critical
FUTUREVET
thinking

COURSE FOR TECH COMPANIES
TRAINING THEM ON HOW TO IMPLEMENT THE NEW MOBILITIES

This document is a result of the project:

"Building the vocational training of the future: companies and educational centres facing the challenge of the organization and integration of a more inclusive and digital VET"

Co-funded by
the European Union

Contents

INTRODUCTION

We are looking for this course to facilitate the hosting of internships in companies for VET students with obstacles with the new VET model.

In view of the challenges experienced since 2020, the European Commission has decided to promote Vocational Training by making it a benchmark for economic and social reconstruction, as well as to achieve the objectives expressed through the Council Recommendation of 24 November 2020 (2020/C 417/01) and coinciding with the 2030 Agenda and the OECD proposals.

Member countries have started to adapt their VET education laws to the new guidelines in order to achieve the proposed objectives. This is the case of the Spanish Government with the Organic Law on the Regulation and Integration of Vocational Training definitively approved in the Senate on March 23, 2022, which will be followed by many other countries such as Italy, Greece or Portugal.

However, the path to the implementation of this new law is not easy. The levels of access to vocational training in many countries are significantly lower than the objectives set (the enrolment rate, according to CEDEFOP reports in Spain is 12%, in Greece 11%, 10.6% in Italy and 20% in Portugal...) and the measures necessary to achieve the 29% target by 2030,will require a very important change both in the way of teaching and in carrying out internships in companies, involving a major effort by teachers and companies to develop new methodologies, new contents, new programming and new structures that give viability to the new economic costs derived from internships.

A radical change that, in addition, has the risk of leaving aside many students with obstacles, who unable to adapt to the new changes and overcome the obstacles posed by this new vocational training model, abandon their studies, closing one of their main doors for social, personal and labor inclusion that takes them out of exclusion

In this context with the Erasmus Plus project "BUILDING THE VOCATIONAL TRAINING OF THE FUTURE: COMPANIES AND EDUCATIONAL CENTERS FACING THE CHALLENGE OF THE ORGANIZATION AND INTEGRATION OF A MORE INCLUSIVE AND DIGITAL VET." we have created this training course for companies with the aim of showing the attractiveness of the new educational model and the opportunities it offers to the company, while helping them to modify their practices and generate the necessary figures for it, such as the company tutor.

OBJECTIVE OF THE COURSE

In this course we are going to propose step by step the preparation of a notebook for the training of a student in a technology company

The objective of this course is to present a methodological proposal for the training of a student of a dual vocational training studies in his/her period of stay in the company. The new Vocational Education System proposed by Organic Law 3/2022 on the organization and integration of Vocational Training is based on the co-responsibility of vocational training educational centers and companies in the training of students. The company is expected to participate in the achievement of certain learning outcomes of the degree that the student is studying, in addition to the results that are expected from the work activity in the company itself. This poses a challenge in terms of dedication of the company's staff, and in particular the student's tutor in the company, and requires prior programming and a method that makes the learning process effective and not too burdensome for the company in terms of time dedicated by its staff to educational tasks.

What we propose from the Erasmus + FUTUREVET 2022 project working group would be more or less like this: At the beginning of the training period in the company, the student will have already received a course on occupational risk prevention at his or her educational center. At the company, the tutor will give he/she the first explanations about his/her job and will give he/she a (digital) notebook that will be a guide for their training. It will contain brief information regarding their personalized training program, but the bulk of the notebook will be filled in by the student himself/herself. The student must write down everything related to the job: objectives, experimental protocols, occupational risk prevention information specific to their job, waste management and others.

The notebook will facilitate the continuous monitoring of the student's progress, and their final evaluation.

It will also collect all the results obtained, for example, experimental results of quality control analyses, designs, management documents and others. The student will also be asked questions and exercises that will help he/she to achieve their intended learning outcomes. The notebook collects all the student's activity, is filled in digital format, is hosted in a specific folder on a company server and complementary files such as spreadsheets, videos, machinery control files, administrative documents and others are added.

The organization of the notebook seeks to develop the student's critical thinking skills, to set relevant objectives and questions, to search for information, to analyze its reliability, to understand and organize it, to express oneself effectively in writing, to act responsibly and intellectually honesty.

The preparation of the notebook involves a process of reflection by both the educational center and the company on the training activities that are proposed to the student.

We hope that the effort put into this preparation will be highly compensated by the ease of development of the training

The evolution of the staff of this notebook will serve to accumulate the experience that will be acquired in the training of students and will allow the methodology used to be continuously improved.

In this course we are going to propose step by step the preparation of a notebook for the training of a student in a fictitious company and we will ask our students of the course to prepare for them a similar notebook for a specific job in their company.

It goes without saying that many of the observations we make are very debatable and should be considered as suggestions that everyone can take to the extent they consider and improve them or adapt them to their specific situation.

A NEW VET MODEL
VOCATIONAL TRAINING IN SPAIN

Vocational training studiess (at basic, intermediate or higher level) are articulated by professional modules that are linked to the competences included in the CNECP.

3.1. The definition of the curriculum. Terminology

Vocational Training covers a very wide range of teaching. Currently (academic year 2023-2024), the training offer includes 588 professional certificates, 175 training cycles and 21 specialization courses. This training offer takes as a reference the National Catalogue of Professional Qualifications, CNCP, which will soon be replaced by the National Catalogue of Professional Competence Standards, CNECP, includes a total of 756 qualifications ordered into 26 professional field [Ministry of Education, Vocational Training and Sports 2024a[1], 2024b[2].

Vocational training studiess (at basic, intermediate or higher level) are articulated by professional modules that are linked to the competences included in the CNECP. The curriculum of the intermediate level mentioned in the previous paragraph includes professional modules such as 0007. Graphic interpretation. 0722. Preparation of machines and automatic process installations. 0723. Mold and model making. 0724. Formed by closed molding. 0725. Formed by open molding. 0726. Preparation of raw materials. 0006. Metrology and Testing. 0727. Training and career guidance. 0728. Business and entrepreneurial initiative. 0729. Training in workplaces.

Dual training is aimed at all Vocational Training, and despite the specificity of each of the degrees, possibly in the fundamental ideas of how to put it into practice, there will be many common features in all degrees and all professional fields. To seek clarity in this course and not have to talk continuously in general terms, we are going to focus throughout the course on some examples that are sure to be easily extrapolated to other situations. We will choose as an example the professional field of Mechanical Manufacturing and within it the current titles of Technician in Metal and Polymer Molding (Intermediate Level- VET) [BOE 2011a[3] and Higher Technician in Metal and Polymer Molding Forming Programming (Higher Level) [BOE 2011b[4].

The name of the modules already shows the presence of modules that are very specific to the profession to which this training cycle is directed, while others are transversal and are present in many degrees.

Royal Decree 659/2023, of 18 July, which develops the organization of the Vocational Training System, defines and regulates the duration of these transversal modules: "Personal Itinerary Module for Employability I and II, Digitalization applied to the production system, Sustainability applied to the production system, Professional English. Intermodular project". When preparing the Individualized Training Plan for a student, the part of these modules that the company is responsible for will be specified, which can belong to both the most specific and the most transversal.

These training cycles, of intermediate (Vocational training) or higher level, have a duration of 2000 hours. Part of the content of the degree is set by the Royal Decree establishing the degree and another part will be set by each Autonomous Community. The content of the degree is expressed in terms of professional, personal and social competences and includes the relationship between these competences and the professional qualifications included in the CNECP.

> The objectives of the training are further defined by expressing them in the form of learning outcomes and assessment criteria for each of the modules. An example of the way in which learning outcomes are specified, in relation to the example we are giving would be:

". Identify tolerances of shapes and dimensions and other characteristics of the products to be manufactured, analyzing and interpreting the technical information contained in the manufacturing drawings."
And the evaluation criteria
".... c) The materials of the object represented have been identified. d) The thermal and surface treatments of the object represented have been identified. e) The joining elements have been determined...."

The training activities both in the company and in the educational center (theoretical and practical classes, search for technical information, supervised study, work in the work environment, participation in work meetings, presentation of results and others) will be aimed at achieving the expected learning outcomes so that the student acquires the competences that have been set out in the definition of the Degree.

3.2. The student's training plan: part of the curriculum that is in charge of the educational center and part of that which is in charge of the company in dual training

Royal Decree 659/2023 [BOE 2023[5] presents a model agreement between the educational center and the company corresponding to grade C (professional certificates) and a minimum training plan template (Figure 1). This template includes a list of all the learning outcomes that make up the degree, ordered by professional modules, and boxes indicating which ones the educational center is responsible for and which ones the company is responsible for.

