The Urban Lab of Europe!

NEWS

PROJECT

AVEIRO STEAM CITY - Urban Network for Upgrading STEAM Skills and Increasing Jobs Added-Value through Digital Transformation in a new economic context

Aveiro, Portugal

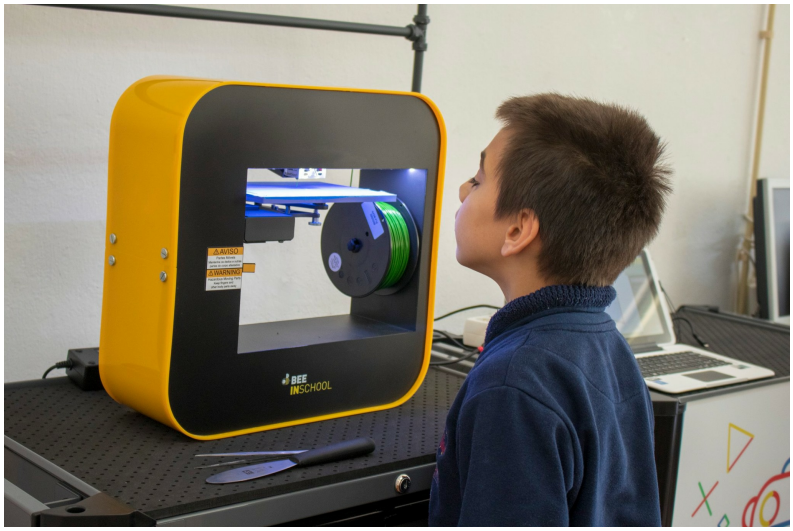
TOPIC

Jobs and skills in the local economy

EDIT 02 OCTOBER 2021
BY LUCIA SCOPELLITI

Zoom-In Aveiro Tech Labs: YOUNG MAKERS IN SCHOOLS!

See on UIA website



Tech Labs in a nutshell One of the challenging objectives of the Aveiro STEAM CITY (ASC) project is the development of a STEAM learning context (science, technology, engineer, arts and mathematics), through Maker methodologies and project development.

With this aim, the project foresees an educational program dedicated to the school community, to be implemented through so called "Tech Labs", developed in Primary, Intermediate and High Schools, giving to students their first contact with electronics, robotics, programming, 3D printed materials and other equipment, for the practice and acquisition of new skills.

The implementation of Tech Labs in 1st cycle schools started in 2019 and had a strong component dedicated to experimental teaching, that promoted the enthusiasm for science and technology, using spaces for experimentation to stimulate the discovery and interest of students in these areas throughout their educational path, increasing the mastery of STEAM skills in the educational community. For the 2nd and 3rd Cycle of Basic Education, the activities started in 2020 and 2021, in all seven schools in the Municipality.

This action is a crucial part of the Municipality's integrated strategy to promote STEAM skills at all levels of primary and secondary education. The pivot space of this initiative is represented by the Maker space of the Centro Ciência Viva Factory in Aveiro.

The protagonists of the initiative

This massive initiative was possible thanks to its protagonists: the Main Urban Authority (Municipality of Aveiro), which served as a framework not only for ASC in general but also for the coordination between the scientific research team, the training providers and the schools. The scientific part was represented by the University of Aveiro (UA) and, in particular, by the Fábrica Centro Ciência Viva; the schools, represented by school coordinators, the teachers and, last but not least, the students.

The UA, through the Fábrica Centro Ciência Viva, within ASC is responsible – among the others - for the task dedicated to learning STEAM.

Schools did not hide their enthusiasm to start working on models that encourage technological knowledge. With the installation of the laboratories, (among other elements, the Laboratories were equipped with 3D printers,

robotics kits, electrical circuit kits and IT equipment), starting from elementary schools, Aveiro entered a new era of teaching through the experimentalism of new models.

The process and the contents

The initiative is intended to "face several themes in an articulated, multidisciplinary and interdisciplinary way, outside the conventional drawers by discipline, and using project-based learning methodologies", explains Pedro Pombo, director of Fábrica Centro Ciência Viva, based on previous experiences.

This is the case of the Maker spaces, first at the Fábrica, involving classes in the curricular flexibility regime of the Aveiro Schools Group, and then within the Maker Academies financed by the Knowledge Academies program of the Calouste Gulbenkian Foundation, the "Maker in Schools programs" (Ílhavo, São Bernardo, Casa da Cidadania, Gondomar and Espinho) and the remaining Maker spaces (Ílhavo and Coimbra), without forgetting the operations launched with municipalities, such as the "Doing space" in Pombal.

