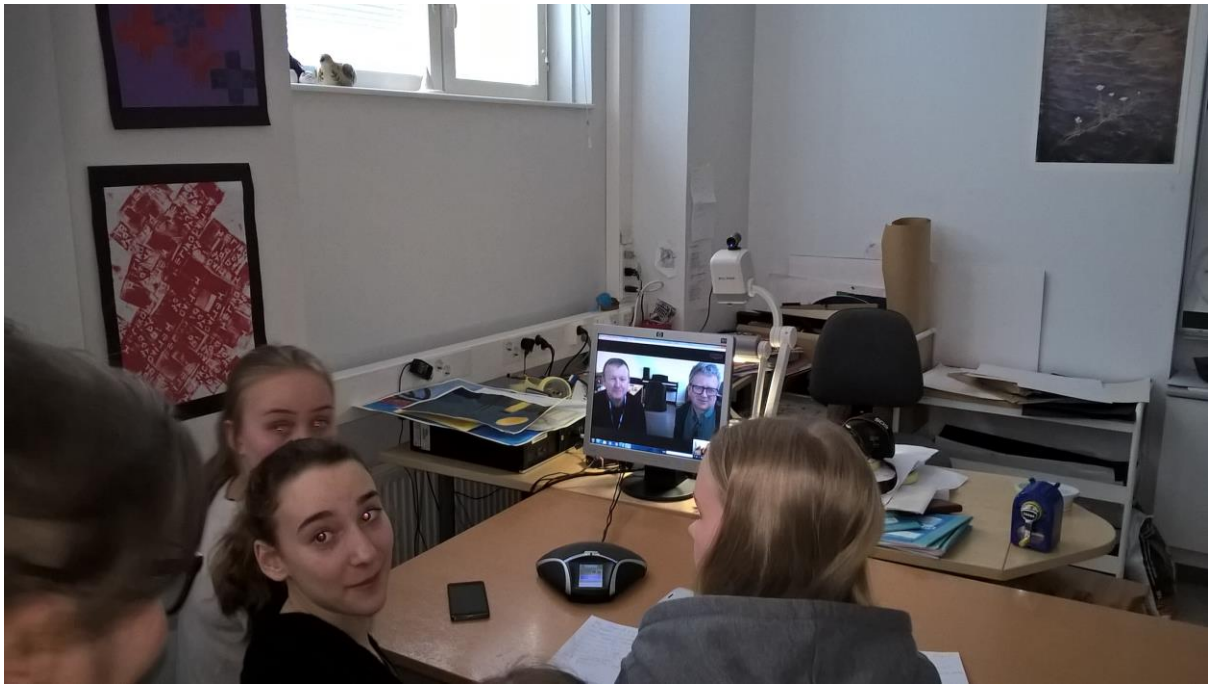
The first on-line discussion has been taken place between the Viitaniemi KIKS group and Lauren Shea, Arkwright Scholar / TeenTech Ambassador / A-level Student, Alton Convent School, who has been participated in the UK KIKS team as a student mentor. Lauren has told about her TeenTech Award project on rocket engineering and Viitaniemi students have introduced their KIKS project on connecting geometry and art. Lauren and the Viitaniemi students have agreed in further meetings, when they have posed some questions to each other and a collaborative problem-solving process has been started with regular on-line meetings. Lauren made a great impression on the Finnish students and many of them has

decided to participate in the TeenTech Award Competition. As a result of this, a TeenTech team from Viitaniemi, Finland has been also invited to the TeenTech finals in the UK.