Bearing in mind that the percentage of participation of companies is 25% or more, it is necessary to consider the capacity of the company to organize effective training activities so that the student achieves the expected results in a relatively wide range of competences.

Figure 1. Template of the training plan proposed as a guideline in Annex XVII of Royal Decree 659/2023, of 18 July, which develops the organization of the Vocational Training System

Organic Law 3/2022 [BOE 2022[6] provides for the possibility for more than one company to share the student's training, especially in the case of small and medium-sized enterprises, and Royal Decree 659/2023 makes this option more specific.

The training stay in the company will be organized during the two years that a cycle lasts and perhaps stays in two different companies can be organized in each of the courses, however, it is necessary to consider whether it is desirable for a student to make several short stays in companies or rather it is preferable that a single company is in charge of the training in at least one course. The insertion of the student in a specific work environment, especially at this stage of training, is a process that takes time. If we think of a cycle with a duration of 2000 hours like the one we mentioned in the previous section, and we think that 25% of that time is dedicated to training in the company, we would talk about around 250 hours of stay in the company in each course, which can be organized in different ways but that together would be equivalent to just under 2 months full-time.

Technology-based companies are in a favorable position to contribute to training the student in a wide range of specific skills related to their sector, even if the position in which the student is most involved during his/her stay in the company is not directly related to them. In the example of the degree of Technician in Forming by Molding of Metals and Polymers, a technology company with activity in the production of polymer parts by 3D printing surely has sufficiently qualified personnel to tutor the training of a student in order to achieve the learning results foreseen in modules of Graphic

Interpretation since they will handle different representation techniques, Preparation of machines and automatic process facilities, Preparation of raw materials or Metrology and tests that you may use directly, but also Manufacture of molds and models even if you are not going to use them and something similar in relation to Forming by closed molding or Forming by open molding. On the other hand, the company's contribution to training in the modules that we have called transversal can be important, providing activities and experience that complement the educational center very well.

By this we mean that a company, even small or medium-sized one, can openly consider contributing up to 25% of their training cycle to the training of a student. The way of participating in the teaching of specific competences of the degree will undoubtedly use different methodologies from those followed in an educational center, and perhaps this different point of view is one of the main contributions sought in dual education. In the following sections we will try to break down our opinions in relation to how to put effective training into practice in the company.

3.3. Training for a professional career versus training for a job.

The training that a worker acquires in the company in which he or she works has always been valued in the business world and in society in general. Work experience involves training in transversal skills such as commitment and responsibility, integration into work teams, oral and written communication, honesty and others. What is proposed in the Vocational Training System goes, however, much further. The dual nature of vocational training implies the co-responsibility of the company in the training of the student for his or her entire professional career, both in specific competences of a given professional qualification and in skills that facilitate their adaptation to the evolution of technology, in particular to the energy transition. ecological and digital, to changes in jobs in a company or to changes in their professional careers seeking their own interests and expectations. This poses a challenge for the companies that participate in this system and the need to generate new methodologies themselves.

> Cooperation between vocational training schools and companies has been highly valued and has not stopped growing in recent decades, being a recommendation of the European Union and the subject of many theoretical studies [Mikkonen 2017, European Commission 2015, Guile 2001, Fuller 2011[7], Vázquez-Cano 2018[8]

In a curricular internship, a student joins a job and for a few months develops tasks related to that position. Their training and personal development comes fundamentally from the very fact of immersing themselves in a work environment. It will possibly be their first experience in this environment, also of the training in their job and what all this entails in terms of commitment to the company's operating rules.

In the new Vocational Training System, it will be necessary to systematize this training because many of the aspects that are required of the training that the company provides to the student will not arise spontaneously, but it will be necessary to plan specific training activities for their development. An example is the key competence of learning to learn depending on the position with which the student relates most, he or she will not find it necessary to develop strategies for searching for information, critical analysis, understanding and organization. If it is considered that in-company training can make an important contribution to the development of this competence, it will be necessary to set out tasks in the student's work plan that require this competence and think about the methodology to help them acquire it. Something similar can be said of other key competences such as linguistic communication, effective oral and written expression, digital competence, entrepreneurial competence and others.

Technology-based companies usually have ways of organizing work that allow this type of activity to fit in, which, on the other hand, will also be enriching for the company's own staff and in particular for those who act as company tutors for the students.

3.4. Motivation

Workplace learning is considered to be an effective means of facilitating the integration of vocational training students into the labour market. On the other hand, the evolution of students' expectations regarding their professional career also encourages an increase in the interest of the workplace as a training center. A large part of the success in learning in the workplace lies in the student acquiring skills to develop self-regulated work. Methodologies for the training of these skills in vocational training students have been studied for years [de Brujin 2011[9], Jossberger 2020[10], Khaled 2015[11], Pylväs 2022[12], Smith 2003[13], Virtanen 2014[14], Zimmerman 1990[15], 2000[16], 2001[17]. The student self-regulates his/her training when he/she initiates and directs his/her effort to acquire knowledge and skills, instead of seeking the help of teachers, tutors, mentors or parents and develops specific tools for that training [Zimmerman 1989, Pylväs 2022]. Theories of self-regulated learning establish the different phases of the process. Although the development of self-learning skills is something that the student does proactively for himself/herself, and does not come as a consequence of the teaching of a teacher, the way in which the student advances in the observation of his/her own processes, how he/she values them and how he/she reacts to them is something that can be observed from the outside and can contribute to the success of the process. In particular, for a vocational training student in a workplace, individual assistance and support from more experienced co-workers may be key [Billet 2001, Virtanen 2014]. A study on vocational students' perceptions of self-regulated work highlighted the importance for students of social support and positive feedback from school teachers, tutors and co-workers in the company [Pylväs 2022]

3.5. The student's commitment to his or her education. Dropout

One of the great concerns of European society, and in particular Spanish society, with respect to its education system is the school dropout rate.

It can be measured as the percentage of young people between 18 and 24 years of age who have not completed secondary education above compulsory education and who are not following any educational program [Ministry of Education 2024[18], Navas Saurin 2020[19], Surera García 2021[20]. In relation to vocational training studies in Spain, the school dropout rate is very high, thus it can be seen that only 50.6% of students who accessed basic vocational training studies in the 2016-2017 academic year had graduated four years later, this figure increases to 64.3% in vocational training and 75.3% in higher vocational training [Ministry of Education 2024]. Early school leaving correlates with the student's commitment or attachment to their studies (this concept is known as engagement in English). It is accepted that an active commitment of the student positively influences the success of his or her learning and decreases the probability that he or she will drop out of school before graduating [Archambault 2009[21], Fredricks 2004[22], Janosz 2008, Wang 2011[23].

The progressive loss of the student's commitment to his or her studies at the vocational training center is the result of the complex combination of cognitive, emotional and behavioral factors, but we can accept that it is largely a process that can be acted upon, which may be different in one learning context and in another [Pöysa 2019, Surera García 2021]. Emotional commitment is understood as the way in which the student perceives his/her relationship with teachers, classmates and his/her family with respect to his/her progress in learning and his/her future prospects and the degree to which these three fundamental agents of his/her environment help him/her to overcome conflicts with his/her learning.

On the other hand, behavioral engagement is related to the way in which the student is actively involved in his/her learning, participates in academic activities, and assumes the norms of the educational center [Elffers 2013[24], Friedricks 2004]. Various studies conclude that the loss of emotional commitment precedes showing behaviors that show disengagement from studies and academic failure and show the transcendent role of teachers in generating and maintaining emotional commitment at the levels of education in which adolescents find themselves [Schwab 2018[25], Truta 2018[26].

The Vocational Training System relies on in-company training to reduce school failure rates in vocational training. Traditional academic education has been blamed for a disconnection from students' real lives, which has also been frequently mentioned as a factor in the loss of commitment to education. As we have said before, the fact that the student begins his or her vocational training studies with an internship in the company, even if it is a virtual internship carried out in the classroom, but directed by the company, clearly contributes to the student's motivation towards his or her studies. But it is clear that this ability to engage the student depends greatly on the activity he or she is responsible for in the company and the way he or she feels attached to it. For the development of the new lines of co-responsibility of the company and the educational center in the training of the student, it is important to learn from what is already known regarding the commitment of the student and try to apply in the company the aspects that are recognized as positive in this sense. It can be intuited that the relationship and support of the tutor in the company and of the co-workers will be especially important in the emotional commitment of the student not only with their tasks in the company but also in their commitment to their studies at the educational center.

3.6. The training period in the company

With the new Vocational Training model, training cycles will combine training periods in the educational center with training periods in companies or equivalent organizations.

GENERAL

500h in the company:
- 1st course between 120h and 240h (March-June).
- 2nd course between 260h and 380h (January-March)

10%-20% of the learning results

Depending on the characteristics of the training period in the company, dual vocational training can be general or intensive.