Pedro Pombo, from Fábrica da Ciência, believes in an interactive and more practical model of seeing science.

How important is 3D Printing in your daily activities?

3D printing in the daily activities of science communication has allowed the creation of solutions for educational content and programs, as well as the development of proofs of concept within the scope of the projects developed by researchers of the Fábrica Centro Ciência Viva de Aveiro.

What is your perspective on the importance of 3D Printing for the advancement of science and education?

3D printing has proved to be of utmost importance for the advancement of science, through the creation of customizable solutions and the potential to make physical ideas and models involved in laboratory work that validates new laws of science.

In the field of education, 3D printing has opened up a whole new area of action and intervention, both for teachers, as a tool to create content and new educational devices, and for students, as a working resource that allows the development of STEAM skills.

"Tech Labs in Schools" was an initiative organized into three components:

1. development and production of Tech Labs and respective contents;
2. teacher training and monitoring;
3. dynamization and training in the classroom context.

With regard to the first component, a STEAM learning program was established and the concept of Tech Labs was created for schools in the 1st Cycle of Basic Education (1ºCEB). Subsequently, all educational materials and content were developed and the appropriate equipment and tools were selected for the respective target audience.

During December 2019 and January 2020, 31 Tech Labs were installed in the 31 schools of the 1ºCEB in the municipality of Aveiro. This operation involves all schools of the 1ºCEB in the municipality of Aveiro, with a total of 200 teachers and more than 3000 students. The 31 Tech Labs integrate 31 3D printers, 62 computers, 62 Maker stations, 31 tools and 248 Maker kits.

In addition to these materials, the Department of Communication and Art (DeCA) of the UA developed programming kits dedicated to younger people, that allow children to get in touch with programming (algorithm), in which they begin to become familiar with computing languages, and learn physical computing, with objects that must be related to and whose functioning is governed by programming concepts.

Regarding the "training" task (second component), the teacher training program involves eight modules for learning STEAM, namely "3D modulation and printing", "scratch programming", "makey makey programming", "electrical challenges", "scribble machine", "programming and robotics", "programming Ozobots", "Buildings and Tinkering".

Finally, the third task dedicated to follow-up is intended to assist the main class teacher in the dynamization of STEAM learning programs, supporting the functioning of Tech Labs in each school. Its objective is to implement an action plan for teacher training in the classroom context and for the development of practical work with students.

The schools receive, by routine, visits by two teams from the Factory, in order to encourage, among the students involved, the development of projects, the promotion of soft-skills and the "learning by doing" approach.

This operation is a pioneer at national level, either in its Maker program, in its scope, training, and in the stakeholders involved.

A Tech Labs program for Secondary Education also started with an extension of the initiative to the 2nd and 3rd Cycles of EB. In this way, a vertical implementation with the possibility of monitoring and evaluation will be achieved.

The involvement of schools in the process

Teachers assumed a fundamental role in this process, as agents for change, transferring knowledge to students by using innovative teaching methodologies. Teachers' support was sustained by a training programme to obtain the necessary skills to deliver the project.

In Primary School all Teachers were trained. Currently, the Municipality has 7 schools' directorates within 31 Primary Schools and approximately 140 Teachers.

The contents of the Training Program for Teachers were articulated with the existing curricular subjects. Additionally, several follow-ups assisted by the program's trainers in the classroom allowed to put into practice what was learned in training and to support local Teachers to implement the activities on daily basis.

This training intends to promote the continuity of the project, ensuring that teachers acquire the fundamental skills to independently and gradually use STEAM method as a teaching tool.

The process began with the communication of the project and the involvement of the 7 schools' directorates, setting up the coordination, explaining the context and scope of the Project. Subsequently the Tech Lab kits were presented, with all the equipment and material to be delivered to each primary School, explaining the designs and objectives of the project. The administrations of all schools were engaged in the Project in order to be able to communicate the project internally and to involve their teachers, always with the necessary technical support in order to have a high commitment to the project all the time.

A deep analysis of the outputs, satisfaction and outcomes, was developed in the schools during all the school year, involving the technical team, teachers, trainers and students.

The monitoring of teachers' engagement was a leitmotiv of the initiative: if a teacher was in need to consolidate a specific training content, this reinforcement was provided through the integration in a new training module or

technical support by the team trainers.

NUMBERS

As mentioned, the Tech labs initiative was scaled since 2019, starting from Primary schools and arriving progressively to involve also all the High Schools in the Municipality of Aveiro, so it evolved from and experimental activity into a structural one.

