
EDUCATIONAL SCIENCE LABORATORY: THE OLD INFRASTRUCTURE SUPPORTS THE NEW TRENDS-A CASE STUDY

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ABSTRACT

The project of Sci-Lab's restructuring carried out in the school year 2016-2017, in the Regional Training Center of Heraklion, with main efforts to concentrate the great variety of devices and utensils, some of them in large quantities, some in poor condition and scattered in many places, and then to catalogue and re-restore in a constructive way. A portion from the collected material, placed in metallic libraries with glass frontages in order to be exploited in the future training and educational experiments, some were deposited in boxes in the store and a few, the oldest and most representative, were placed in exhibition stand inside the Sci-Lab. Students in internship and teachers volunteers supported the initiative, of which part was, also, the creation of a Museum Collection with experimental devices of the last half of previous century.

The re-organized Sci-Lab can function in the modern era of Science Teaching and Training, and promote changes in the traditional Science teaching of schools of Crete and widely. So that, it can support 21st century schools in real and virtual environments, live and remotely, with the additional aim, that the whole project to become a good practice and dissemination source of expertise in schools.

Keywords: science laboratory, Science Museum Collection, Science teacher training, training centers, restructuring public premises, rehabilitation, renovation

INTRODUCTION

The Regional Training Centre of Heraklion (RTC-Her) is one of the 16 founded in 1992 in Greece with the purpose to offer training programs to the teachers of all specialties of Primary and Secondary Education, under the guidance of the Greek Ministry of Education, Research and Religious affairs and the Greek Institute of Educational Policy. It has range all the teachers in the four prefectures of Crete and is under the supervision of the Regional Administration of Primary & Secondary Education of Crete. RTC-Her is situated in Heraklion, in the Campus of the Technological Educational Institute (TEI) of Crete and cohoused with the Experimental Gymnasium of Heraklion (EG-Her), the Experimental Lyceum of Heraklion (EL-Her) and the 1st Public Institute of Vocational Training of Heraklion (PIVT-Her) which, occasionally, share the infrastructure. In the premises belong many offices, classrooms for 30 trainers, stores, toilets, and an amphitheater of 180 sites, a Science Laboratory (Sci-Lab) with 24 work positions and two Computer Laboratories with 30 PCs. In the Computer Laboratories operate training programs applied by the School Advisors and the Center of Training Advising which carries out training programs of the Greek Institute of Computer Technology.

Educational venues are undoubtedly places with special requirements because students spend inside many hours of the day. It is important that the spaces are well structured and functional, as well as predisposing children to work in and out of these spaces. The labs has been extensively studied, for the last few decades in the context of school architecture, and has been the subject of numerous surveys. In Greece, while the importance of their proper formation has been highlighted, the steps of changing and rearranging laboratory spaces are proceeding very slowly (Andromida et al, 2017). According to the same study, the RTC-Her is a typical example of school space, in which the laboratory space was not properly formed. It is characterized by the wrong dimension of the rooms, small storage spaces, no provision for adequate ventilation, poor room brightness, limited teaching instruments, results that emerged through a short research that carried out on the existing state of the spaces.

More specific, Science teaching must be able to combine the student's interest and, on the other hand, to incorporate fundamental scientific ideas to support the learning of Nature. Particular emphasis should be given by the learners to their own scientific study, in recognizing relevance to their life, which is associated with the use of materials from everyday life, quality of life and in relation with the rest life in the planet. In this logic, cannot stand the separation of practice-theory, nor the logic of making the students experiments following instructions. In the discovery model of teaching, which in addition to knowledge, cultivates and skills, students do not follow instructions but formulate and control assumptions, handle variables, etc. (Kumaras, 2013). In extension of this perception of learning, furthermore in the adult life, work-based learning refers to knowledge and skills acquired through carrying out and reflecting on tasks practical way, in a vocational context, either at the workplace or in a VET institution. Work-based learning has been a high policy priority at European level in the period 2011-2020, having the thought that apprenticeships, internships and volunteering cross educational sectors and can take place, also, outside of educational sectors (Broek et al, 2017). The total number of interns in a given year is estimated to lie between 4 and 6 million, approximately one in every two EU citizens aged 15-35 has enrolled in at least one internship in their life, and one young European in four has engaged in voluntary activities. Apprenticeships, internships, traineeships and volunteering allows individuals to document their practical work experience as part of developing their CVs, and/or as requested in educational curricula, or to gain work experience for the purpose of facilitating the transition from education and training to the labor market. For this purpose, to provide a proxy of the weight of the apprenticeships, internships and volunteering, the participation is compared to the total number of annual newly enrolled EU students, so it is estimated that work-based learning plays an important role in the skills development of young people.