INTENSIVE

700h in the company:
- 1st course with a duration of 335 hours.
- 2nd course with a duration of 365 hours.

30%-35% of the learning results

It should be noted that, according to Order EFD/657/2024, of June 25,[27] the competent administration will assume the management of the Social Security registration of the students during the training period in the company and the non-bonified contribution cost.

THE COMPANY TUTOR

The methodology we propose here seeks to train the student in autonomous learning tools. Of course, the tutor will be key when it comes to guiding the learning of these techniques

According to Organic Law 3/2022, "the effective commitment of companies and the figure of tutors" is of particular importance in the success in the development of dual vocational training. The tutor of a student during his training period in the company will be aware of identifying the learning outcomes of the training plan that is going to be carried out in the company, making sure that the student will have the necessary resources at his disposal, designing the activities of the student in his job and also the training activities aimed at achieving the expected learning results.

On the other hand, it will be pending together with the educational center the assignment of the person who is going to receive training in the company, that the selection of students respects the principle of equal opportunities. Throughout the training period, it will monitor and evaluate the acquisition of learning outcomes, in collaboration with

Another **essential aspect** of the tutor's work is to adapt the training plan to the student's progress, the monitoring of the student's response in planned training activities must result in a reprogramming that will serve to adapt the work plan to the specific characteristics of each student and in particular to the inclusion of students with obstacles.

The **other aspect** to consider is the ability of the methodology we design to adapt to the mobilities of new students, so that it is increasingly less expensive for tutors to receive a new student.

the workers who participate in the training of students in specific aspects of their job and ensure that the expected results are achieved.

Mentoring can require significant dedication that may not be available to many small and medium-sized businesses. It is necessary to approach the role of the tutor in a realistic way if the process is to be effective. It is therefore important to establish a teaching methodology that focuses on the autonomy of the student in their training. It does not seem realistic to think that the tutor of the company adopts the role of a teacher who gives lessons to the student, who explains each of the concepts or technologies related to each of the learning outcomes. It will not have time for it, nor would it contribute to training what the change to dual vocational training intends. The methodology we propose here seeks to train the student in autonomous learning tools. Of course, the tutor will be key when it comes to guiding the learning of these techniques, but the training and monitoring notebook of the training plan that we propose is already in itself a guide for the student to discover the methods of autonomous learning.

A DIGITAL, INCLUSIVE AND CONTINUOUS WORK MODEL
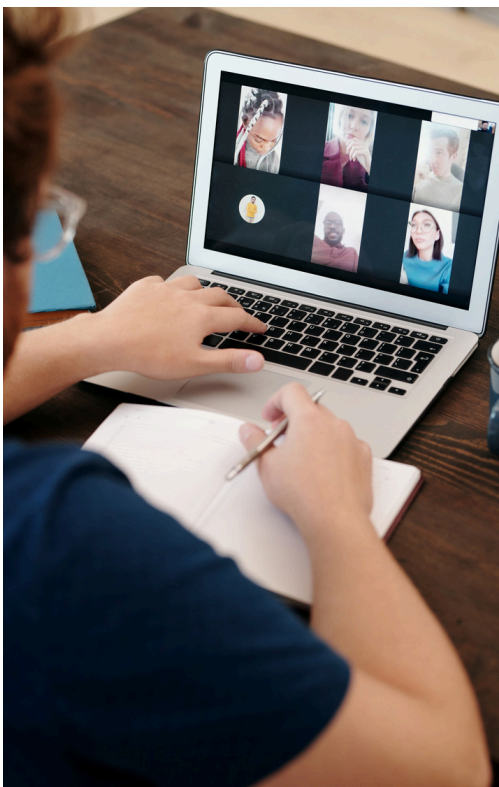
It is clear that dual training seeks to exploit the full training potential of the work environment. It seems key that the student is immersed in a job in a company for long enough periods. It must also be accepted that the social reality in many regions does not make it easy to find internships in companies for all students at all levels of vocational training. There are experiences of virtual internships in vocational training that may be of interest in order to perhaps cover a part of the training period in the company.

It is clear that dual training seeks to exploit the full training potential of the work environment.

1

Virtual Internships

One way to organize them can follow the same rules that the company has for teleworking, something that will be feasible or not depending on the sector of its activities and the company's business plan. This type of internship has been tested within the Erasmus + programme. Virtual internships have made it possible to give this work experience in European companies in countries other than the student's country of origin, with very interesting results in terms of European integration, language skills and work experience to students in less favored regions and with few possibilities of travelling abroad. [28] [29]

2

Being a part of it

Another interesting way of carrying out these virtual internships has been the projects that make the classroom of the educational center a virtual R+D+i cabinet of the company. It is the company that proposes a project in which an innovative design is sought, for example. The students carry out the work organized according to the company's rules and directed remotely, with digital tools, by a company tutor and with the help of the teacher in the classroom. [30][31]

The appropriateness or otherwise of the fit of this type of internship in the development of the new Vocational Training System is something that should be opened to discussion.

METHODS TO ENHANCE THE EFFICIENCY OF THE COMPANY THROUGH ITS INSERTION IN VOCATIONAL TRAINING

Increasing the diversity of the company by incorporating young people and also the collaboration with teachers from schools can have very beneficial aspects for the company's objectives.

It is worth asking what the company will gain by participating in the educational plans of vocational training. There will have to be a balance between what the intern brings to the company's work plans and the time and effort that the tutor in the company and other workers will have to dedicate to make the training process effective. Without a doubt, this balance will depend a lot on each specific company.

One of the factors is that the student's internship period is relatively short. You will need a part of that time to adapt to the job.

On the other hand, we defend that the job in which the student should be inserted must be a position with training characteristics for his or her professional career.

We would like an internship in which the student is driven to study new concepts, new techniques, to learn in depth everything related to his or her job. That is why we defend that the entire training period is carried out in a single company, to make the most of what is being learned and that both the student and the company get the most out of it.

Something that is worth reflecting on is the value of teaching for the one who teaches, it makes one have to reflect on the methods he uses, on the concepts on which his activity is based. There are many aspects that you don't stop to think about until you have to explain it to someone else. This is also true for a small or medium-sized company. Participating in the training process of students may make them rethink and improve some of their methods. Opening up to the opinions of very young people with possibly different points of view from those of more experienced workers can also boost innovation, which is favored if the organization of work favors channels for students to express their points of view and question specific points of the company's operation.
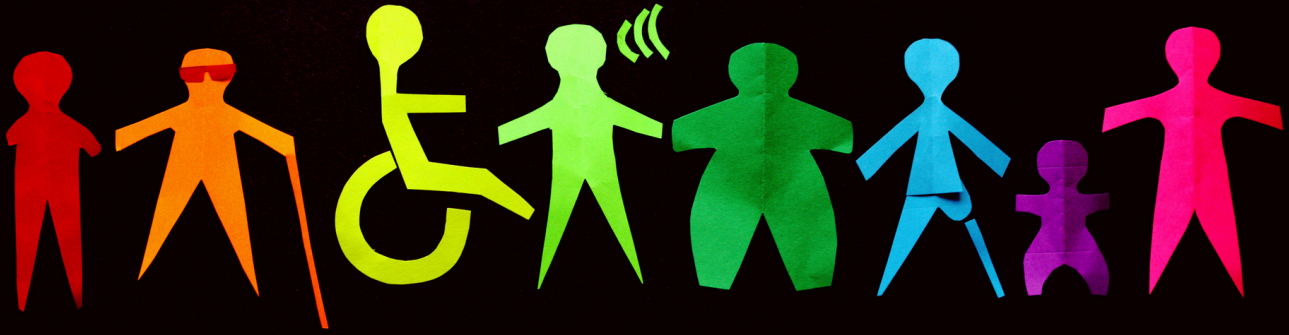
STRUCTURAL AND ORGANIZATIONAL CHANGES IN INCLUSIVE TECH COMPANIES

The general lines of the company's diversity and inclusion policies and the actions that the company carries out with its workers to implement them must be extended to the students who carry out their training periods in the company.

7.1 Characteristic features of the inclusive company

In general terms, an inclusive company is distinguished by a structure, working methods and training plans for the workforce in aspects related to

- Diversity in the composition of the workforce and equal opportunities
- The culture of respect and appreciation of differences.
- Adapting the work environment to make it accessible to all.
- The promotion of the professional career of all employees with equal opportunities
- Communication strategies that allow all workers to be heard and their opinions to be valued

Inclusion policies mean a step further with respect to diversity, they try to take into account the opinions of workers, that they feel that they are treated fairly and that their contribution to the work of the group is considered valuable or that the group collaborates so that the contribution of each one is valuable.

