DESCI

2nd DESCI TESTING PHASE REPORT

This document has the goal to report the main aspects emerged during the 2nd testing phase (academic course 2017-2018). Each school must to fill in a report for each alternating training scenario realized. Your information will be valuable both for the reporting to the National Agency and to better know the experiences realized in each school.

Overall section

Indicate the course of studies and the curricula involved in the alternating training experience (School itinerary, grades and age of student involved in the alternating training project)

Technical Technological Institute with 3 courses: IT, Electronics and Environmental Biotechnology.
In 2017/18 students of different grades were involved in the alternating training project: 5th grade students, 2 Electronics class-groups and 1 IT class-group who were continuing the training path started in the previous school-year; four 3rd grade and four 4th grade IT classes. The students' age was between 16 and 18. The areas addressed were 3: IT, Electronics, and IoT with the realization of 3 scenarios: Tech-Care, Environmental Monitoring, Smart City.

Indicate the partner/s formally involved in the alternating training experience (enterprises, social actors etc)

Experts and makers from **"FormaScienza"** Association were the main Partners, also involved as tutors (Cinzia Belmonte, Angelo Cei, Fabio Piccoli, Luca Frogheri, Giacomo Cappucci)

Experts from **Assoknowledge** on "Living-Lab" methodology (Fabrizio Ricci)

Experts from **CNR** (Antonella Ciocia e Fabrizio Pecoraro)

CNR-IRPPS (Institute for Research on Population and Social Policies), Project Leader

Representatives of the world of Education and Research from Italy, Greece and Spain.

Describe the scenario and target competences

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The activities carried out with the DESCI approach involved, during the testing phases (school years 2016/17 and 2017/18) 3 classes from the final three-year curriculum (47 learners), 4 teachers (internal tutors), various partners from Research Institutes and Enterprises: 5 experts and makers from the Association "FormaScienza" (external tutors), 2 CNR educators (external tutors), 2 experts from Assoknowledge, the Business accelerator "Digital Magic", trainers from the project Cogito Ergo Impresa "*How to build and finance innovative enterprises* ", meetings with the IT firm PTV SISTeMA.

The students, together with the internal and external tutors,

-designed and implemented a co-working environment at school

-implemented a scenario, called **"Tech-Care",** for a home automation system for elderly citizens' needs availing themselves of the fast growing IoT World and its extensive and economical open source platforms

- implemented a scenario, called **"Smart City",** for designing a programmable electronic prototype aimed at detecting road surface conditions, data acquisition and processing, Bluetooth technology transmission, creation of user interfaces and data base.

-implemented a scenario, called **"Environmental Monitoring",** for designing a system to detect and evaluate environmental parameters; built devices from recyclable or recycled materials and analyzed issues related to aging population

Sectoral and transversal competences targeted

- Accountability: taking responsibility for all work and study activities
- Adaptability: adapting one's behaviour to circumstance, problem solving, self-management within guide-lines in a work or study context, generally predictable but subject to change
- Working collaboratively
- Identifying structural and functional features of an enterprise
- Developing computer applications
- Clear Communication: presenting publicly technical innovation
- Devising information campaigns for a local community
- Designing and differentiating by product marketing strategies

Describe the kind of Living Lab activated (dates, functions, objectives and targets, results?)

The living-lab approach has afforded a way to overcome the limits of traditional education. Personal ideas, experiences, knowledge and daily needs become the starting point of an innovation process aimed at developing new products, services or applications of social utility.

Following the DESCI living-lab approach the concept design occurrs through a cycle which can be repeated many times, until the final concept is reached:

- definition of the concept matching the problem with identified resources and personal competences
- analysis and evaluation, actively involving users and external bodies

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- redefinition of the concept

The students were able to design and implement, at least in part, the reached solution, checking its value with end-users, its feasibility and sustainability with enterprises also able to provide start-up support and with experts in education and innovation from *Confindustria* (Italy's lead industry organization). A co-working environment was activated at school also involving experts from the Maker movement.

Describe the connections with the local community

The students interacted with various subjects other than tutors: they interviewed elderly citizens in an Association in Frascati; they met business representatives from **Assoknowledge** who were able to direct and evaluate their projects; they worked with an exponent of the maker movement who acted as trainer in the final phase of the project implementation; they met a business accelerator **"Digital Magic",** with trainers from the project Cogito Ergo Impresa "*How to build and finance innovative enterprises* "; and had meetings with the IT firm PTV SISTeMA.

