

# Scientific Research Projects in Vocational Training Schools

Zita Esteves(1,2), Manuel F. M. Costa(2)

(1)Externato Maria Auxiliadora Avenida S. João Bosco, 365, 4900-896 Viana do Castelo, Portugal. [zita.esteves@gmail.com](mailto:zita.esteves@gmail.com),

(2)Departamento de Física, Universidade do Minho Campus de Gualtar, 4710-057 Braga, Portugal. [mfcosta@fisica.uminho.pt](mailto:mfcosta@fisica.uminho.pt)

**Abstract.** *Vocational schools are a resource for many students, with usually low motivation and high learning difficulties. The fact that this type of teaching is of a more practical, experimental, and job oriented type, points to teaching strategies less theoretical and focus on a more practical student involvement.*

*Profiting from those characteristics, the study of the use of scientific projects on vocational teaching was initiated. It was proposed to vocational school students, high-school equivalent students, the development of small science projects in the subjects of physics and chemistry with the final objective of being presented.*

*The difficulty level of the science projects was increased progressively, in a way to be correctly adapted to this type of teaching. Learning gains were evaluated through questionnaires and tests presented at different stages of the learning process.*

**Keywords.** Science projects, Vocational training.

## 1. Introduction

Vocational training schools have as primary goal to promote an alternative curriculum to students, giving them the opportunity to acquire a higher level of education and professional qualification. This kind of teaching is in fact oriented to the direct integration of the students on the labour market. The curriculum is prepared according the type of course [1].

There are a wide variety of vocational training courses in Portugal [1,2]. In the official report [1] the courses are divided into:

- Vocational Courses, aimed to insertion of students on the labour market but also allowing the continuation of their studies.
- Learning Courses, strengthening the involvement of companies where students have internship periods in parallel with their studies.

- Education and Formation Courses, aimed preferentially to students older than 15 years and in risk of dropping out from school, that already dropout or, students that already complete high school and want to acquire professional qualifications.

- Courses in Specialized Art Education, based on visual arts and audiovisual programs in domains like dance and music.

- Education and Training of adults, with different school levels oriented to already working students and prepared to certify particular skills. The technical and vocational teaching in Portugal began on the XVIII century, but only on the XIX century it had a greater development due the necessity of qualified labour workforce upon the Industrial Revolution [3].

For this reason, this different area of teaching was created. It was called the technical-professional teaching aiming to qualify people for the labour market. This teaching promoted the manual dexterity and developed the know-how instead of the theoretical scientific and humanistic knowledge normally taught at regular schools [3].

However, despite these intentions, the fact that these courses do not allow further education at university's level, made them only frequented by students from poor families, from rural zones or by students with learning difficulties [3].

The failure of this approach became soon evident. Since then, several changes were implemented, allowing, for instance, the entry of these students into the university. However, studies reveal that the students attending these vocational schools remain the same [3].

Currently, besides trying to qualify the labour force, these courses seek to minimize the scholar failure an increase the level of literacy of the Portuguese population [1,3], and to promote the articulation between education, training and society, leading to a more significant teaching [1]. For that, the government wants to involve others institutions like universities with the vocational teaching [1,3].

## 2. The Project Developed

The work herein reported was made on “Education and Formation Courses” and “Learning Courses”.

Most of the times, students registered in vocational training schools reveal major difficulties and no motivation to study [4].

The youngest students, from Education and Formation Courses, were in risk of dropping out from school [2] for different reasons, such as learning difficulties and/or problems with classroom behaviour.

The second group, from Learning Courses, consists of students that already completed the mandatory scholarship, i.e., the first nine years of school, but also want follow their studies [2]. Two types of students are found on these classes: those that already have work experience and need specialization in some particular field, and

others that have difficulties in achieving regular school objectives and choose a vocational track.

In both cases physics and chemistry subjects are part of the scientific and technological component of the courses. Since many students cannot find any relation between these subjects and the course practical curriculum [4], it is important to remember them that the idea is not only to be specialized on a specific area but also obtaining the basics of a good education [2,4].

Therefore, this type of teaching should be based on practice with only a minimum of theoretical background [4]. The lack of resources like chemistry labs or materials makes this task more difficult.

The Table 1 shows some of the skills that should be developed during the vocational courses and that can be facilitated by the development of scientific projects for the students during classes.

Competencies to Developed	Stages of Development
<ul style="list-style-type: none"> <li>- Documents Analyses.</li> <li>- Research of different information sources.</li> <li>- Data collection, selection and organization.</li> <li>- Formulate hypotheses.</li> <li>- Observation of experiences.</li> <li>- Confrontation of ideas and argumentation.</li> <li>- Propose solutions to solve problems.</li> <li>- Present papers and answer questions.</li> <li>- Capability of presenting ideas, oral and writing.</li> </ul>	<ul style="list-style-type: none"> <li>- Subject selection</li> <li>- Project Development</li> <li>- Presentation</li> </ul>

**Table 1 . Some skills to be developed in vocational courses [5] in different phases of the development of scientific projects [6,7]**

The main objective of the development of these skills is to promote the scientific knowledge and, therefore, a better comprehension of the natural world [5].