The initiative in numbers:

Tech Labs Primary Schools - Implementation Period: from the 2019 / 2020 school year

Schools: 31 (Total of schools in the Municipality of Aveiro)

Engaged students: 2985

Engaged teachers: 140

Teachers training scheme: 200-hour training by the University of Aveiro

Training follow up in schools: 830-hour by the University of Aveiro

Tech Labs Intermediate Schools - Implementation Period: from the 2020 / 2021 school year

Schools: 10 (Total of schools in the Municipality of Aveiro)

Engaged students: 3919

Engaged teachers: 34

Teachers training scheme: 50-hour training by the University of Aveiro

Training follow up in schools: 272-hour by the University of Aveiro

High School - Implementation Period: from the 2019 / 2020 school year

Schools: 4 (Total of schools in the Municipality of Aveiro)

Engaged students: 3690

Engaged teachers: 16

Teachers training scheme: 34-hour training by the University of Aveiro

Training follow up in schools: 128-hour training by the University of Aveiro

Evaluation of the Tech Labs activities by the participants

The evaluation of the Tech Labs activities by the participants is referred to the first 4 years of Primary School. Here are presented some quantitative and qualitative results collected amongst its participants through 2 instruments:

- a survey

- 4 focus groups.

Regarding the quantitative data, they were collected through an ad hoc survey dedicated to the teachers; all teachers who answered the surveys (66% of the total recipients) reported that they developed their STEAM and digital skills, and were very satisfied with the knowledge learned and its practical application, the strengthening of their role as change agents for their students, and the learning of innovative teaching methods (Charts 1 to 3).

Teachers' satisfaction with the knowledge learnt and its practical application in implementing activities in STEAM areas with students

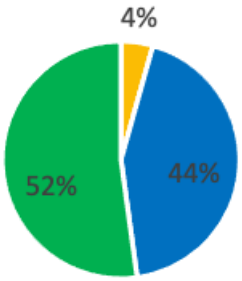


Chart 1

Teachers' satisfaction with the content learnt for the implementation of innovative teaching methods

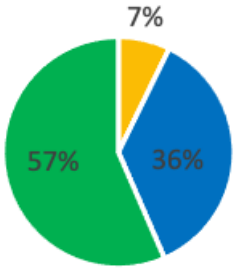


Chart 2

Teachers' satisfaction with the contribution to their role as a change agent for their students

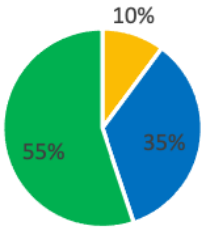


Chart 3

RED 1 - absolutely dissatisfied ORANGE 2 YELLOW 3 GREEN 4 BLUE 5 - completely satisfied

Both students and their teachers reported that not only their appreciation and interest in STEAM and digital areas increased, but their own STEAM and digital skills, as well as several soft skills, were developed within the Tech Labs activities.

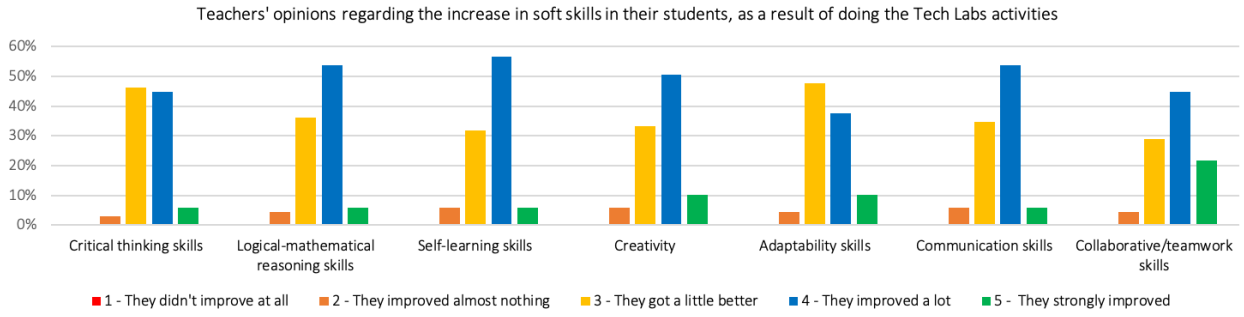


Chart 4 - Teachers' opinions regarding the increase in soft skills in their students, as a result of doing the Tech Labs activities