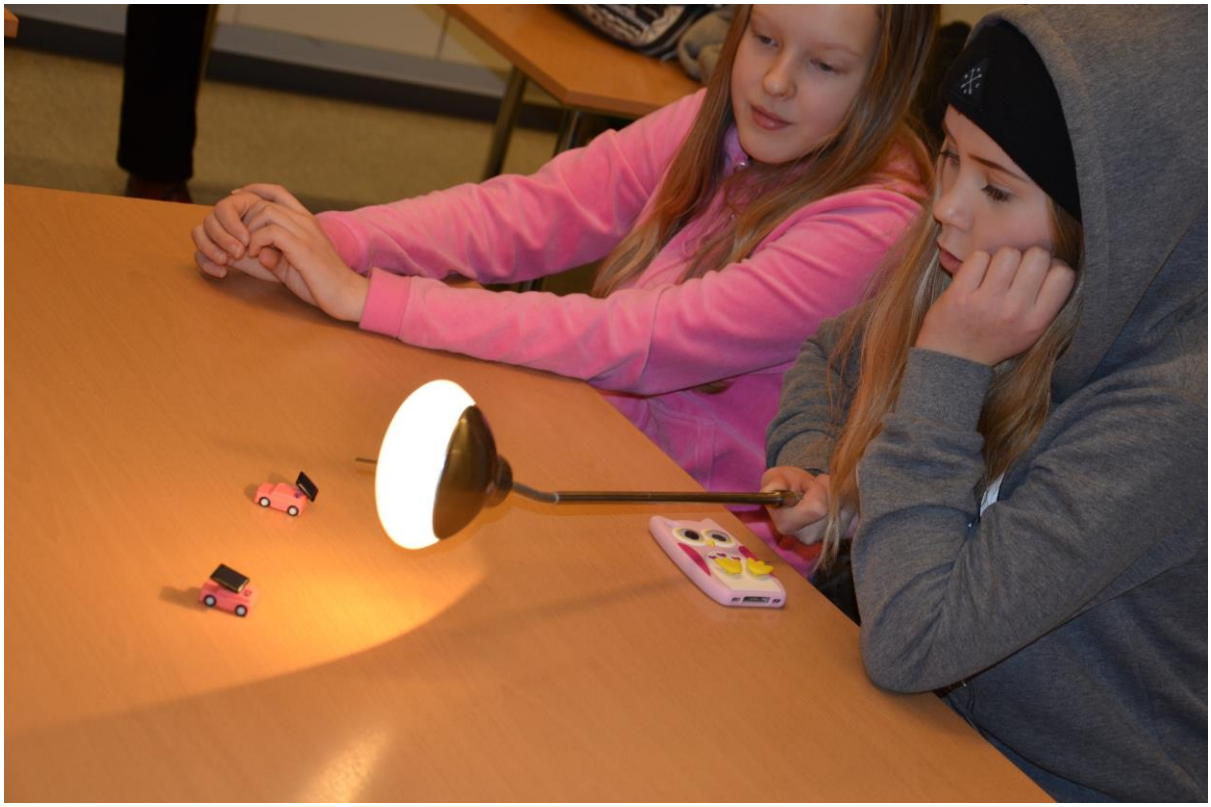
20 December, 2017: Viitaniemi KIKS students are discussing with Lauren Shea, Arkwright Scholar/TeenTech Ambassador/A-level Student, Alton Convent School

In 2017 February, a series of on-line conference calls have been started with an on-line discussion with UK KIKS researcher Tony Houghton and UK KIKS teacher, Mike Challis. The UK KIKS members have introduced students of Mike Challis' KIKS projects to the KIKS team of Laukaa School. Laukaa KIKS team have also introduced their KIKS project and telling about their KIKS experiences to the UK KIKS team. The on-line discussion with the UK KIKS team was a great experience for the Finnish students, as most of them have never interacted with native English speakers before and they found UK KIKS projects very interesting. Houghton and Challis have commented Laukaa School's KIKS project on scientific shadow theater in details and there were many questions to each other during the discussion.



February 2017: Laukaa students are discussing on-line with UK KIKS researcher Tony Houghton and UK KIKS teacher, Mike Challis

Several on-line video conferences have been taken place between Laukaa KIKS groups and various Spanish KIKS groups. A Spanish KIKS team have sent solar cars to the Laukaa KIKS students to carry out some experiments on determining the Finnish team's geographical location based on various measurements of sunrays' angles. Funnily, the Finnish KIKS students were unable to perform the experiment, because the Nordic sunlight in the beginning of March still was not strong enough to make the solar cars running. Nevertheless, the Finnish group have tested the solar cars with artificial light and have learnt about the physics of solar energy with the help of the solar cars.