The legislation referred to the Sci-Labs of RTCs is poor, they function under the Law 2009/1992 and the Presidential Degree (PD) 250/1992. Article 14 of PD 250/1992 which are about the support of training activity in RTCs by organizing and operation of Libraries, Workshops, and Laboratories. According to the articles 10 and 11 of the PD 250/1992, the Coordinating Council of RTC identifies the needs in infrastructure and other equipment and make the necessary administrative steps to address them. The Director is responsible for the maintenance and repair of the teaching staff, the furniture and utensils of RTC, as well as for the

procurement of the necessary equipment, supervisory instruments and any other necessary material.

The purpose of the restructuring was to be concentrated the great variety of devices and utensils, some of them in large quantities, some in poor condition and scattered in many places in the Lab and the store, to catalogue and re-restore them in a constructive way. It aimed, also, a portion from the collected material to become a Museum collection. Students in internship and teachers volunteers supported the initiative, of which part was the creation of a Museum Collection of devices used in the Science laboratorial teaching of the previous half century, to prepare appropriately for educational exploitation in the future.

The re-organized Sci-Lab can function in the modern era of Science Teaching and Training, and promote changes in the traditional Science teaching of schools of Crete, in safe and well-equipped environment. The renovated teaching environment, with the old long benches and the new workplaces in the Sci-Lab, supported by wireless internet, interactive whiteboard, laptops, web-camera and portable phone, opens the Sci-Lab to the educational community, able to materialize real and virtual experiments, exploiting the well-organized experimental equipment, and broadcast them through televisual and conferences, training, re-training and educational initiatives to the educational community of Crete. Students in internship and teachers volunteers supported the initiative, of which part was, also, the creation of a Museum Collection for the Science laboratorial teaching with educational exploitation in the future.

METHOD

The paper is a personal narration of the new appointed Director of the Regional Training Center of Heraklion (RTC-Her) who undertook the initiative to restructure the infrastructure and layout the premises, particularly the Science Laboratory (Sci-Lab) as her specialty was Biologist and had very good experience in laboratorial use from her doctoral studies, and as woman who sought the tidiness. The purpose of this study is to highlight and clarify the activities of the esthetic and functional interventions that took place in the Sci-Lab of the RTC-Her during the restructuring in the school year 2016-2017.

For the monitoring of the project, there were taken many photos in different dates, recording the existing situation and the ongoing restructuring procedure. Many notices and notifications helped the involved persons to restructure the equipment and, in the end, the concentrated material to be recorded in EXCEL sheets and placed in cabinets, cupboards and boxes inside the Sci-Lab and the warehouse. Photos and texts constituted the archival material, which was examined with content analysis (Bird et al, 1999). The research categories were located by the progress of the analysis of data, depending on the subjects negotiated in the particular thematic areas of the project, progressively constructing and reconstructing of the exploring data. The research method of case study allowed the detection, evaluation and assessment of the design, the detailed description of the educational activities, the objectives initially set, and the way they were achieved (Cohen & Manion, 1994; Bell, 1997). The study contributes to the understanding of the framework, the procedures, and the target of the undertaken initiative by focusing the following categories: i. The purpose of the initiative, ii. Description of the Sci-Lab, iii. Study for the renovation of Sci-Lab, iv. Museum collection of the

old science laboratorial instruments, v. The study for the museum collection of Sci-Lab, vi. The restructuring phases-monitoring of works, vii. Volunteering and Internship support.

With this study is clarified and revealed the whole effort in details, with the hope to be useful as a good practice for those who intend to undertake similar initiatives in the future. The results of the study are presented with texts and photo galleries, in the website of the RTC-Her initiatives (<https://pekherinitiatives.wordpress.com/science-laboratory/>). In the study included also parts of the Studies-Proposals drawn Andromida M. et al (2017) and Kalathaki M. (2016) for the renovation of the Sci-Lab and the creation of Museum Collection. The very well-kept updated and neat archive of RTC-Her and the constructive way of reforming, in combination with the expertizing in the subject teachers volunteers, and the help of the students in internship, ensured a comfortable and effective work in a difficult project.