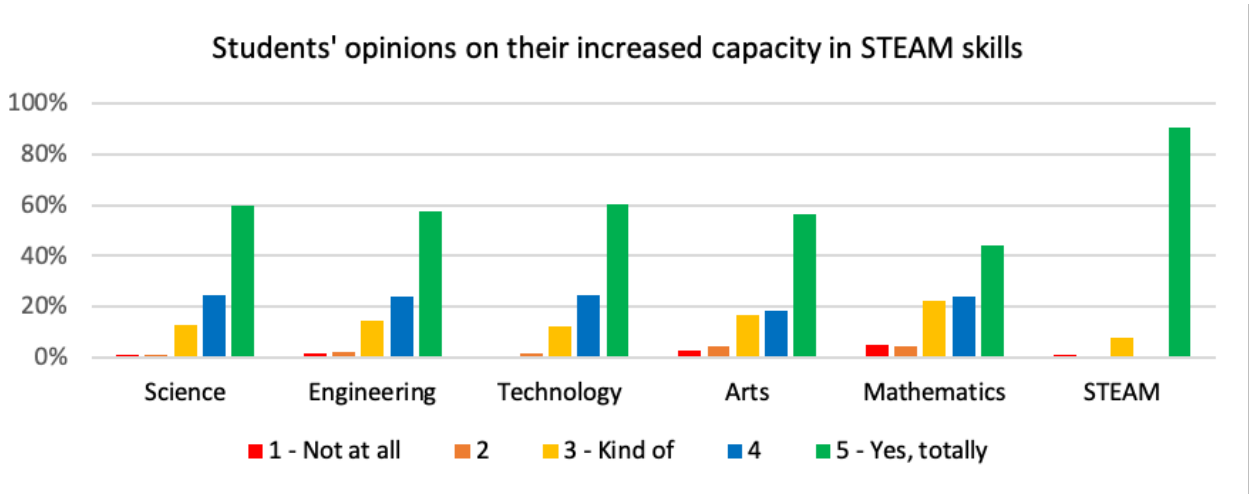


Chart 5 - Students' opinions on their increased capacity in STEAM skills

Student feedback (41% respondents of the total recipients) shows a more accentuated impact of Tech Labs activities on their skills and interest. Moreover, all the teachers interviewed during additional Focus Group sessions were unanimous in considering that all their students were highly impacted by the Tech Labs activities.

As for the qualitative data, 4 focus groups were developed.

The information collected during the four focus groups (2 for teachers and 2 for students, with 7 participants each) reveal the importance of Tech Labs not only for the education of primary school students, but also for their teachers. Students, on their side, were thrilled with the Tech Labs equipment.

Teachers and students have repeatedly asked in the Focus Group sessions for these activities to be continued in the future and, in fact, intensified/reinforced.

The most relevant comments / evidence that emerged are provided below:

1. All the teachers interviewed in the Focus Groups (14 in total) were unanimous in considering that their STEAM and digital skills were greatly developed by their participation in the Tech Labs initiative and, interestingly, they say that they learned these skills not only with Fábrica Ciência Viva, but also with their students, in a process of sharing knowledge, involvement and collaboration. This was true also in the community, particularly students' parents, strengthened their digital knowledge and skills. This unplanned knock-on phenomenon emphasizes the multiplying effects of this activity in the Region and its community.

2. All teachers also stated that the Tech Labs activities undoubtedly create and develop STEAM and digital skills in their students, as well as helped them understand the usefulness of a subject (such as mathematics), and how it can help them solve concrete problems in a real-life context. In addition, other areas of knowledge are improved, such as Portuguese and grammar, as well as several soft skills like problem solving, creativity, adaptability, communication, autonomy, teamwork, behavior, concentration, or discipline.

3. Also, all the consulted students (14 in total) reported that they have enhanced their STEAM and digital skills, as well as some soft skills, and also their interest and appreciation for STEAM areas.

4. For the teachers the Tech Labs activities allow students to «create knowledge on their own, ... create tools and strategies they need for the future»; in that sense this initiative is supporting children not only in creating core skills for the future that prepare them for jobs that don't exist today, but also in creating resilience both personally and professionally.

> «This ability to adapt, to solve problems (developed in the Tech Labs) will allow them to create their own jobs (entrepreneurship)... This is really fantastic. I think it's not enough; we want more (Tech Lab activities)! »
> Primary School Teachers

5. Even children with "low academic performance" can have outstanding career futures if they are stimulated to do so, and the Tech Labs activities seem to contribute to this.