2 March, 2017: Unsuccessful solar car experiments in Laukaa with the gift of the Spanish KIKS students.

Finnish KIKS students from Laukaa, as an exchange for the solar cars, also have sent to Spain some packages of a 4Dframe, a geometric toolkit, which they have been used to build truncated icosahedra, the 3D models of the Buckminsterfullerene. The Spanish students have put together these models in a collaborative problem-solving process and made a research on the role of the truncated icosahedral shape in mathematics, chemistry, art and real life. The Finnish students were impressed by the impact of their gift on the Spanish students.

Another Spanish KIKS team have been shared their research and findings on the geometry of arches, which they have been explored in their city, Pontevedras (http://www.kiks.unican.es/en/arcos-de-medio-punto/). The project was especially interesting for the Laukaa KIKS team, because the differences between Spanish and Finnish urban architecture and the interesting physics and mathematics problems integrated in the Spanish project. The Spanish and the Finnish students have set problems to be solved to each other in connection with their KIKS project contents.

5.1 Lessons learnt

There was a great interest in the teams, which were participating in the international discussions to get into dialogue and develop international contacts. In addition to questions related to the KIKS project, students were interested about student life in each other's country. The discussion was a great way to Finnish students to develop their communication skills and practice English. After the first moments of shyness, real discussions have evolved and real exchanges have been happened.

6 Impact and Dissemination

6.1 High Visibility Events

6.1.1 Helsinki STEAM Symposium

As a follow-up program of the world largest mathematics & art community's congress, the Bridges at the University of Jyväskylä, the Finnish KIKS team has organized an international STEAM symposium in the Hungarian Center for Science and Art in Helsinki. The program was combined with the KIKS Management Meeting in Finland, therefore all KIKS-member country could participate and held a presentation at the event in a special session concentrated exclusively on the KIKS project.

The event had the following program:

15 August, 2017

2.00-2.10 Opening: Gábor Richly (Counsellor of Hungarian Cultural and Scientific Centre Helsinki), Kristóf Fenyvesi (researcher of STEAM education, University of Jyväskylä)

2.10-3.10 STEAM Histories. Chair: Osmo Pekonen (historian of science, University of Jyväskylä)
Panelists: Johan Stén, Manfred Stern, Osmo Pekonen

3.10-3.20 Discussion

3.20-3.30 Break

3.30-4.00 Kids Inspiring Kids in STEAM - Erasmus+ panel. Chair: Zsolt Lavicza (director of STEM Center, Johannes Kepler University, Linz)
Panelists: Tony Houghton (STEM Team East, UK), José Manuel Diego Mantecon (University of Cantabria), Zsolt Lavicza (JKU)

4.00-4.40 STEAM Education Research panel. Chair: Heikki Ruismäki (Professor of Arts and Skills Education; Vice Dean, University of Helsinki)
Panelists: Hannu Salmi (University of Helsinki), Helena Thuneberg (University of Helsinki)

4.40-4.50 Discussion. Chair: Kauko Komulainen (Senior Lecturer, University of Helsinki, Dept. of Teacher Education)

4.50-5.00 Break

5.00-5.30 Art of STEAM. Chair: Jouko Koskinen (architect, futures director emeritus in Heureka, the Finnish Science Centre)
Antal Kelle: Theory and Practice.

5.30-6.00 Closing Discussion. Chairs: Kristóf Fenyvesi (JYU) & Hannu Salmi (UH)

6.00 Antal Kelle - Personal Abstractions. Exhibition Opening by Marjorie Senechal (Smith College - Mathematical Intelligencer) and reception

6.1.2 Math-Art Workshop by the Finnish KIKS teachers in University of Cambridge's Primary School, UK

In the framework of the KIKS Management Meeting in the UK, a workshop has been organized for 1st graders in the University of Cambridge's Primary School, UK. The workshop has been facilitated by Finnish KIKS teachers and has been many connections with the Finnish KIKS Hothousing topics.

20 March, 2017: UK primary school teacher, Robert Drane, and members of the Finnish KIKS Team Leena Kuorikoski, Mirka Havinga, Merja Sinnemäki, Kristóf Fenyvesi (from left to right) in their workshop at the Cambridge Primary School.

20 March, 2017: Member of the Finnish KIKS Team, Leena Kuorikoski at the Finnish KIKS teachers' math-art workshop in the Cambridge Primary School.

20 March, 2017: Member of the Finnish KIKS Team, Merja Sinnemäki at the Finnish KIKS teachers' math-art workshop in the Cambridge Primary School.