RESULTS AND DISCUSSION

THE PURPOSE OF THE INITIATIVE

The Director of the Regional Training Center of Heraklion (RTC-Her) undertook the initiative in October of 2016 to restructure the infrastructure and layout the premises, in particular the Science Laboratory (Sci-Lab). Restructuring a Science Training Laboratory is a multifactorial issue, which falls within the director's general administrative duties, as well as the duties of those who undertake the operation and the use. According to the article 10 of the Presidential Decree 250/10.08.1992, the Director of the RTC carries out the maintenance and repair of the building, the furniture and utensils, ensuring that any expenditure related to the operation of the RTC is paid. The EG-Her and the 1st PIVT-Her, after the concession of the Lab's use, appoint a responsible teacher for each school year, but, without clearly defined obligations. With the official document (protocol 212/14-12-2016 of RTC-Her), the Director asked for volunteers from the scientific and education community of Crete, and elsewhere, in order to reorganize the Sci-Lab so that it can support 21st century schools and training programs, with the additional aim, that the whole project to become a good practice and dissemination source of expertise in schools. The Sci-Lab of the RTC-Her is invited to design and propose experimental approaches of scientific notions and mechanism of Nature, since the school curricula are based on inductive theories, and students are introduced to scientific theories through their observations, experiences and experiments as safe foundations of scientific knowledge. The approach of scientific knowledge in schools is through an oscillational induction and non-induction approaching that theories should be considered justified only to the extent that they can be induced by the safe observational foundation and that the radical distinction between observation and theory is impossible, since observation, the expressions arising from observation, are permeated by theory (Chalmers, 1992).

As the Sci-Lab was limited used for training activities by the RTC during the last ten years, the previous Administration ceded the use to the EG-Her and the 1st PIVT-Her, as they housed in the same building with the RTC-Her. The target of the initiative was the aesthetic and functional upgrading of the Sci-Lab with limited and inexpensive interventions, initiative that could be useful and exemplary to Science Teachers, and could motivate and inspire to rebuild the

school science laboratories so they can host more modern teachings. Some educational systems in Europe give particular emphasis on leaders and school leadership that determine the pace and direction of change, facilitate open communication, encourage creative thinking and innovation, motivate staff and students for greater successes and operate as example, first by applying the principle of lifelong learning (EC, 2007). Re-use is goal of Sustainable Development. In the new EU house, part of the former Residence Palace, the walls wrapped around the new north-eastern corner of the building include a patchwork of 3,750 recycled window frames that come from renovations or demolition of buildings across Europe (ENB, 2017). Architects explained that the new façade is a statement, in practical and philosophical level, about the re-use of these traditional building materials, expressing the European variety of cultures.

DESCRIPTION OF THE SCIENCE LABORATORY

The Sci-Lab of the RTC-Her is situated in the ground floor, on the left of the entrance, consisting of three spaces, one central for the experiments and two others, the Preparatory Rooms of Physics and Chemistry. The floor is covered with beige marble in rectangular plates about 1 meter, without a joint. On the roof there are three rows of about 9 sconces in each row. There are several offices around the room, with cabinets (metallic libraries/stands) with laboratory equipment.

The Central area is rectangular 9X3,59m, with one long side fully covered with windows, which they start from the height of 1.00m up to the ceiling. In front of them are placed metallic libraries/ display stands (1.20X1.60X0.40m) with old laboratorial instruments, some of them as a Museum Exhibition. On a wall is hanging a white board marker. There are a pharmacy box, and fire extinguishers of dry ice and dust.

In the central area, there are two long benches 5X1,50m with 24 work positions of 1 m² each, with 2 drawers and 1 cupboard. Each position has supply of water and gas with alarm system. At the beginning of work benches there are sinks with cupboard for cleaning the equipment 0,40cm. The surface of the benches is covered with beige rectangular glossy tile. Mounted on each bench, there is a parallel glass shelf, 20 cm wide, raised 70 cm above, which offers more surface for utensils and instruments and have also the gas and water plugs.

On either side of the central space there are two rectangular rooms with dimensions 3,70X7,25m each, the Preparatory Rooms of Physics and Chemistry, equipped by the laboratory instruments and utensils of Biology, Chemistry and Physics. Each one has a large window and many metallic libraries/ display stands in front of the walls, a long bench and wheelchairs, an interactive whiteboard marker, internet and telephone connection. The chairs, the tables and desks, and the metallic libraries, which were scattered on the premises of the RTC, transported to the Preparatory Rooms of Physics and Chemistry, creating new work places. In this way, the Preparatory Rooms have double use, as they, additionally, transformed into spaces for teamwork with 15 workplaces each, with good technological and electronic infrastructure capable, also, for remotely performing of laboratory training exercises.