The contribution of different subjects should be valued because it will allow students to feel the importance of different subjects in their knowledge construction. Furthermore, we expect to promote teaching techniques that develop the willingness to learn.

## 3. First Case study: Middle school students

The first case that we present here was done with students of Education and Formation Courses. This class had initially 17 students, 10 boys and 7 girls, and the majority of these students were older than 15 years old. During the course 5 students dropped out for different reasons but mainly due to family problems. Three other students were expelled from the course by the teachers' council due to their large amount of faults in classes. Mainly this situation happened due to the inappropriate behaviour of these students. They didn't respect their teacher's rules and none of the strategies applied seems to have worked on them, and on the other hands they

also hindered their colleagues learning. Therefore, at the time of this project, the class only had 9 students.

This project, that will be described, were developed as an interdisciplinary field named “Energy and Environment” that was presented at the “open week”<sup>1</sup>, were many students from others school visit the training center. Here, students have constructed a small city reusing garbage, like newspapers, milk cartoons... as is possible to see on Figure 1.



**Figure 1 - Project developed by the students**

Student’s committed involvement during the construction of this healthy city, without pollution and using only renewable energies, was evident. They worked during class time but also during breaks, which is quite unusual in this kind of students with major behavioural problems and learning difficulties.

During this work we also asked to students to perform research about the subject and to create posters in English and leaflets including some relevant information.

They worked on the construction of the city and the creation of the leaflets during the classes of Physics and Portuguese. On the English class they create the posters.

The presentation of this project was prepared and practiced. During this phase of the project they presented clearly lower motivation and higher difficulties than during the construction of the project. In fact most students failed on their presentation. This part of the project requires major attention and improvements due to the lack of social skills of these students. However it seems to be an extremely important part of their learning process. One solution could be to involve these students in simpler projects and

extend the preparation and presentation’ training to the class first and only then they would be more comfortable to present to a larger audience.

#### **4. Second Case study: High School students**

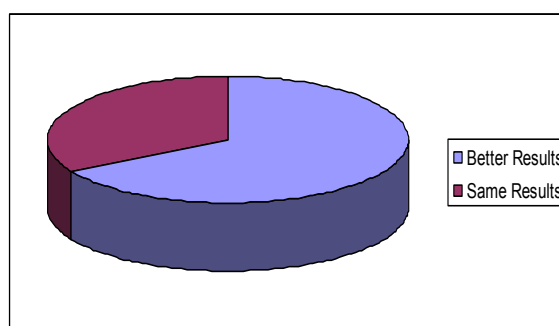
This project has been developed with 14 students from the second course. They have already completed the mandatory school years but want to continue the study trough vocational training. About 10 of the 14 students reveal no basic knowledge on physics or chemistry and presented major learning difficulties.

The lack of a suitable laboratory and support materials imposed a different approach: to the students it was proposed to work in groups of 2 or 3 students, choosing a simple topic or experiment that they will study and later on present to the class.

All this work process was given as optional and to be developed at home after class. The student should find the materials by themselves and be responsible for the development of their works. These projects (each student had the possibility of presenting up to 3 per year) were evaluated and had an impact to the student’s final evaluation.

All students participated, did research for the chosen subject, proposed it to the teacher and set the date to the presentation. The projects were done out of the classroom with only a minimum amount of time being made available on the classroom to clarify some of students’ doubts.

To measure the efficiency of this project on students learning, some inquires related with the projects were made one week before their works’ first presentation. The same inquiry was given one week after the last presentation.



**Figure 1 - Results of the inquiries**

The **Figure** shows that on 18 of answers, the students improved their results while on 9 presented no significant improvement.

Again a significant feature was that students (4 of the 6 groups) were specially committed on their research and not so much on how to explain/present their specific project.

After this first set of presentations, it was possible to reach to the conclusion that the groups should have only 2 elements per group instead of 3, since one had always a lower participation level on preparation and presentation, and also due to the simplicity of the projects.

In spite the relatively small population involved, positive changes were observed. However, it is possible to conclude on the greater enthusiasm that students showed on preparation and presentation of these little projects. The interest and participation on classroom subject and their performance also increased.

## 5. Conclusions

In both cases, the project developed by all the class about energies and the small projects developed by the older students, we could conclude that students can be motivated by using the development of simple science project. Unfortunately, the lack of suitable materials and other resources make this kind of activities more difficult to implement. However, this fact has a positive aspect as it is possible to show to these students that science is in everywhere and that it is possible to make science with simple everyday resources.

We can also conclude that in both project' cases the motivation and the acquisition of knowledge on the particular subject researched was improved. On the second case we could clearly

conclude that the overall learning of the subjects of physics and chemistry was improved.

With this study, we intended to give a first step on the demonstration of the importance of the development of scientific projects on vocational courses, not only by the knowledge students acquire, but also on developing their interest on science.

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