20 March, 2017: Members of the Finnish KIKS Team, Leena Kuorikoski and Merja Sinnemäki at the Finnish KIKS teachers' math-art workshop in the Cambridge Primary School.

20 March, 2017: Member of the Finnish KIKS Team, Mirka Havinga at the Finnish KIKS teachers' math-art workshop in the Cambridge Primary School

6.1.3 Finnish KIKS Teachers in Cambridge and Cambridge Mathematics in Finland

Finnish KIKS teachers have participated in the meeting organized by the UK KIKS team in the Raspberry PI Foundation in March 2017.

On 27 April, 2017 the Finnish KIKS teachers have joined to the Mathematics Education Research Kaleidoscope conference, organized jointly by the University of Jyväskylä KIKS Team and the Cambridge Mathematics, UK. The KIKS teachers have introduced the project and their school activities in a full session in the program of the conference. More information: http://www.elmenymuhely.hu/education-sensual-mathematics-cambridge-mathematics-is-hosted-in-finland-by-experience-workshop/?lang=en

6.1.4 A delegation from Eszterházy University, Eger, Hungary visits the Finnish KIKS Teachers in Viitaniemi

An official delegation from Eszterházy University, Eger, Hungary, including the Rector, Dr. Kálmán Liptai has visited University of Jyväskylä in May, 2017. The Hungarian delegation introduced and discussed the Complex Basic Program (aka 'KOALA'), a project from Eszterházy University for the comprehensive methodological reform of the Hungarian education system. Members of Eszterházy University's delegation have met with several important researchers and partners of University of Jyväskylä, including teachers and students of the Kids Inspiring Kids in STEAM project from the Viitaniemi School to discuss innovative elements of the KIKS project from the aspect of the Hungarian KOALA plans. More information on the meeting:

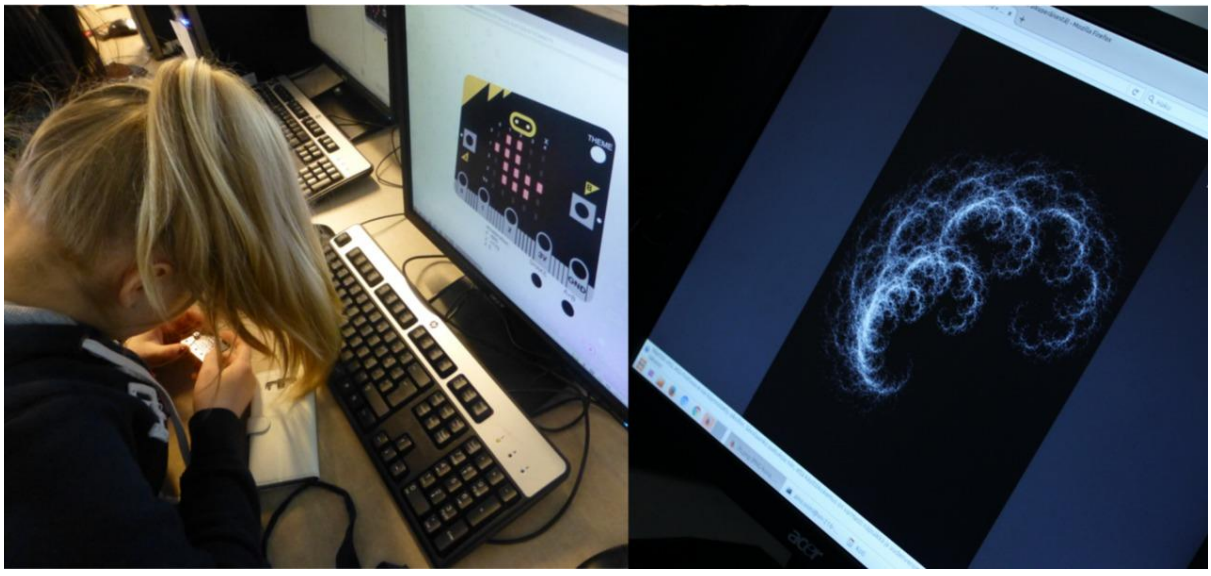
http://www.elmenymuhely.hu/eger-university-from-hungary-visits-university-of-jyvaskyla-and-experience-workshop-in-finland/?lang=en