STUDY FOR THE RENOVATION OF SCI-LAB

The Study-Proposal drawn by the 1st PIVT with 6 chapters, as follows: Chapter 1: Historical retrospection of the school building in Greece: School in Greece at the beginning of the 20th century, The 1930s and Modernism, The school building in postwar Greece, The period from the 1960s to today, The school architecture In modern times. Chapter 2: Natural Sciences Laboratories in Modern Schools: The role of laboratories in the school environment, The role of laboratories in the learning process, Specifications for the proper functioning of the Laboratory of Physical Sciences, Laboratory Equipment: Room and Environmental Requirements, Specifications for Access for Persons with Disabilities, Evaluation of Selected Physics Laboratories. Chapter 3: Examples of Modern Physics Laboratories: Modern Laboratories of Physical Sciences in Greece and Abroad. Chapter 4: The existing situation of the Laboratory of Physical Sciences (area, sheltered educational institutions, brief historical review, the building site, the purpose of the educational institutions, their activities and functions, description of the workshop, description of the eastern and western rooms. Chapter 5: Proposed Formulation of the Physics Laboratory and of the two connected halls (Factories). Chapter 6: Conclusions. In Annex there are floor plans and cuts and photorealistic drawings of the Laboratory and the Refineries (Andromida et al, 2017).

The proposing solutions developed in the context of improving the current situation, regarding surfaces, spaces, and the interior of the halls and took into account the characteristics of the environment around, the characteristics of the building, the use also as school, as well as the probable needs of students, teachers, and trainers. The ultimate aim of the study was to create models imitation in the educational community, to adopt new attitudes, views and habits, to ensure the proper operation and usability of the premises.

The referred in the Study disadvantages of space are many, below are listed some: The central space is not functional and there is a sense of disorganization, with stacks of furniture, so the space diminishes enough, with no clear point of reference. There are no functional furniture to place the utensils and devices, instead there are old, bulky, with small openings, dull colors, giving a claustrophobic character in space. With them is lost the feeling of harmony and order. A very significant disadvantage of spaces is the light, which does not properly channeled into space because the windows are located on the southeastern side of the building and the construction reflect the radius of light on the floor and creates blurring, phenomenon which does not promote the smooth running of the experiments and courses in general. There is not, also, the necessary ventilation in spaces.

In the preparatory room of Chemistry, the light that emerges from the glass blocks serves its purpose only when presentations are made, but is inappropriate for teaching and other activities. Also, the two washbasins and the large work bench occupy much of the space there.

In the preparatory room of Physics, the metallic libraries are bulky, dark and monochrome, with no ergonomic layout, resulting, also, in the claustrophobic character of the space. The lighting is very intense and has not been studied necessary shading of space.

In the study are listed many proposals for improving the existing situation of the Sci-Lab, some of them are below summarized. The floor meets the requirements for its proper operation workshop. The marble slabs used could be polished and passed with a leach-protecting material in order to lose its absorbent property. White color is suggested ideally for the walls, used like a

canvas for a neon plant, to avoid confusion in the eye. Also white color works as a good conductor of heat. In addition, it gives the room a sense of cleanliness, which is essential for laboratory premises. The western wall will become the reference point of the central space, for this reason it will be dyed black and it will act as a message and teaching board.

The permanent built-in cabinets of the central space will remain as they are, except that their exterior will be dyed gray to give a depth and a delimitation of the window, adding colored glass. The permanent built-in cabinets in the preparatory rooms can in the interior will become blue, with a neutralized gray, and the knobs will be painted in peach (orange) color. The selected colors blue-gray-orange represent Science (blue), Neutrality (gray) and Contrast (blue the orange). The cabinets could, also, be dyed blue-red-yellow, the three basic colors, alternately in each of the six doors each one has.

On the walls is proposed to covered with wallpapers with Einstein's quote in gray and black letters, irregular geometric shapes (triangle, square, circle) and rays (vertical, horizontal, oblique lines). On the eastern wall of the central hall will be a biological concept's installation with a 'molecular structure', of transparent Plexiglas, where various decorative elements will be placed on it, as flowers, bottles, photos, etc. Below the installation, in peach color, will be used as storage and exhibition of experimental objects. On the western wall of the Preparatory Room of Physics will be added square boxes with asymmetrical layout (peach-wood color).

The technical lighting will remain the same, with the required repairs, because it meets the requirements of adequate illumination of a laboratory room. Indoor plants (*Spathiflora*) will placed, which is said that clean the air and for it used very often in offices.