Indicate the participatory practices activated

Cooperative learning:

- Brainstorming
- Metaplan (needs analysis and concept design)
- Group interviews to users
- Group web inquiry about technologies mapping
- Design thinking
- Round table

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Describe the activities developed in the Design phase (stakeholders involved, number of meetings, positive and critical aspects etc)

Meetings with: representatives from Formascienza and Assoknowledge, teachers, tutors, students (stakeholders)
No of meetings : 49
Positive aspects:

- Ideas, experiences, knowledge and daily needs as the starting point of an innovation process aimed at developing new products, services or applications of social utility
- Revision of the traditional teacher-oriented educational model that relegates the student to the passive role of reproducing imparted knowledge in project form
- Development of concept design techniques through various participatory tools (interviews, metaplan, round table, brainstorming, web inquiry, design thinking).
- Design Thinking: process of concept designing involving creativity and problem solving skills, in which the student as well as applying acquired knowledge is motivated towards further learning
- Working in co-operation with enterprises, associations and research centres of the community
- Creative thinking, the maker «philosophy», the living-lab model.

Critical issues:

- Having to stay in the school environment.
- Tentative character of the first implementation with interim adjustments
- 400 hours of AT in 3 years.

Who defines the alternating training program of the student? If possible, give further information about the role of each part in defining the alternating training program of each student

The alternating training program is defined by the Scientific Technical Board, by the Teachers' Board, by each Class Board on the basis of the suggestions/offers from the territory. These are aptly evaluated by the school tutors and then presented to the students, who, according to their potentialities and aspirations, stipulate an educational agreement which binds them to the school and the company/ research institute.
Once the agreement has been signed, of great importance is the co-design phase with external tutors and trainers where the team identifies the best tools to employ and the work plans to follow for the best implementation of the educational path.
In this case it was decided to involve the whole class as a totally new methodology was being analysed and implemented.

Implementation phase

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Please, describe the activities developed in the Implementation phase (specify how much time in the school and how much time in the enterprise/ describe the role of teachers and enterprises in the development of students' alternating training)

At school, **during school hours**, activities were developed for 90 hours corresponding to 10% of the total classes for each discipline
At school, **outside school hours**, activities were developed for 99 hours in 34 meetings with Formascienza and Assoknowledge as officially agreed.
During the activities the students designed prototypes under the supervision of a maker movement representative who acted as trainer in the implementation phase of the project; held discussions with internal and external tutors on methodologies to use and already used; had their prototypes evaluated by business representatives and by the teachers' board.
The internal tutors contributed together with the external tutors to the guidance and tuition of the students, kept the logbook, cooperated towards the achievement of transversal and technical/professional competences.

Evaluation phase

Please, describe activities developed in the Evaluation phase and specify who is responsible for student evaluation during alternating training?

A. The teachers
B. School entities (please specify):_____
C. The government
D. The enterprise
E. Both school entities and enterprises
F. X A mixed system that also includes other stakeholders

Satisfaction questionnaires were administered to students, teachers, parents.
The Internal Tutors with the respective class teachers' board , and the external tutors / enterprises were responsible for the evaluation of the students.

Evaluation Framework

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Results of the Focus groups of the Evaluation Framework (to be filled in for each focus group realized)

Please describe, in a synthetic way, background and issues addressed during the Focus Groups and include the input provided by the participants.

INPUT provided by Teachers and Tutors

The DESCI project is potentially useful in experimenting a new methodology through which the students have the opportunity to address complex problems in real life situations where they can identify/consolidate their aptitudes and interests. In this sense the project could also contribute to the development of technical and professional competences useful for entering the world of work and provide a competence-based evaluation system useful to assess the efficiency of alternating training paths.

An issue was represented by the need for a more agile and apt form of communication towards the students and thus to operate a selection of the materials to be used and shared. To this end the creation of structured working sheets could be useful both for planning the teachers/tutors work and for showing to the students at every meeting in order to clarify the activities being carried out, so as to make them more aware of their tasks.

A suggestion is to decrease the red tape which tends to deprive the process of operating agility, and to increase cooperation and communication between internal tutors, external tutors and students.

The Desci project had start-up difficulties due to a series of factors connected with the specificity of Law 107 that regulates AT in Italy.

Another issue was the withdrawal from the project of the business partner initially identified, whose presence, according to the Law, should be compulsory for the performance of part of the alternating training activities.

The DESCI process reverses the traditional learning pattern, because the objectives of the project are identified before the technical competences required for its implementation are acquired or enhanced, according to the needs detected interacting with the real world and the expectations of possible users. However, since the project's distinctive features became clear only in progress it was difficult to motivate the students effectively from the start.

The Teachers' Board approved the use of the competence evaluation rubric provided by Assoknowledge (partly simplified /integrated) for the end-of-term assessments (school years 2016/2017 and 2017/18), to certify the competences developed by the students during the AT training.