7.2. The inclusion of students with obstacles in the company

It is increasingly accepted that addressing diversity in the company is not only an ethical issue, but also has important benefits for its operation and for achieving its objectives. The fact that the company's workforce is made up of workers of different social origins, skills, knowledge, experience, ethnicity, sexual orientation, etc., translates into having a greater range of points of view when addressing a problem and greater guarantees of choosing an appropriate solution. It can also allow us to have different visions of the relationship between the company and society and generate more creative and innovative ideas. The fact of incorporating students into the team can provide a vision of society and the company's working methods that is different from that of the rest of the workforce and taking it into account is sure to be positive for achieving the objectives.

In the case of students, especially the youngest, it must be taken into account that at least in the first moments they may have the perception that their knowledge, skills or abilities are very limited and that they can add little to the work of others except to perform the tasks that are entrusted to them as best as possible. The student will be more integrated into the company if he or she is informed as thoroughly as possible of the relevance of the work he or she is doing, training activities are prepared that make him or her understand in depth the physical, technological, legal, etc. principles that govern the phenomena involved in his or her activity or clear channels are established for his or her opinions to be heard. As we said before with respect to diversity, inclusive policies in the company must be expected to generate significant benefits in the achievement of their objectives through the improvement of the work environment, the involvement of each worker, their feeling of attachment and commitment to the company and in their own training.

7.3 The role of the methodology we propose in this course in the inclusion of students with obstacles.

It is known that the level of prior knowledge at the time of starting training in the company can be very different in one student and in another, also the motivation in relation to their studies can be very variable. On the other hand, there are students who have to overcome important obstacles of a social, economic, or health problems. In a classroom of an educational center, it is difficult to attend to each student according to their particular needs and for those who do not reach the level established in a certain course it is very demotivating to see that they are left behind. The way we approach training in the company allows the training process to be largely individualized.

The methodological approach of autonomous student learning through the programming notebook and monitoring of the training plan is an important tool to adapt the pace of learning to the characteristics of each student and in particular to students with obstacles. We are proposing that the student learns concept by concept or technique by technique by performing a series of exercises that are posed to him or by answering certain questions in his or her workbook, looking for information or asking his or her tutors or other classmates about specific issues. The programming and monitoring notebook is digital, it is hosted on a server to which both the student and the tutor in the company have continuous access. The tutor can see the progress of the student both in terms of their job, seeing the results they obtain, and in terms of the learning results of the basic contents of the degree, or the way in which they express themselves when answering questions or presenting their work activity. Depending on the student's progress, the tutor may modify the degree of difficulty of the questions posed at any time. It is a challenge to raise questions at an increasingly higher level, but in a way that does not involve insurmountable ruts that in the end only demotivate the student. In the same way, in the opposite case, when it is seen that for a student the questions raised fall short, training can be redirected towards new fields of interest or posing greater challenges. There is no doubt that this requires paying some attention to the student's progress reflected in his or her notebook. Collaboration with the tutor of the educational center will be of great help in this regard.

CRITICAL THINKING APPLIED TO VOCATIONAL TRAINING

It is a quote that we find in a multitude of essays on education from primary to university and that seems to be of special application to professional careers.

One of the key aspects of training students for a professional career is the development of tools and skills related to critical thinking [Paul 2005[32], Ennis 2011[33], Pithers 2019[34], Solano-Martínez 2019[35]. Critical thinking is essential at all stages of any student's education and applies to all aspects of life. Piaget said in a conference in the 60s:

"The main objective of education is to create men and women capable of doing new things and not simply repeating what other generations have done: men and women creators, inventors and discoverers. The second goal of education is to form minds that can be critical, that can verify and not accept everything that is offered to them."

In this course we understand critical thinking as thinking that evaluates itself [Paul, 2005]. It is a reflective thought that requires stopping to consider the reasons that lead us to accept as valid information that comes to us or to make a certain decision or judge a situation in a certain way. It is not something that arises naturally in people, rather the opposite happens: the person immersed in a social group has a tendency to act in a way that is accepted by others and that often means not stopping to think about issues commonly accepted by the group or even if one raises them and important doubts arise not to raise them with others so as not to be rejected.

You can put yourself in the shoes of a student who is starting his or her training period in the company. You will find yourself in charge of carrying out a series of tasks for which precise procedures already exist. You will learn how to perform these tasks effectively and the fact that you do them will contribute to your knowledge of the specific area of the company in which your work is framed, also to the development of certain basic competences. But perhaps it will stop at learning to follow a series of established recipes and protocols without considering why things are done the way they are done. Learning to faithfully follow known recipes makes you efficient in the work you do, but it doesn't make you capable of doing something new.

In-company training within the framework of a dual education system can make a decisive contribution to going further in the training of the student. The company can program the activities and the work methodology in such a way that it encourages them to consider the objective of their work for the company, the reason for the tasks that lead to achieving that objective, the physical, chemical, mathematical, legal principles, etc. that govern the operations they carry out. It is clear that this approach demands a significant over-effort on the part of the student, but it will multiply their progress in order to achieve basic skills for their life and professional career.

It also means an extra effort for the tutor in the company both in terms of the preparation of the training plan and its monitoring. Later we will advance a methodological proposal that could help in the planning, monitoring and evaluation of the student, based on critical thinking applied to vocational training.

Acquiring critical thinking tools will advance the student in terms of their ability to evaluate their own reasoning and activity, search for information critically, read carefully, understand and organize it, define objectives and pose and solve problems, pose relevant questions, propose hypotheses and contrast them with the essays they make, carry out their work with an open mind,with intellectual honesty, with perseverance, or to communicate effectively orally and in writing.

It should be noted that this way of seeing the student's work in the company requires that they dedicate time to a series of additional training activities to those that a company worker may have. Scheduling your tasks will need to allow you to have that time.
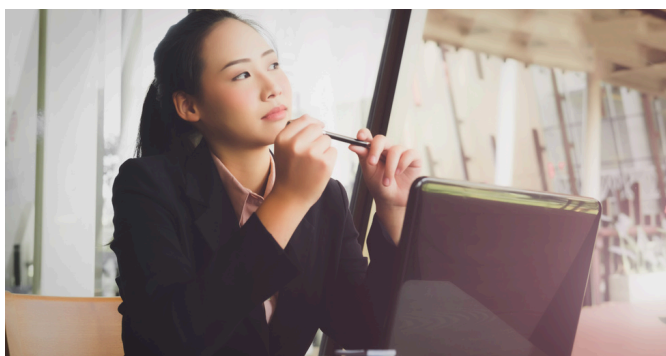
Consider

Rationalize
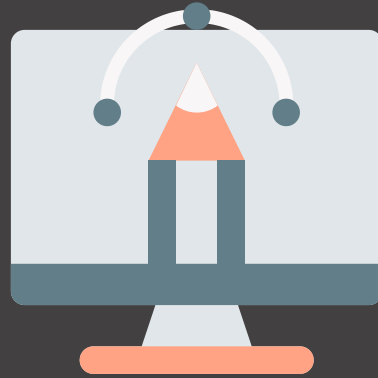
Think

Fact Find

Critical Thinking!

Deepen understandings and thinking.

Judge

Correct

Analyze

Problem Solve

THE SEARCH FOR SCIENTIFIC OR TECHNICAL INFORMATION AND ARTIFICIAL INTELLIGENCE APPLIED TO VOCATIONAL TRAINING

One of the pillars of the new Vocational Training System and also of our methodology is to teach students tools for self-learning that can be useful not only throughout their degree but for a whole professional life.

One of the pillars of the new Vocational Training System and also of our methodology is to teach students tools for self-learning that can be useful not only throughout their degree but for a whole professional life.

The training plan programming and monitoring notebook, which we will develop in the following sections, aims to be a guide for students on the concepts, technologies and critical thinking skills that they must acquire during their training period in the company, but which are also tools that must be useful in their professional career.

In this sense, in the work in the company as well as in a certain way also in the academic work that is proposed to the student in the educational center, we could say that the sequence of steps in the search for information and the learning of new concepts could be:

1 A problem arises. For example, I am commissioned to perform tensile strength tests on plastic parts. The colleagues at the company provide me with the protocol for handling the machine and the test protocol.

2 I am not satisfied with following those protocols to the letter and delivering the results that the machine gives me. I want to understand what I am doing and to be able to contribute to providing solutions to the problem.

3 I ask myself what I should study, that is, I ask myself questions about this topic. In the example proposed, when I read the test protocols, I see that they tell me about Young's modulus, the yield stress or the elongation at break, in a very particular way that the test specimens must have...