MUSEUM COLLECTION WITH THE OLD SCIENCE LABORATORIAL INSTRUMENTS

The Sci-Lab was established in 1970 around, funded by the International Bank, for the educational needs of Teacher Academy of Crete. The Laboratory, from the beginning, constituted by the central area, the two Preparatory Rooms of Physics and Chemistry and the jointed Amphitheatre, inside of which, there was a long bench with ceramic brick material, for demonstrating scientific experiments to large audiences. The Sci-Lab was very well equipped by the Greek Pedagogical Institute and the Ministry of Education. Historical data regarding the Sci-Lab is concentrated from any available source, mainly from discussions with its 1st Head, now old Physician, Specific Associate Professor of the Pedagogical Institute, who significantly enlightened the creation and the past training activity of Sci-Lab, additionally to the photo collection of 2005, the notes and the slide presentations that he had collected, cultural goods that need protection.

A great variety of devices and utensils, some of them in large quantities, were scattered in the Science Lab and the store of the RTC-Her. There were recorded 23 different glass and porcelain utensil for Chemistry experiments. A portion from the collected material, placed in lockers with glass frontage, in a constructed way, in order to be exploited in the future training and educational experiments, some were concentrated in boxes in the store, and a few, the oldest and most representative, were placed in exhibition stands inside the Preparatory Rooms. The old projector machines exposed in special metallic libraries/display stands in the Sci-Lab, hoping in

the future to be able to re-operate as exhibition event. In the metallic libraries and cupboards, discovered the old Laboratory Events' Book and the Laboratory Material Book, which we scanned and transformed into pdf's format. Another important finding was a photo collection in CD-ROM shows the Science Laboratory on duty in January 2005, probably the last year with training programs reach in experiments for Science teachers of Secondary Education of Heraklion. The photos are uploaded on the website of the RTC-Her initiatives (<https://pekherinitiatives.wordpress.com/science-laboratory/>). The collected, scattered in various places, slides, videocassettes, films, CDs and DVDs, which was the used audiovisual educational and training material in the last 50 years in Teachers' training, organized and catalogued in Excel files, and stored in the Library. Audio resources can help students and trainees develop listening skills and encourage imaginative responses to narratives and fantasy. In 1998, Hollins refers that their use in science was very limited and there were no broadcast programmes for schools in the subject, and very few tapes available. Today, there are abundant collections of certified and guaranteed educational material for any teaching subject in digital form, and most of them of free access in internet. All the printed material concentrated also, such as manuals for the laboratory devices, manuscripts of the science protocols, training worksheets, notes, etc. and placed in the newly created Library of Didactics and Pedagogy of the RTC-Her.

The exhibition, "Industrial Heritage in Greece, 1980-2015 - Conservation, Research, and Education", explored the 30-year dynamic course of discovery, documentation, conservation, re-use and revival of the latest remnants of our technical culture. It developed at all levels of education, and in the wealth of museums and archives, efforts to rescue and revive historical machines, technique, and memory of work. The research into the historical and technical treasure for the preparing of that exhibition had been enriched, flourished and expanded thanks to the persistent work of volunteer scientists from local initiatives and scientific institutions, as in the preparation of the Sci-Lab's Museum Collection (DT, 2015).

Many teachers, with very good knowledge and experience in the laboratorial science teaching, who helped in the restructuring, explored the devices and the appliances, parts of which were found in various places in the Lab, and impressed with the emerged treasure, unknown to the current educational community of Crete. It is a cultural heritage, similar to that remains dusty in many school laboratories of Primary and Secondary schools, and it is a challenge for the local educational communities to save and highlight it, also teaching students with this. Students' grandparents and parents will be very interested into re-live ways of teaching of their school years that will awaken memories and joys, and can begin correlations and reflections on the used and modern teaching methodology. The traditional perception of public libraries has been associated with books and culture exclusively and, with the advent of the internet and digital media, public libraries as institutions are quite often described as outdated and no longer relevant. Today there is a trend in upgrading the role of libraries and make them much broader than to merely store information, to be closer to the Laboratories' older conceptual and operational framework. They have become one-stop-shops for informal learning and knowledge, and they have had to continuously develop new services that exploit the possibilities of digital interactivity. With their wide range of services to all citizens, public libraries offer chances for innovation and for inclusion and integration as well (Lison et al, 2016). Local authorities face

enormous challenges regarding current social, technical and economic change in order to make their communities fit for future developments. These challenges mainly rise from the increase of economic and social inequalities, from the transformation of workplaces and jobs, from the emerging digital society, from demographic change, from climate change and much more and can contribute to the social integration and cohesion.