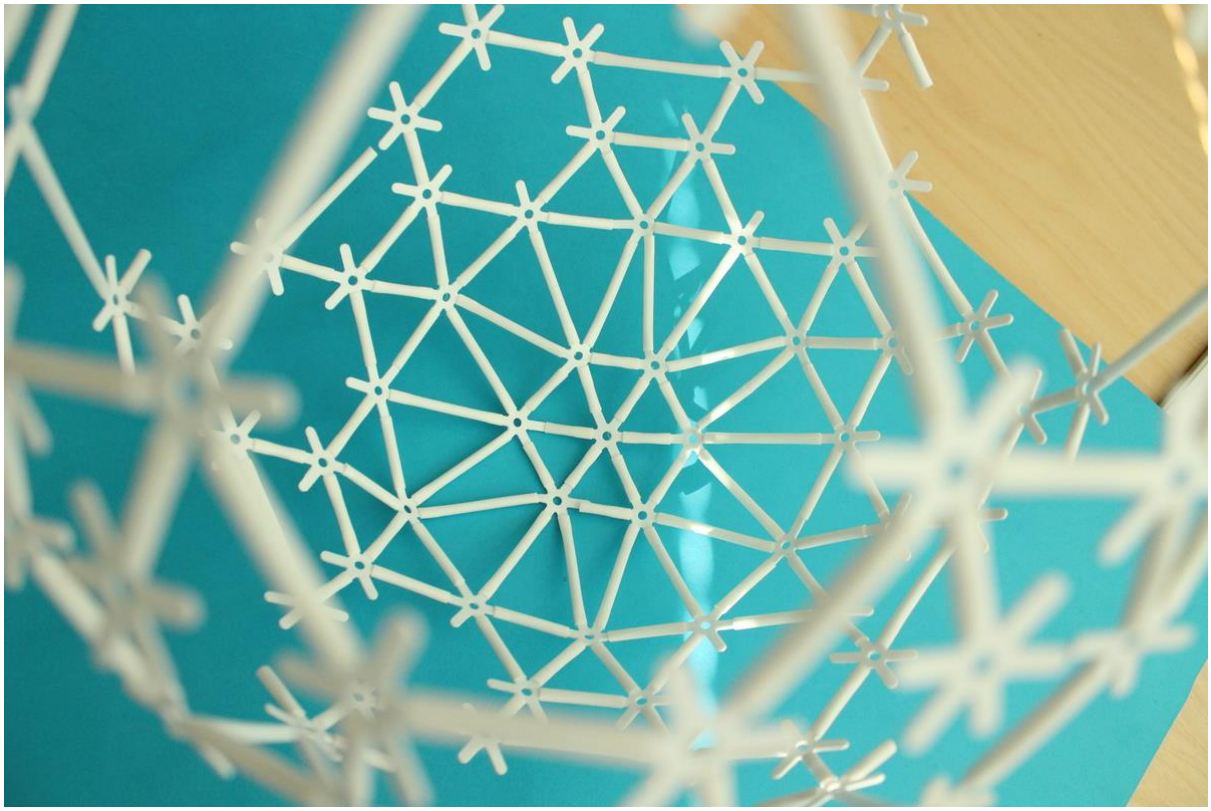
6.1.5 Jyväskylä Christian School

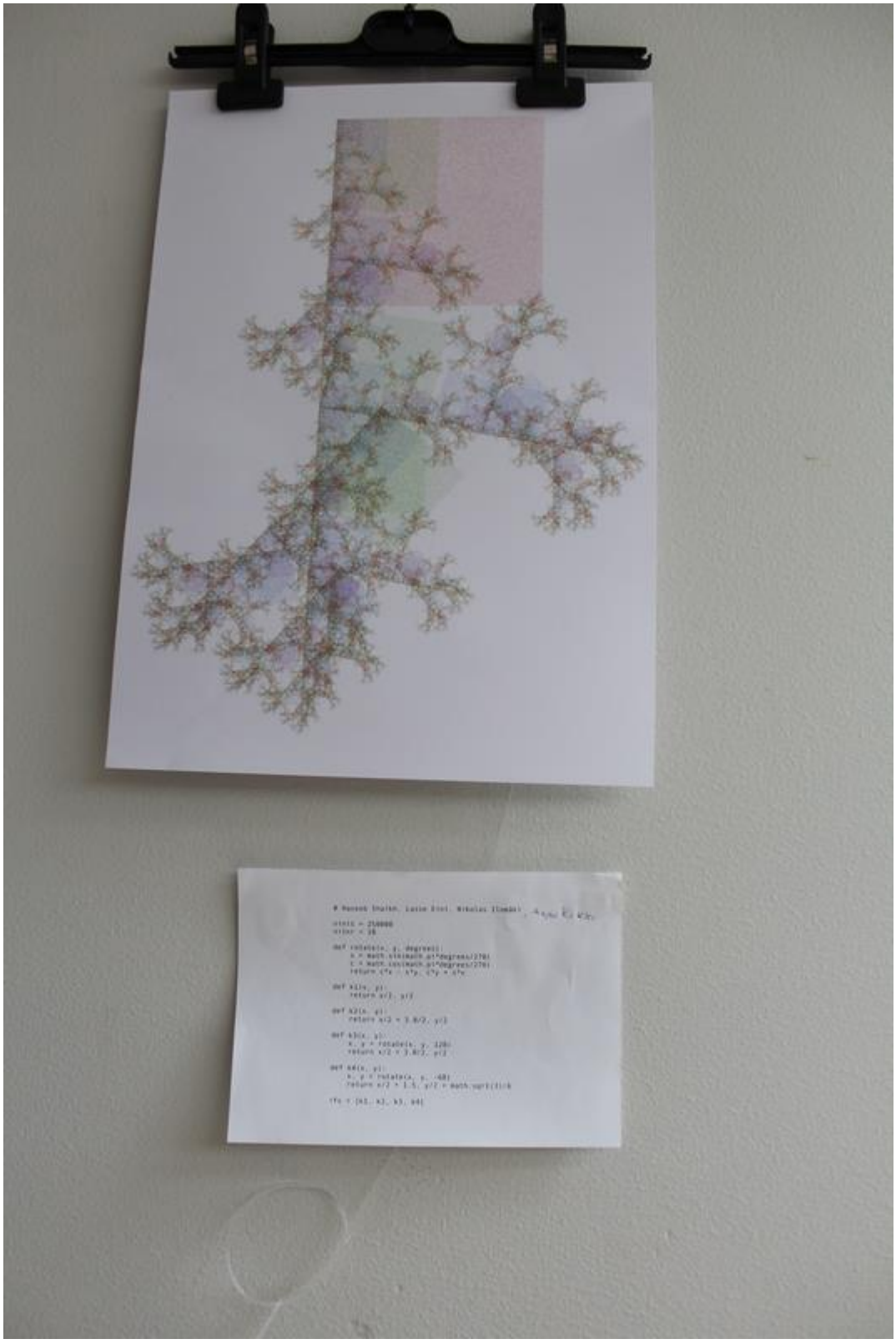
During the KIKS project in Finland, fruitful cooperation has been emerged between the KIKS project and the Jyväskylä Christian School, which is supporting similar methodological approaches that has been characteristic to the KIKS project as well, including the STEAM framework. During the KIKS project several joint events have been organized with the Jyväskylä Christian School, which have opened ways to implement KIKS results also in primary education context.

6.1.6 Math-Art-Learning Festival with Exhibit of Algorithmic Artworks created by the students and several workshops in Viitaniemi School

Viitaniemi School was very proactive during the whole KIKS-project. On the basis of the combination between art & science and connections they have collected during the KIKS project, the Viitaniemi School has organized a math-art festival by inviting the fractal artist, Risto Paju in their school, who has led workshops for the students. As a result of these workshops, students created fractal artworks. In addition to Risto Paju's workshop, workshop presenters from Jyväskylä Christian School – including students have offered micro:bit activities for the participating students.







Full program:

https://peda.net/jyvaskyla/viitaniemenkoulu/monoryhm%C3%A4t/ifoaas

6.2. Dissemination

6.2.1 KIKS Closing Multiplier Event in Finland

The **Finnish KIKS Team's Closing Multiplier Event was held on September 29, 2017**, in the framework of the **University of Jyväskylä's European Researchers' Night** program. The event had two main parts. The first part was primarily addressing children and their teachers and offered opportunities to the Finnish KIKS Teams to provide inspiration to students and

teachers from schools, which have not participated in the KIKS program. The second part was addressing mainly professionals and academic people, who became interested in KIKS-methodology and our project's technology-related contents, such as the micro:bit.