4 I look for information about these concepts, about the physical properties involved, in which units they are measured, how they are calculated from the values measured by the machine. Possibly the first thing is to ask my tutor in the company or my tutor in the center for indications of where to start looking. There are several options: classic books or manuals, notes from the subject of my degree related to this problem, the internet where teaching or technical pages on this topic will appear and currently, we cannot ignore applications that use Artificial Intelligence (we will talk more about this point later).

5 The problem immediately arises for me to distinguish which documents I find are written in a way that I can understand more or less easily and also whether I will be able to distinguish if in one of them they are giving me wrong information. I can again seek help from my colleagues, or my tutors in the company.

6   I extract the main ideas, I see what I understand and the new questions that are posed to me, which will make me look for information again.

7   In the end, I feel satisfied with what I have learned and I assess whether I am able to analyze and draw conclusions from the results that the machine gives me, for example, if I am able to detect an error caused by a defective specimen, if it is necessary to repeat some tests or if I myself can assess whether or not a series of specimens complies with quality controls.

The sequence we propose starts from a specific problem and the study focuses on solving that problem. The approach is generally different in the teaching of a subject in the educational center: it is based on a script of the subject, a content with a series of concepts to learn or techniques to apply, with a manual or notes from the teacher, texts to be learned, and exercises to be carried out to pass an exam at the end. We do not want to speak disparagingly of this way of learning that in the end has trained millions of good professionals throughout history. It's different. It is probably even more suitable for many students for the age and level of study in vocational training modules. However, it has the disadvantage that the student develops learning tools that when they finish their studies they will probably not have at their disposal. In academic teaching, active learning methodologies have been enormously developed, such as project-based teaching that places the student in a virtual environment more similar to the one described above for work in the company [Blumenfeld 1991 [36], Fontanela-Romero 2022[37], Herreid 2011[38]. It is part of a project or a problem that is normally carried out in a group. In the educational center, learning would follow more or less the steps described above, but the student is more accompanied by the teacher and the demand when it comes to reaching a real solution to the problem posed is obviously lower.

We return to the issue of the autonomous search for information by a student or a professional and we cannot ignore the recent irruption of Artificial Intelligence, especially since the appearance of ChatGPT. In order for the student's autonomous learning during their training period in the company, the tutor in the company can guide the students so that they use it to learn basic concepts or applications in a very efficient way, as we want to show in the example that we give a little below.

In the academic world, the appearance of ChatGPT poses an important change in certain teaching methodologies. In the early days, there has been a lot of talk in the educational world about the negative aspects that it could have for the education of students, in the sense that the student will not see the need to learn many things that quickly become accessible with ChatGPT. Saving the distances, something similar to when calculators appeared, and it seemed that children would no longer have to learn to add. There has also been a lot of talk about the loss of validity of educational methodologies such as the completion of academic work. As we said before, carrying out an academic project that requires the search for information, its organization and understanding to write a well-prepared text is a useful tool for the development of essential critical thinking skills: setting objectives, asking essential questions, searching for information, expressing oneself effectively orally and in writing... But if that text is generated by ChatGPT in half a minute, many students will not dedicate the time and effort that learning makes them.
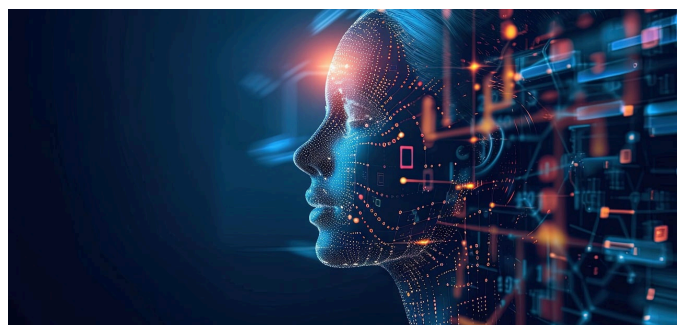
But the fact of verifying certain negative aspects has to make us see the need to change certain teaching methodologies in such a way that we take full advantage of the many positive aspects that artificial intelligence is going to bring to teaching and in particular to self-learning tools.

The fundamental point is to make the student see ChatGPT as a tool to learn and not as a tool to get by.

In the example we gave earlier, a student can ask ChatGPT: Explain to me as if you were a teacher at a vocational training center and I am a student of an intermediate degree what Young's modulus is and what shape a stress-strain curve measured in a piece of plastic has.

This is what the AI answers us in 15 seconds:

What is Young's Module?
Young's modulus, also called modulus of elasticity, is a measure of the stiffness of a material. Imagine that you have a rubber band. If you stretch it a little, it returns to its original shape; But if you stretch it too much, it permanently warps or even breaks. Young's modulus tells us how much a material deforms when we apply a force, and it is related to the amount of stretching (strain) that the material can withstand without undergoing permanent changes.

Mathematically, Young's modulus is expressed as the ratio of stress (force applied per unit area) to strain (change in length divided by original length) on the elastic part of the material. The larger the Young's modulus, the stiffer the material. To give you an example, steel has a much higher Young's modulus than plastic, which means it's much harder to deform.

What does the Stress-Strain curve look like in a plastic?
Now imagine that we do an experiment where we pull a piece of plastic and measure how it stretches and how much effort (tension) it requires.

The stress-strain curve of a plastic has several phases:

Elastic zone:

In the first part of the curve, when you apply a small amount of force, the plastic deforms but returns to its original shape when you stop applying force. In this area, the deformation is proportional to the force applied. This is elastic behavior and the place where Young's modulus is relevant.
Yield Point or Yield Strength:

If you keep applying more force, you get to a point where the plastic starts to deform permanently, although the tension doesn't increase much more. This is the creep point.
Plastic area:

After the yield point, the material enters the plastic zone. Here, the plastic deforms a lot with little additional force, and it does not regain its original shape when the load is released.
Fracture:

If you keep applying force, eventually the material breaks. This is the breaking point.
The shape of this curve depends a lot on the type of plastic. Hard plastics (such as PVC) typically have a shorter elastic zone and break faster, while more flexible plastics (such as polyethylene) have a larger plastic zone.

Curve Display:
At first, the curve is linear (the slope is Young's modulus), indicating elastic strain.
It then flattens (plastic zone), and finally falls when the plastic breaks.
In short:

Young's modulus measures the resistance to deformation in the elastic part of the curve.
The stress-strain curve of a plastic has an elastic zone at the beginning, followed by a plastic zone, and ends in fracture if you apply enough force.
Is it clear to you or do you need more details on any point?

The application has been able to write the information clearly, adapted to the level of the student, as we had requested. The efficient use of ChatGPT requires the student to learn how to pose the questions well to get the answers they are interested in, and that is something their teachers and tutors can help them with. It is still necessary to develop the criterion in order to be able to assess whether the information is complete and whether it does not contain any errors.

We can still ask ChatGPT to give us some bibliographical references with which we could eventually contrast a specific point, and this is what he tells us:

Here are some bibliographic references on Young's module and stress-strain curves, suitable for an intermediate vocational training student:

"Science and Technology of Materials" by José Luis Pérez Rodríguez: This book covers the basic principles of materials, including polymers, with an accessible explanation of Young's modulus and the mechanical properties of materials.

"Introduction to Materials Science" by William F. Smith and Javad Hashemi: Although it is a more technical text, it is translated into Spanish and is used in vocational training. He explains in detail the stress-strain curve, with emphasis on the elastic and plastic part.

"Materials Technology" by Adrián Santana Vega: This book is aimed at vocational training students and clearly presents the mechanical behavior of plastics, including Young's modulus and the stress-strain curve.

These resources will help you better understand the mechanical concepts of materials at an accessible level for vocational training.

We could give many more examples showing that it is a tool that is worth teaching to vocational training students, especially in the company.

PROCESSES FOR TEACHING STUDENTS WITH OBSTACLES IN THE COMPANY

THE PROGRAMMING NOTEBOOK & MONITORING OF THE TRAINING PLAN.

In this section we make a suggestion on how to collect in a single document the programming of the student's work in the company, the objectives, the activities of all kinds that the student is carrying out, information collected, results obtained, achievement of objectives and conclusions.

We approach it as a digital document that the student fills out throughout their stay in the company. The template of this document is designed so that the student has to reflect on each aspect of his/her activity.

The template of this document is designed so that the student has to reflect on each aspect of his/her activity.

They will set out in writing the objectives of their work that will have been explained to them by their tutor in the company, they will present the results obtained with the help of tables and graphs, they will explain the mathematical treatment of the data they obtain, they will look for the information they need to analyze the data and draw conclusions, they will judge the reliability of the results of their tests or the quality of the parts they have produced,Resolve questions that the tutor of the company may raise in relation to the learning outcomes included in the training plan for which the company is responsible for achieving and issues related to the self-evaluation of their work and personal progress.