THE STUDY FOR THE MUSEUM COLLECTION OF SCI-LAB

The study for Museum Collection of Sci-Lab in the RTC-Her drawn by the Director and submitted, with an official letter to the Ministry of Culture (with protocol number 128/1-11-2016), who was the previous Minister of Education, requesting financial support (Kalathaki, 2016). It was about the funding of a School-Science Museum Collection with the old laboratorial instruments used in Science teaching and training in the last half of previous century. The purpose was the conservation of the science-educational heritage of Crete. The study was drafted after discussing with the Heads of the Science Laboratory Centers of Crete and retired Science teachers, with the advices of the Director of N Kazantzakis Museum in Myrtia, Crete.

The planned Museum Collection in the Sci-Lab of the RTC-Her will not be a Museum with the static and past-term sense of the notion, but it will have all the dynamism of Education for progress and evolution, since intended to open into all three levels of Education of the island of Crete, so that students, teachers, educators and trainers from Primary and Secondary Schools, the University of Crete, the Technological and Educational Institute of Crete, the Research Technology Foundation Hellas, Municipalities, Institutions for Vocation and Training and citizens benefit from that. Many people will support the initiative in any convenient way, since all have memories from their early ages studies and teachings with the old laboratorial, and share the common vision to expose them and show to the next generations, in the cultural field of History and Philosophy of Science. Many examples have been given about how the history and philosophy of Natural Sciences can contribute to a better, more comprehensible, encouraging and critical teaching of concepts to increase student participation. Teachers as professionals need to have knowledge of the history and philosophy of the natural sciences, regardless of whether this knowledge is used directly in the classroom, as a wider culture than those of the curricula, as John Dewey says, they introduce their students in an intellectual discussion of humanity. The crisis in science teaching that has been repeatedly declared, the analysis of the causes that led to it, and the proposals for its restoration, lead to the conclusion that it is necessary teachings to be enriched with elements from history and philosophy (Matthews, 1994).

The initiative will, also, act as a pilot and modeling tool to the Science Laboratory Centers to develop analogue initiatives in their premises and to help schools of their prefectures to develop their own, saving cultural heritage in Science Education, which has been largely lost, saving that can still. For these reasons, we kindly asked from the Physician Minister of Culture to give a little money to save some of the educational culture in Sciences that we found in the Sci-Lab of Heraklion, relying on his emotion and logic. It was also applied a request to the "EduLabs-Open Label Technology Innovation Program", guided by the Greek Ministry of Education, to include the Sci-Lab of RTC-Her in the beneficiaries of the Program. RTC-Her can

pioneer other RTCs in Greece who are interested in doing so as it intends to disseminate the whole project through conferences, workshops and uploading on the RTC-Her webpage.

The content of the Museum Collection is planned to be digitized and posted on a special website, so to be useful to everyone is interesting in the subject. It can also be incorporated into wider Lifelong Learning Programs that RTC-Her or other organizations may materialize in the future. Teachers participating in the establishment of this Collection will be practiced in the laboratory teaching of the Science in schools by using and classifying old and modern laboratorial devices and instruments, testing protocols and recording observations from the two points of view. Retired Science teachers have been activated to offer their knowledge and experience, remembering the old teaching methodologies and tools, reliving the past in the future. The students and teachers of the co-operating Experimental Schools and the 1st PIVT of Heraklion, together with Professors from Higher Education, Architectures, Decorators and other Experts, in jointed works, can deposit ideas and aspects and then undertake to implement the final decision and make reality the design and the plans. They also could undertake the conversions, repairs, microstructures of the existing equipment, in showcases and storages, in the Museum exhibition.

RESTRUCTURING PHASES AND MONITORING OF WORKS

The renovation of the science laboratories and preparation area was rated as high priority on the RTC-Her master plan in 2016. The plan for the renovations was to re-purpose up to the laboratory spaces and the rest spaces of the building, in order all together to be able to support future educational and training collaborative activities carrying out by the three level of Education in Crete. Many Universities and Institutes has upgraded their Science Laboratories under a project management (VT, 2018). In Wright State University, the facility contained a unique teaching facility for the science teacher education program on the first floor, the rehabilitation of Oelman Hall with upgrading to the building infrastructure and creation of new general classrooms, teaching labs, an Earth and Environmental Sciences computer lab and upgraded Chemistry research facilities. The project management included assurance of quality construction through on-site management, compliance with plans, specifications and building codes, and the management of project budgets and schedules (WSU, 2018). Given the practical nature of investigative and experimental science, it is a key area of importance, and one which will consume most time, effort and money. Effective management of materials and equipment by the Sci-Labs' coordinators can show very good returns in both staff and learners (Hollins, 1998).