The guide-lines and the operating tools have not always seemed simple or replicable. With some streamlining to reduce repetitions and redundancies they could be used more effectively and modularly among teachers and tutors. The toolkit could support the teachers' daily job in enhancing the students' learning process. As regards technical and professional competences, for example, they could be detected in a specific and differentiated manner according to the various AT scenarios and articulated in different abilities to apply the acquired knowledge to real situations. The same applies to Linguistic, IT, Civic and Social competences.

The methodological tools, the practical guidelines and the process monitoring tools, though useful, must be simplified to make them practicable.

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The timeline is not totally clear. The adoption of an excessively long timeline has determined a significant fall in students' motivation.

The duration is sufficient but the distribution of the activities is clumsy.

The evaluation toolkit was useful for teachers in assessing the students' competences developed during the two-year testing phases.

INPUT from Electronics students

The students of the Electronics course of specialization considered it useful to learn how to develop ideas, to pass from the concept design to its implementation, solving the problems arising during the process. They suggest, however, giving a clearer indication on how the experience could be useful in the future world of work.

The learning environment created with a mixed group of students coming from 2 different specializations (IT and Electronics) generated some initial unease as the students with an electronics background had some difficulties grasping concepts that required some IT skills though they eventually saw the usefulness of understanding the IT know-how underlying the electronic equipment they were producing.

They felt the theoretical part, devoted to research, was too long. Also they would have preferred to have greater freedom in choosing the project macro-area. They would have liked to visit firms, especially large ones, where the process of development and production is already a practice , and cooperate with their designers.

They think they have improved their technical and professional skills: they learnt to use C++, and other programmes to develop flow-charts online, to work as a group and in general, to use tools for sharing documents online; they also improved their language skills by using the English language.

They consider the evaluation by the user (exogenous evaluation) a sensible practice since in the work market the worker is being increasingly evaluated by the user; instructive to work as a group with participatory methodologies such as a metaplan.

INPUT from IT students

The students of the IT course of specialization considered it interesting and important to acquire professional methods and an external approach in alternative to school usual practices, to address real life issues and make concrete choices to develop a real project.

They think they have improved their personal skills, dealing with organization and respect of deadlines for deliveries. They suggest including similar projects in the curricula, so as to have the maximum cooperation of all actors involved. They favour sharing experiences and competences with students from different courses. The living lab approach allowed them to address the real problems of the elderly and their everyday life so as to meet their needs in the best possible way. They benefited from the interaction with professional engineers and researchers and their pragmatic approach to problem solving.

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Venue: I.T.T "E.Fermi", Frascati
Participants: students, teachers, tutors

NAME OF TUTORS /TEACHERS /MODERATORS	ORGANISATION	EMAIL
Filomena Cirino, Rossella Innocenti, Enrico Purchi, Sara Rosati, Cinzia Belmonte, Angelo Cei, Luca Frogheri.	I.T.T "E. Fermi", Frascati	rmtf180009@istruzione.it

Please describe, in a synthetic way, background and issues addressed during the Focus Groups and include the input provided by the participants.

- High number of students attending
- Low number of trainers compared to number of trainees
- Too lengthy Introduction on methodologies
- Inadequate focus on product development
- Inadequate contact with the business world

The limited contact with the world of work was compensated by the use of Arduino, a useful instrument in the realization of prototypes in the field of Interaction Design, IoT and other devices dealing with man-machine interaction. The students developed relevant competences in designing and implementation through an empirical approach to problems. They had to deal with problem solving, enhancing their skills in electronics and in the application of their IT knowledge, managing to write complex algorithms and have their prototypes interact with the user so as to adjust the surrounding environment.
The course addressed topics such as the study of practicability parameters and proportional cost-effectiveness, and the investment/risk ratio. The creation of models with Arduino platform programming. 3d modelling with Tinkercad and Autodesk Fusion 360, mechanical parts animation, sensors and actuators positioning in the prototype.
The groups were then sub-divided into sub-groups to handle the technical issues and the presentation of the realized project, both global and specific.

The second focus group, envisaged for the second year, was performed administering the evaluation toolkit questionnaires to teachers, tutors and experts from the world of work and research. This was followed by a qualitative and quantitative analysis with excel data processing. The Evaluation Framework questionnaires were filled in.

Suggestions for the Toolkits improvement

Please indicate, for each toolkit (teacher toolkit, student toolkit and evaluation toolkit) the critical issues emerged during the testing phase and give a specific input to overcoming it.

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During the 2-year development of the project continuous working tables with teachers, internal and external tutors were organized to adjust the 3 toolkits.

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