In the first part of the KIKS Multiplier Event, the Finnish KIKS Teams met with children from non-KIKS schools and run workshops for them. These workshops were based on the projects which they have developed in the KIKS program. During the workshops the students were discussing with each other and the KIKS students not only provided inspiration for learning to other students, but also got direct feedback from other children to their work.

In addition to the experience of running programs to previously not known children, our KIKS students could enjoy the personal meeting and conversation with the international guest of our event, **Micro:bit Education Foundation's CEO, Zach Shelby**, who has also worked together with the KIKS children in the KIKS Multiplier Event on micro:bit related projects.

Risto Paju, Jyväskylä-based fractal artist (http://algoristo.com/) has joined to our event too: together with the Viitaniemi KIKS-team, he held an exhibition tour in the Viitaniemi KIKS Student Math-Art Exhibit of fractals created by programming.

The **Jyväskylä Contemporary Theater Association's OFF-Humanity Project** (https://offhumanity.wixsite.com/offhumanity) organized a science&art theater workshop for the children, related to robotics.

The first part of the event took place from 9.30 AM to 11.00 AM, under the title of "Kids Inspiring Kids in STEAM – Erasmus+ Multiplier event". Three non-KIKS schools have participated in the event:

- Kortepohja School, Jyväskylä with 16 kids and their teacher: Saana Karjalainen
- Halssila School, Jyväskylä with 20 kids and their teacher: Minna Suikkari
- Christian School, Jyväskylä with 6 kids and their teacher: Timo Koljonen

The following KIKS schools has participated in the event:

- Laukaa School, Laukaa, with 5 kids and their teacher: Mirka Havinga
- Viitaniemi School, Jyväskylä, with 10 kids and their teachers: Merja Sinnemäki, Leena Kuorikoski
- Palokka School, Jyväskylä with 1 student and her teacher: Jarmo Laaksonen

PROGRAM:

9.30-9.40 Welcome by University of Jyväskylä's KIKS researchers, Kristóf Fenyvesi & Markus Hähkiöniemi

9.40-10.00 Short presentation by Zach Shelby Micro:bit Educational Foundation on Micro:bit and the kids

10.00-11.00 Parallel Workshops:

- Giant Warka Water Tower construction workshop by Viitaniemi KIKS team
- Micro:bit by Viitaniemi KIKS team
- Buckyball construction workshop by Christian School's STEAM Club
- Scientific Shadow Theater workshop by Laukaa KIKS team
- OFF Humanity project's workshop


Kids Inspiring Kids in STEAM - Erasmus+ @ European Researchers' Night -
Photos: www.experienceworkshop.org


Kids Inspiring Kids in STEAM - Erasmus+ @ European Researchers' Night - Photos: www.experienceworkshop.org


Kids Inspiring Kids in STEAM - Erasmus+ @ European Researchers' Night - Photos: www.experienceworkshop.org

11.00-11.20 Exhibition guiding:

- Systems in Art exhibit introduced by Palokka KIKS team
- Fractal Art exhibit introduced by Viitaniemi KIKS team

11.20-11.30 Closing by University of Jyväskylä's KIKS researchers, Kristóf Fenyvesi & Markus Hähkiöniemi

Optional program: 11.00-12.00: Visiting Musica's Researchers' Night programs.

More info on the KIKS program on University of Jyväskylä's Researcher's Night website: https://www.jyu.fi/fi/akateemiset-tapahtumat/tutkijoiden-yo/ohjelma#autotoc-item-autotoc-8

The second part of the Finnish KIKS Closing Multiplier Event took place also in the afternoon of 29 September 2017, from 14.00 to 15.00, organized jointly with University of Jyväskylä, Faculty of Information Technology's prestigious **Agora ICT-forum**. In the framework of the program, KIKS researcher, Kristóf Fenyvesi has introduced the KIKS project in general and the Finnish KIKS team's contributions to the project. **Zach Shelby** has also greeted the KIKS project and made his lecture under the title of **Get Creative, Get Connected, Get Coding! Micro:bit in Finland and around the world.**

Participants: 16 researchers and teachers has participated in the event.