The construction and renovation manager of a science lab has to accept that there will be problems regarding the lab design, construction or renovation, and be prepared to be flexible and cooperative in finding solutions that do not compromise safety, budget, scheduling and quality. As Headrick K (2010) writes in his article, many published articles are aimed more at architects and engineers rather than the non-specialist lab manager and he is not aware of any relevant articles written from a lab manager's perspective. Also, there is no formal training available about the lab manager facing in a lab construction or renovation. The lab manager needs to keep a close eye on all aspects of the project, should scrutinize the various user needs, scope of work, engineering, tender, purchase order, construction, as-built blueprints, and other documents, as

errors in any of these may adversely affect the success of the project. The quality and quantity of the output from a lab is dependent on the technical training of its staff, as well as the management skills and training of the supervisors and managers.

The project for the restructuring of Science Lab's started in October 2016 with the photographical record of the existing situation and continued in school year 2017-2018, with the main efforts in the winter of 2016-2017 and the finalizing phase in the summer of 2017. In the first phase, it tried to be separated the useful from the useless things, because, as the years passed and the Lab was being used less and less, it had been un-functional with accumulating various material. With the volunteering support of the Heads of the Science Laboratory Centers and Science teachers of Chania, Heraklion and Rethymnon, all the material gathered, cleaned, separated, grouped and stored together. The large quantities of the same appliances, utensils and materials, scattered in different shelves of the three areas of the lab, also in the old toilets which had been converted into a warehouse for laboratory and electronic damaged and useless equipment of RTC and EL-Her, were deposited in large boxes in the warehouse, which cleaned and reformatted to meet the current needs. The rest equipment, representative of each type and category, was put in metallic libraries/display stands shelves, and in the cupboards under the two long laboratorial benches, spread in the three areas of the Science Lab. Continually, the works and the material were photographed, recorded on Excel file in their new positions with indicating labels on the frontages of the cupboards, cabinets and boxes, making them easy to access and convenient to use in the future.

An important issue that concerned the reorganization of the Sci-Lab, and the whole RTC-Her, was the Safety with electricity, gas supply, chemicals storage, fire and the Pharmacy. Discussions with expertise and bibliographic research carried out in order to clarify the legal status governing the operation with safety of training and educational halls and to plan the renovation. In consultation with the Head of Science Laboratory Center of Heraklion, removed the expired, useless and dangerous chemical reagents from the Chemistry Chamber, which had either been tampered with, damaged or lacked a label for their identification. The safety of occupants in a chemical laboratory building, the requirements for storage of chemicals in stockrooms and laboratories and compliance with environmental regulations can be improved by providing dedicated and appropriately designed space for storage of chemicals, hazardous waste, and emergency equipment (3 Technical Issues, 2000). A careful review of all requirements by the project team is needed to ensure an adequate design for chemical storage space and to safeguard this space against re-appropriation to other functions.

For the monitoring of the works, notes and notifications were kept and shared among the involved. A large number of photos, 640 in totally, recorded the restructuring, from the beginning and the ongoing works. There were taken 404 photos of the central space on 16th different dates, starting from 12th October 2016 and ending on 24th of August 2017. 134 photos recorded the existing situation and the ongoing restructuring procedure of the Preparatory Room of Chemistry, in 11 different dates, starting from 20th of October 2016 and ending on 9th of August 2017. As for the Preparatory Room of Physics, there were 102 photo records in 10 different dates, starting on 20th of October 2016 and ending on 9th of August 2017. After all the equipment was placed in boxes, in metallic stands, and cupboards, it photographed, recorded in

Excel files, and placed labels in front to make them easy and convenient to use in the future. A clear labelling and recording system which shows where an item is kept, when it is to be used and how it is to be looked after or replenished advances planning of topics and enables realistic budgets to be compiled, and can allow a longer-term strategy for the purchase of equipment (Hollins, 1998). More than 150 different equipment recorded by the internship students in EXCEL files. The photo gallery, available in internet, reveals significant details of the project for restructuring of the Sci-Lab of RTC-Her, in the Central Hall, the Preparatory Rooms of Physics and Chemistry, the Library and Warehouse, useful for more deepen study and to motivate school directors to restructure their school Sci-Labs, (<https://wp.me/P8OefN-2U>).

The reorganization of infrastructure has not yet finished and many ideas are often emerged about the educational and training exploitation, renovation, and reforming.