This workbook is a guide for the student in their training process and should provide the company and the educational center with a follow-up that allows the student's activity to be redirected at any time to get the most out of their work. It will also facilitate a final assessment of the skills acquired and allow conclusions to be drawn for the programming of other students in the future.

As we said before, the template is designed to advance in the development of critical thinking tools and skills. It is considered important that it is the student who writes in his or her words the instructions sent to him or her by his or her tutor or other company staff about each of the activities.

In the template we will collect questions that lead to a reflection on the reasons for the company or the technical principles that lead to carrying out some of the tasks or to propose some of the specific objectives. Also, some fundamental questions about the scientific or technical principles involved or related to the specific competences included in the training plan.

It is preferable that the digital notebook is hosted on a company server, a computer to which both the student and his/her tutors in the company and in the educational center have online access, who will be able to enter comments in the text with observations, questions or corrections to what the student has written.

Along with the digital notebook, you can add files of all kinds with results, technical information, bibliography, presentations, videos, etc. The use of digital tools, computer security protocols, the exchange of notes with questions and answers between the student and his/her tutors in the shared access digital notebook will contribute to the development of basic digital competence.

The notebook can include a schedule that, like the rest of the sections, must be defined by the student according to the information provided by the tutors and other people about the time that each of the tasks may be required. A schedule will need to be updated with some frequency.

It is clear that at the beginning of the stay in the company, the student cannot gauge the time required for manufacturing or analysis tasks or those necessary for tasks of searching for information, its study and the answer to the questions that are posed.

But it must even be considered that the tutor of the company could not precisely define the scheduling of the tasks without knowing each specific student. Moreover, not only the times allocated will have to be adapted to the personality of each student, even the planned activities may have to be modified depending on the progress of the training and work and it is necessary to consider the training plan with all the flexibility that is necessary.

In accordance with all this, the template of the programming and monitoring notebook of the training plan that we propose may contain all or part of the following types of sections or boxes, being aware of the enormous variability of the activities of the different companies and the different professional fields.

- Personal data.
- Company Data
- Details of the educational center and training cycle.
- Details of the stay in the company. Timetable. Duration. Start and end date.
- Basic competences to which in-company training aims to contribute.
- Specific learning outcomes for which the company is responsible in the student's individualized training plan.
- Global objective or business plan of the company and/or the area of the company where the stay will take place.
- Global objective of the student's work.
- Tasks assigned and the objective of each of them.
- Schedule.
- Results of tests carried out or parts produced. Its analysis, graphic representation, personal assessment of the reliability, quality, or reproducibility of the result obtained.
- Results of bibliographic or technical searches that are required in relation to specific aspects of the activity in the company or with the specific competences included in the training plan.
- Notes collected in meetings of the company's work team in which they are integrated.
- Response to questions, questions or problems raised by the tutor.
- Self-assessment of the work done and progress in the competences set out in points 5 and 6.

Finally, some boxes are included to facilitate the tutor's final evaluation. As we said before, it should be considered that the content of points 8, 9 and 10 can be varied to adapt to the real evolution of the student's work, a history of the changes made in the staff itself can be kept or it may be preferable to simply keep the history of the file itself and collect in the programming and monitoring notebook only the updated version, Let's say "clean".

Below we propose an example of programming in which we will complete the different sections of the template that we propose for the programming and monitoring notebook that we include in the Annex and we ask the reader who follows the course to complete a program thinking of a student who does the internship in his company.

10.1. How can you define the job in which the vocational training student will collaborate during his/her training in the company?

The imaginary company we will use in this example is dedicated to polymer 3D printing, both in terms of printing machine production and the design and additive manufacture of custom parts.

The student will work on the design and manufacture of prototype components for a 3D printing machine under development. He will join the research and development department. It will use three-dimensional design software and software to generate control files for the printing machine. He or she will manufacture parts designed by himself or herself or by other company personnel.It will characterize the properties of the parts produced and will contribute to the quality control of the process both in terms of dimensional characteristics and the physical properties of the materials.

We ask the reader who follows this course to define a job for a student in their company and in the following sections we will build step by step a draft of the programming notebook and monitoring of the training plan.

Brief definition of the job in which the student's training in the company is framed

10.2. Nature of the student's work in the company

A clear premise of Organic Law 3/2022 [BOE 2022] is that dual vocational training students should not be covering jobs in companies. In any case, as the duration of the internship in the end is not very long and a good part of the time is needed for the student to train in the tasks that he/she is asked to perform, it does not seem that a job in the company could be based on a student intern. However, the co-responsibility of the company and the educational center in the training of the student proposed by the legislation will require a significant dedication of the company's staff to training tasks, in particular the tutor of the student in the company and it does not seem unreasonable that the work of the student will compensate him or her with results that really contribute to the objectives of the company. On the other hand, for the student's internship in the company to be truly formative, his or her work must be real and useful. We will return to this point later when we draw up the training programme. In the end, the balance between one thing and the other will lead to the fact that welcoming students in dual vocational training does not eliminate jobs in the company and is in the interest of both the company and the student himself.

The key to the company's participation in a vocational training degree is that the activities that the student carries out, being of interest to the company's plans and objectives, are formative for the student. Organic Law 3/2022 clearly proposes a student-centered education. The planning of an individualized training plan should be based on a reflection on the learning outcomes that the learner will obtain and the competences that he or she will achieve with the help of the company. This approach goes beyond objectives such as a first work experience or a first contact with the business world, we expect the student to acquire both transversal and specific skills of their degree during their internship in the company and we want to show that good planning is mutually beneficial for the company and for the student.

10.3. In which vocational training qualifications can my company offer collaboration?

The information available about vocational training studies in Spain is very extensive and well organized. The website of the Ministry of Education, Vocational Training and Sports of the Government of Spain [Ministry of Education 2024a] allows you to find all the available studies grouped into Professional Fields, Levels, and Professional Certificates.

For example, with a more or less close relationship with the activity of our imaginary company, we find the professional fields of

- Electricity and electronics
- Mechanical Manufacturing
- Computer and communications
- Chemistry

The subject matter we have included in the definition of the practice may have aspects related to several of these professional fields. Whatever is chosen, when the student is working in the company, they will carry out activities that they will recognize as related to subjects or concepts that they will have seen in their previous studies, but they will also have to face concepts and techniques that will be new to them and that they will have to learn to meet the objectives that are set for them. It is no different from what any graduate finds in their first job and then in each of the jobs they will perform throughout their professional career. It is good for the student to abandon as soon as possible the idea that they are only capable of carrying out tasks contained in the curriculum of the degree they have studied, only to do what they have been taught, and to change that idea for a preparation to learn how to learn that allows them to self-train throughout their lives.

The above paragraph serves to downplay the fact that it is impossible to perfectly match an internship in a company with a specific study program.

PAGE 51
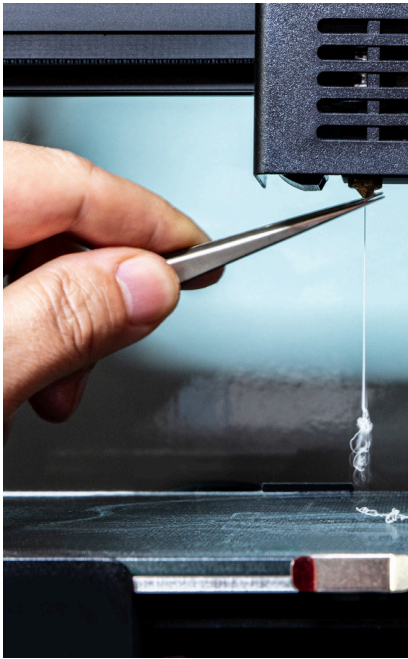
In the **case of the example** we are giving, the 3D printing of polymer parts or polymer matrix composite materials, seems to fit well with the Mechanical Manufacturing field and within this we find qualifications such as

- Metal and Polymer Molding Forming Technician (Intermediate Grade).
- Higher Technician in Design in Mechanical Manufacturing (Higher Degree).
- Higher Technician in Production Programming in Metal and Polymer Molding (Higher Degree).

We also find a specialization course closely related.

- Additive Manufacturing Specialization Course (GS Access).

When deciding to participate in an intermediate or higher degree, it will be necessary to know the characteristics of the students of the specific study center, but probably what determines the level chosen is the degree of maturity of the student that is required for the work that we think of for their collaboration. and the degree of responsibility that he or she will assume. In fact, one of the problems for the generalization of dual vocational training is that a very high percentage of companies prefer students in higher cycles to students in Vocational training.

In the case of our example, the student will work with printing machines and characterization equipment that would make us decide on a student who is pursuing a higher degree. You can be the Senior Technician in Production Programming in Metal and Polymer Molding. However, with regard to the methodological approaches that we will describe below, we will also talk about the vocational training level that is directed in the same line of Technician in Forming by Molding of Metals and Polymers.