«Something that is fantastic is when children have difficulty in reading and writing, but afterwards show us that they have very good logical thinking, managing to succeed in electricity activities or in construction with blocks, and develop activities that surprise me and surpass me by the vision they have and the global way they envision, the own interpretation they make of space! »

Primary School Teacher

6. Social equality was targeted through the access to technologies. The Tech Labs allowed students from lower socioeconomic backgrounds, without the possibility of contact with technological equipment or toys like other children, to experiment and work these tools for the first time in their life.

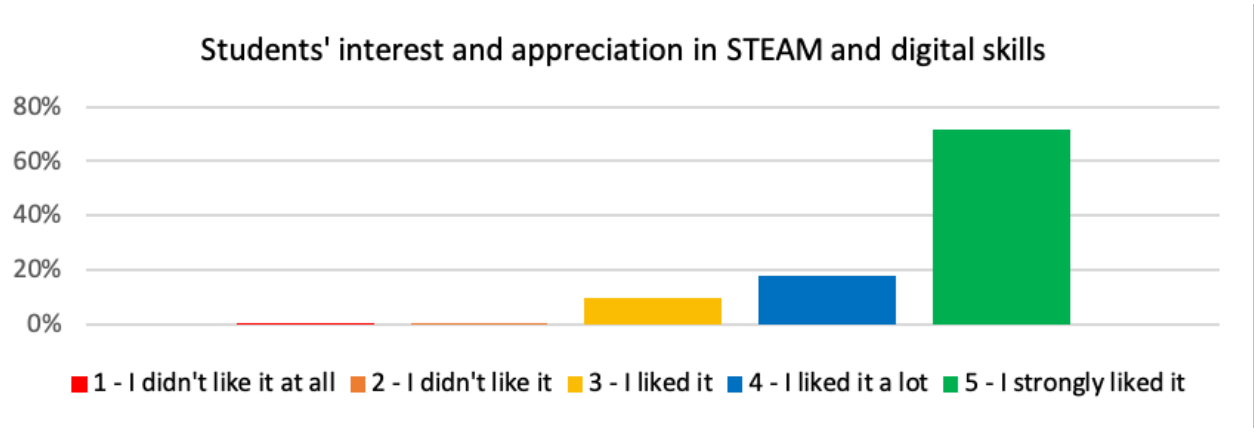


Chart 6 - Students' interest and appreciation in STEAM and digital skills

Some recommendations

Some recommendations have emerged from the Focus Groups, coming from participants' comments:

- Despite the fact that some teachers feel comfortable with the training, they all consider that it would be important after the initial and general phase – that give the basics for each tech tool – to run a specialized training for each piece of equipment. This recommendation is also in line with the feedback given by some teachers who feel "overwhelmed" with so many topics at the same time (although only some of them showed this concern). Moreover, the training received was considered insufficient for them to feel autonomous in implementing classroom activities with students. Teachers stated that they needed more follow-up sessions to feel more comfortable and confident with the themes covered and to implement the subsequent activities.

- Many teachers mentioned the need to have even more units of equipment for each subject at their disposal, so that they can work with all the students simultaneously on each theme. In addition, teachers stated that when they are alone in class with their students, they are not able to conduct several Tech Labs activities because there are too many students (24 or 26 sometimes) who raise very different questions about each equipment in particular, and they cannot support them all.

- Given the aspiration of the city of Aveiro to be recognized as a "Tech City", it seems important to check and monitor all the schools of the Region in order to verify infrastructures and technological resources (internet, computer equipment, interactive whiteboards, ...), so that all teachers and children in the Region can benefit equally from such strategic initiatives for their future, as is the case of the Tech Labs.

- Referring to the STEAM acronym, the area less developed through the Tech Labs activities is the "Arts". The artistic component seems to have been reserved to the drawing of TóZé Rex, the creation of objects from straws printed in the 3D printer, and the use of the Scribbling machine. Given the importance of the artistic (and, consequently, cultural) component for education, as well as the growing and current trend of its integration with technology, it will be important that an effort is made to include more components or activities that develop artistic skills in children.

- It might be appropriate to adapt some exercises for the 1st and 2nd grade students and for the ones with learning difficulties, because they do not know how to read and write, and are much more dependent on the teachers.

It is unquestionable that Tech Labs activities impact not only the direct recipients, but the Region and its community economically and socially, both in the short and (prominently) in the long run.

This will certainly be one of the ways to build and hopefully to retain talents in the Region. It is then up to the several regional actors (economic and governmental) to make available and viable the conditions that will retain them in the territory, but Aveiro's case is nowadays a recognized best practice in this context.

Jobs and skills in the local economy

See on UIA website