VOLUNTEERING AND INTERNSHIP SUPPORT

In the years of economic crisis, the voluntary support to Education is the best solution and a secure gate to progress. Waiting state funding for any strategic plan in educational Institutions is usually futile, since many are those who expect financing for various activities and initiatives. Inadequate economical support of education and training finally drives to slow of the growth and removes the hope for a better, more auspicious tomorrow in local communities and the country in general. As there was not any appropriate way for state funding in RTC-Her in 2017, it was asked help from relatives, friends and teachers to contribute as much as they could to the project for the reorganization of the RTC-Her, especially the Sci-Lab. Many people responded to the request for help, 35 persons from Heraklion, Rethymnon and Chania prefectures offered volunteering work in this project, 10 of them were teachers and the rest were 2 Architects, 1 Decorator, 18 students of the 1st PIVT-Her, the Cleaner woman of the RTC, the two secretaries and, occasionally, some students of the co-housed EL-Her and 1st PIVT. Also, two workers helped in transporting the heavy metallic stands and devices. In the beginning, an email were sent to the schools via the 4 Administrations of Secondary Education of Crete (Chania, Rethymnon, Heraklion, Lasithi) but only three persons responded to the request for voluntary offering work in the reforming of the Sci-Lab of RTC-Her. Nevertheless, all the people, who received personal request face to face from the Director, responded directly and helped much.

The students of the Sector 'Interior Architecture Decoration and Object Design' of the co-housed 1st PIVT, under the guidance of their educator Architect, undertook to carry out a study and make proposals on the conformation of the Science Lab, the corridors and the canteen, incorporating the project in the semester courses. They worked from October 2016 to June 2017 weekly, in teams, measured the spaces, designed the top views, made a small survey on how a science laboratory must be, and finally in June, they presented the results to the educational community of the building. Also, the support of the internship students coming from the 1st PIVT-Her was significant, with reciprocal value to themselves, since internship provides the platform for students to touch authentic context as they learn to face random matters which less likely happen during their traditional theory study. So, internship plays key role in pulling and

pushing the combination of two kinds of knowledge and in this way, the whole knowledge structure contains theoretical and practical parts (Yong, 2012).

In the restructured Sci-Lab took place also many training and educational actions. The morning session at 9 of December 2017 of the Educational Conference “Teaching Sciences in Schools with Creativity and Innovation: Transforming the Theory into Practice”, which held in Crete 6-11 December 2017, the Science Laboratory for ‘Natural Remedies’ at 24 June 2017 where Science teachers from Chania prepared liqueurs, soaps, ointments and toothpaste, also, the Experiential Laboratory "Creating a culture of lifelong learning: tools, techniques, values" during the visit of Lithuania VET Teachers at 10 April 2017. In collaboration with three Science teachers of the Experimental Lyceum of Heraklion and a Professor of the University of Ioannina conducted educational research in graduate students within the framework of the International Program ‘Views About Scientific Inquiry’ (VASI). Through the school Years 2016-2018 lessons of the 1st PIVT in the Project ‘Functional & Aesthetic Interventions in the Science Lab of RTC-HER’ and in the course of ‘Art Restoration’ were carried in the Sci-Lab. Through the RTC-Her YouTube Channel materialized the first trial with demonstration experiments on Static Electricity by the old Physician 1st Head of the Sci-Lab, opening the Sci-Lab to the Web.

EPILOGUE

Discussions for future collaborations and partnerships in the field of Science Education and Teacher Training, according to the European Union’s Strategies and the international standard and trends, have developed and are ongoing, with the cohousing educational institutes, the Natural History Museum of Crete, the Creta Aquarium ‘Thalassocosmos’, the Technological and Educational Institute of Crete, with Institutes of the Foundation of Research & Technology Hellas (FORTH) and departments of the University of Crete, the Educational Support Structures of the Regional Administration of Primary and Secondary Education of Crete, etc. Teachers benefit from partnerships with universities by being in contact with applied research and, in consequence, they improve their skills particularly with regard to teaching science in specific contexts. In fact, collaborating with businesses or university science departments can support inquiry-based learning and discovery teachings. Not only do teachers have access to more resources and materials for their inquiry-based activities, but through the partnerships they can also become agents for instigating changes in teaching approaches within their schools (EACEA, 2011).

Sci-Lab can develop various opportunities to participate in various scientific activities such as talks, exhibitions, competitions, visits to research centers, laboratories, workshops, conferences and seminars for teachers, many cultural and artistic events, opening the space to the world around. It can function, in the modern era of Science Teaching and Training, to promote changes in the traditional Science teaching of schools, so that it can support 21st century schools to teach the Science courses with more attractive and effective way, in real and virtual environments, live and remotely, with interdisciplinary approaches, keeping the values from the past and open to the future challenges (AD, 2016).

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