The reader who follows this course can search in this links for the professional field and the complete qualification that may interest them to continue with our application example.

Spain   Portugal   Italy   Greece

Professional fields related to the job
Preferred professional field
Vocational training
Preferred Vocational training

10.4. Can other alternatives be studied if the company receives offers from educational centers that teach professional degrees related to the activity of our company, but perhaps not with the specific position we have thought of?

The initiative to seek the collaboration of the company in a vocational training may come from the Vocational Training Educational Center. If that is the case, the offer will come with a smaller range of professional fields and qualifications within each of them. It will be necessary, in this case, to analyze how flexible we can be in terms of adapting the job or if it is possible to keep the job that interests the company and adapt the student's training plan, even if there is a greater part of the concepts and techniques that they have to learn during the internship.

In our example, the student's activity in the company, being polymer molding, will serve to establish many concepts contained in his or her Higher Technician Degree in Production Programming in Metal and Polymer Molding:

- Properties and characterization of amorphous and semicrystalline polymers.
- Rheology, flux of molten polymers.
- Mechanical properties.
- Design of plastic parts. Mechanical resistance. Fracture and fatigue of plastic parts.

However, it is a very particular molding and for the development of their work the student will have to be trained in techniques and know properties that are not included in the basic contents of this degree:

- Computer-aided design programs
- Chemical modification of polymers.
- Chemical analysis.
- Polymer adhesion.

The question is: if a Vocational Training Educational Center asks us to collaborate in a degree such as *Higher Technician in Industrial Automation and Robotics, Technician in Electrical and Automatic Installations, Higher Technician in Analysis and Quality Control Laboratory*, would it be feasible to adapt the job to a certain extent and assume that the complementary training we have to give the student is greater than what we thought in the previous approach?

Look for other qualifications from other professional fields in which it would be possible to collaborate by adapting to a certain extent the objectives and work plan set out above

10.5. Contribution of the company to the training of the basic contents of the degree

Organic Law 3/2022 [BOE 2022] provides that part of the learning outcomes foreseen in the degree will be taught in the company, as seen in the training programme template suggested as a model in Royal Decree 659/2023, of 18 July, which develops the organization of the Vocational Training System [BOE 2023]. The number of hours dedicated by the student in the company to develop these learning outcomes is very open to agreement between the VET study center and the company. We can suggest exploring first of all what basic contents and what learning outcomes the company considers likely to be developed during the student's internship. Later we will allow ourselves to suggest a teaching methodology that we consider appropriate for teaching in the company.

The Royal Decree that develops the chosen degree contains all the details of the minimum education that is set for that degree, then the Autonomous Community and the educational center itself develop the rest of the content.

We continue with our example, we look at Royal Decree 882/2011, of 24 June, which establishes the title of Higher Technician in Production Programming in Metal and Polymer Molding and sets its minimum teachings [BOE 2011b] to which we have been led by a link on the website of the Spanish Ministry of Education, Vocational Training and Sports https://todofp.es/que-estudiar/ciclos/grado-superior.html. The professional modules that make up this vocational training are the following:

Professional Module	Equivalence in ECTS credits	Minimum duration in hours
0007. Graphic interpretation.	7	70
0530. Characterization of materials.	7	70
0531. Closed molding.	20	180
0532. Open molding.	14	120
0162. Programming of automatic mechanical manufacturing systems.	9	90
0163. Production scheduling.	8	60
0165. Quality management, occupational risk prevention and environmental protection.	9	90
0533. Verification of conformed products.	10	90
0534. Production scheduling project in metal and polymer molding.	5	25
0535. Training and career guidance.	5	50
0536. Company and entrepreneurial initiative.	4	35

Our company works with polymers and the student will be involved in activities that will help them achieve these results, but they will not be very in contact with metal molding. There is the possibility in the Law that the training period in the company is divided among several companies, especially in the case of small or medium-sized enterprises. However, this possibility would have to be carefully analyzed. The duration of the internship, although it will reach the minimum required by Law 3/2022, which would be 500 hours for a degree of 2000 hours, with the contents set by the Autonomous Community, is not very long and the student may get more out of a continuous stay in a single company. If so, we could suggest completing the training with other training activities in those aspects that the job in which the student collaborates does not cover. We will give some methodological suggestions in this regard later.

> On the other hand, in the professional module of Material Characterization we find.

- It characterizes the influence of raw materials and polymeric processes in the production of parts by molding, relating their properties to the parameters of the transformation processes.

- It determines the influence of raw materials and processes of a metallic nature in the obtaining of parts by molding, relating their properties to the parameters of the casting processes.

- It defines the influence of raw materials and ceramic processes in obtaining parts by molding, relating their properties to the parameters of the transformation processes.

- Identify the influence of raw materials and composite processes on the production of parts by molding, relating their properties to the parameters of the transformation processes.

Our company may be interested in participating in training aimed at learning outcomes 1 and 4 of this professional module. Obviously, the teaching methodology for this training is going to be very different from that used in an educational center and precisely this different way of approaching teaching is a very valuable contribution of dual vocational training to the educational system. But this training poses a challenge to the company, which has to develop a new methodology from scratch. In this course we make a suggestion in this regard that, of course, does not pretend to be more than that, an idea on how to face this challenge among the many others that can be raised and that will be tested in other areas.

Professional modules in which the company would contribute		Hours
Professional Module X		XX
	Learning Outcome xx1	
	Learning Outcome xx2	
Professional Module Y		YY
	Learning Outcome yy1	
	Learning Outcome yy2	

With all of the above, the company is in a position to analyze, discuss with the educational center and reach a consensus on a training plan for the student, which will be included in a document such as the one suggested in Figure 1 and which we will include in PART 1 of the training plan programming and monitoring booklet so that the student can have it at hand throughout the internship.

10.6. Training activities 1. The workplace

PART 2 of the training plan programming and monitoring notebook is aimed at the workplace in the company. In this part, as in all the rest of the notebook, we suggest that the student fill in the different sections after a conversation with the tutor of the company who will explain the objectives and the work plan, with the specific tasks that the student is going to carry out. We consider it extraordinarily formative for the student to put in writing the fundamental points of what their work is going to be, which will force them to reflect on it, see what they have not understood and ask relevant questions and consult with their tutors. Then the tutor in the company will approve what the student has written or refute it if it is not correct or is not well expressed.

In this section of the course, we analyze in some detail how to consider the student's work plan in the company. We are always within the framework of dual training focused on the student, as clearly stated in Organic Law 3/2022. We feel obliged to ensure that the tasks entrusted to the student in the company are as formative as possible for him or her. They must serve to achieve competences and skills that they will use throughout their professional career, possibly in companies other than ours, with different business activities or even if it is our same sector with different technologies and in continuous innovation. Therefore, the approach to the tasks that will be carried out during their training and the training to carry them out goes beyond an operating procedure, occupational risk prevention rules or waste management regulations. We suggest below a methodology to take advantage of this activity to develop critical thinking tools applied to professional activity in the student.

What we wanted to say in the previous paragraph could be specified as follows: one of the tasks that the student is going to perform is to operate the fused filament printing machine. This machine starts with one or two rolls of plastic filament (typically 1.75 mm in diameter) that is melted and extruded in a printing nozzle that builds the part layer by layer, with movements controlled by stepper motors and defined in a text file that we will call GCODE. In these tasks, the student will learn routines for receiving, storing and controlling stocks of raw materials, will learn how to operate the machine, its calibration, and certain quality control routines with dimensional control, mechanical resistance measurements and certain specific details of the parts produced by additive manufacturing. We hope that the performance of these tasks will be very formative in relation to the learning outcomes specified in the royal decree that regulates the degree that the student is studying. The company's technicians will give the student specific training detailed for that job. They will also receive detailed training in occupational risk prevention in the specific job (the student will have already received training in occupational risk prevention of a general nature in their educational center before starting training in the company, as provided for by law).

The issue we mentioned before is that the approach to on-the-job training should go further, to take into account that we are not training a worker to perform this position in the company for a long period of time, but that it is one more basic training activity that must serve them throughout their professional life.

In this sense, it is necessary to influence actions that make the student not settle for following established protocols to the letter but try to understand in depth the principles that govern the activity they are carrying out.

In **our example** we could raise the situation that a manufactured part does not meet any of the required characteristics, for example, it has small cracks or pores, it does not have a good bond layer by layer, the layers have not welded well during printing. The machine operator has the option to report this fact and wait for design changes to be made that resolve it. But the printing procedure was going well, other parts have been manufactured with this procedure before.

How many times the solution to these problems comes from the experience of the professional who manages the equipment.