More information: https://www.jyu.fi/it/uutiset/tiedekunta/ict-foorumi_shelby

6.2.2 The KIKS project in conference talks and publications with contribution by the Finnish team

In addition to the KIKS-related events, the Finnish KIKS group has mostly promoted the KIKS project in conference talks and workshops all over the globe.

List of talks given mostly by the member of the Finnish KIKS group, Kristof Fenyvesi and member of the Hungarian KIKS group, Zsolt Lavicza:

April 15, 2016
2nd SEMINAR - BERA STEAM RESEARCH COMMISSION FORUM. UNIVERSITY OF CAMBRIDGE, UNITED KINGDOM.
Presentation by Kristóf Fenyvesi.

4 May 2016
Research and Collaboration Days at Johannes Kepler University, STEM Education Centre, Austria.
Presentation by Kristóf Fenyvesi.

22 July 2016
International Symmetry Festival. Vienna University of Technology, Austria.
Presentation by Kristóf Fenyvesi.

30 July 2016
2nd International Conference on 'Building Interdisciplinary Bridges across Cultures'. UNIVERSITY OF CAMBRIDGE, UNITED KINGDOM.
Presentation by Kristóf Fenyvesi.

15 August 2016
KIKS Session at the STEAM Seminar, organized in the Hungarian Center for Science and Culture in Helsinki.
Presentation by Kristóf Fenyvesi.

October 2016

EU H2020 'Creations' Project Seminar at University of Helsinki.

Presentation by Kristóf Fenyvesi.

8 February 2017

IT Forum at University of Jyväskylä, Finland.

Presentation by Kristóf Fenyvesi.

20 March 2017

KIKS Workshop at Cambridge Primary School, UK.

KIKS activities by KIKS teachers Mirka Havinga, Leena Kuorikoski, Merja Sinnemäki & Kristóf Fenyvesi.

27-30 March 2017

Shaping the Future 4, Center for Education Technology, Israel.

Presentation by Kristóf Fenyvesi & Zsolt Lavicza.

26 April

KIKS Special Session at Cambridge Mathematics Visiting University of Jyväskylä, Finland.

Presentation by KIKS teachers Mirka Havinga, Leena Kuorikoski, Merja Sinnemäki & Kristóf Fenyvesi.

15 May 2017

May: Month of Mathematics. Center for Promotion of Science, Belgrade.

Presentation by Kristóf Fenyvesi.

24 June 2017

1st International Congress of Art Education in Eötvös University, Hungary.

Presentation by Kristóf Fenyvesi & Zsolt Lavicza.

30 July 2017

GeoGebra Conference: STE(A)Ming Ahead. Port Elizabeth, South Africa.

Presentation by Kristóf Fenyvesi.

14 August 2017

STEAM Seminar at Open Design Festival, Cape Town, South Africa

Presentation by Kristóf Fenyvesi.

25 October 2017

STEAM Forum at Inha University, Korea

Presentation by Kristóf Fenyvesi.

7 Evaluation, Conclusions and Sustainability

According to interviews made with the Finnish KIKS teachers and informal discussions with the students, the KIKS project has positively inspired the participants and opened up new perspectives. KIKS also offered new methodologies and materials, ideas, and provided new co-operation opportunities for the teachers inside and outside the KIKS schools. The teachers and students were generally satisfied with their experiences and the high level of student and teacher participation. According to the teachers' views, the students had the possibility to learn new skills, improve their English, and to develop on fields such as connections between mathematics and art, programming, chemistry on a new, sometimes unexpected way. Participating schools for the first time encountered such innovative digital and hands-on tools, like BBC micro:bit and 4Dframe. Teachers found very important the experience of co-operation on all levels, including the institutional and personal dimensions. KIKS schools have explored new capacities in the involvement of artists, other specialists, teachers of other schools, university researchers, etc. in the learning process.

The most active KIKS schools' teachers in Laukaa and in Viitaniemi are determined to bring forward the main components of KIKS, even when the project is finished. Most of the teachers generally seemed to be open to participate in future university-school projects.