But you don't get to contribute effectively to problem solving from an uncritical experience, with the experience of someone who has done an operation many times without thinking deeply about what they are doing. In order for our professional to contribute to the solution of a problem or bring new ideas to their job, they need to know the principles that govern 3D printing, how the properties of the polymer change during printing, how it affects the parameters that define the process: temperatures of the plastic and its environment, the speed at which it cools down after being deposited,environmental parameters such as temperature or humidity if applicable, possible impurities generated during printing and others. We want the student to want to have sufficient skills and want to act in their work with the aim of contributing to the success of the task they perform. Our training plan can include a series of training actions that guide the student on how to acquire the necessary knowledge and how possibly throughout their professional life they will not have a teacher by their side to ask or teach them to do it autonomously.

These issues must be raised with empathy, for our methodology to be effective we will have to put ourselves in the student's shoes, take into account their previous training and not pose unattainable challenges or challenges that take longer than what has been specified for their training.
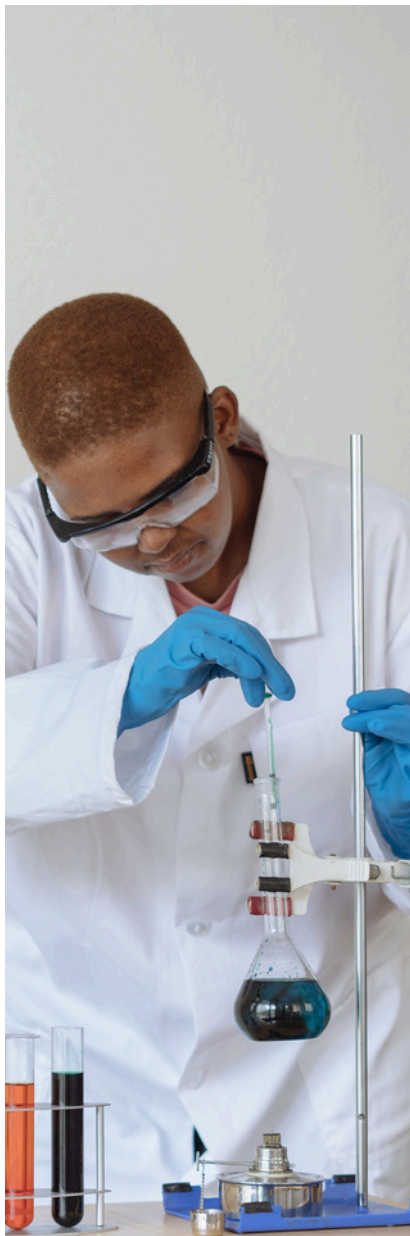
In PART 2 of the notebook, we are going to leave a space to ask the student a series of questions that he or she must answer by looking for the necessary information, analyzing it critically and making the effort to understand that information in depth.

In some cases, it may be conceptual issues, in other cases technical information of certain products, or questions related to physical, economic, or management magnitudes. It is clear that these issues are very specific to each sector and each activity in the company, it is very difficult to generalize regarding the type of questions that we can raise, but possibly there is a common point in the training of any student which is that these activities seek to advance in the achievement of transversal skills related to what we have mentioned before.

10.6.1. Conceptual Issues

We give some examples simply to specify what we are trying to say. In PART 2 of the notebook, we ask the student a series of questions such as the following:

1 **What is an amorphous polymer and what is a semi-crystalline polymer? Give examples of one or the other among the most common fusion filaments.**

This question seeks to make the student understand that polymers have an inherent difficulty in crystallizing. Crystallization needs regularity in order to organize molecules in a spatial network. Polymer chains have many irregularities and that means that even a polymer capable of crystallizing only partially does so. Polymers are called semicrystalline. A part of the material is always left in a disordered, amorphous phase. But other polymers do not even have that crystallization capacity, they are amorphous polymers. Examples of semi-crystalline polymer filaments are polylactic acid, PLA, polypropylene, PP, or polyester, PET, while examples of amorphous polymers are ABS or polystyrene.

We include this brief explanation so that the type of information that the student has to find and understand is understood. In this case, it is a concept already included in the basic contents of the degree and the student may resort to notes from the classes taught in the educational center, to the bibliography that is suggested in those studies and the consultation with the teachers that he or she has had in the educational center should not be ruled out. However, in other concepts that we are interested in understanding in order to perform their job, because they are more specific or more difficult to understand, the student will be forced to look for information on the internet, in ChatGPT or look for bibliography and here the difficulty that not only the student, The tutor in the company will also find is to distinguish those sources that explain these concepts at the level of the student of a vocational training.

We have already commented before on the usefulness that Artificial Intelligence applications can have in this regard. It may be that the student finds texts or web pages more aimed at university students or professionals with a lot of experience. In this regard, we believe that it will be necessary to guide the student in the way of looking for information, as we have already commented in section 3. The teachers of the educational center, with a lot of experience in teaching at this level of studies, will be of great help and the company itself has bibliography on these topics that are specific to its production with which the student can work or even be interested in acquiring some books.Of course, the problem is exacerbated when it comes to students in Vocational training education, with less initial training, less autonomy in study and less maturity. But the training objective for them is the same. A mutual benefit will be obtained for the student and for the company if the student is interested in understanding these concepts and in acquiring the ability to seek the means to obtain the information and assimilate it. Perhaps in a different way, but the question is the same regardless of the level of education. It is necessary to find a way to guide the student in this learning process and motivate their interest to understand in depth everything that surrounds their work in order to contribute efficiently to their objectives and those of the company.

It would be a matter of thinking of a series of questions of this type that we think that a student who faces them acquires sufficient knowledge of the principles that govern the processes involved in the work he or she is starting. We will briefly present some more examples of this type of conceptual issue below.

2 **At what speed does a polymer, initially molten, harden when its temperature is lowered?**

Here we want the student to see that when you cool the polymer that comes out of the printing nozzle, if it is a semicrystalline polymer, the crystals are formed first, the solid phase. The rate at which the polymer crystallizes is highly variable.

There are polymers that crystallize very slowly, for example, polyesters, one of them polylactic acid, PLA, widely used in 3D printing. So much so that if the cooling is very fast, the temperature may drop faster than it costs the polymer to crystallize and there will come a time when the polymer molecules lose mobility and no longer crystallize. PLA can occur amorphous or semicrystalline. Others such as polyethylene or polypropylene crystallize very quickly. The part that remains uncrystallized, or the polymer as a whole if it is an amorphous polymer, vitrifies at lower temperatures and is left with the appearance of a rigid solid. The glass transition is a completely different process from crystallization. Understanding these processes is not easy and is important for designing print parameters.

3 Can a plastic be dissolved?

On many occasions we will find plastic residues adhering to the surfaces of the machine or plugging a nozzle. They can be removed with a solvent. The student has to understand that solvents are very specific to each plastic and that those that dissolve the plastic in question may also damage the surface you want to clean.

4 What does it mean that a polymer is biodegradable?

Among the polymers used for printing are biodegradable polyesters such as PLA, which degrades slowly by hydrolysis in a humid environment. This has an impact on the recycling and durability of the parts produced with this material. More and more biodegradable polymers are appearing for uses in which the life of the material is short and its elimination from the environment is favored in the event that it is not properly recycled or discarded.

5 How is industrial plastic waste recycled? What are microplastics?

This would be a question related to waste management, the student will have to review information that has been given to him or her when starting the work in the company.

6 — Why does the printed part deform during production or when cooling?

Material shrinkage when cooling is one of the biggest problems with fused filament printing. Some polymers contract more than others and manufacturers bring products to the market that try to minimize this effect. It is important to know why this phenomenon occurs in order to understand the technical information of the raw materials.

7 — What is form memory?

A part of an amorphous polymer that has been produced by molding the material at a high temperature and then cooling it below its glass transition temperature maintains its shape indefinitely as long as the temperature does not exceed the glass transition temperature again, if it does the material remembers the shape it previously had and recovers it.

8 — How is printing filament industrially produced?

It is important to know this production process, to know that the filament is not a pure polymer but incorporates a significant amount of additives that can have transcendence in the printing process.

We have tried to show in our concrete example how to guide learning based on a series of questions that force the student not only to study some texts but also to reflect on specific concepts, look for convincing answers and know how to express them in a concise way.

In the process of training for the job, the student is acquiring specific skills that are very valuable for the performance of their functions in the company and we are also contributing to the acquisition of basic critical thinking skills: asking relevant questions, looking for information, assessing its reliability, understanding and organizing it, expressing oneself effectively in writing. Surely the experience of the tutor in the company and the rest of the team will allow us to easily raise a set of questions that sufficiently cover the area in which the student's job is framed.

We propose below the exercise of thinking about a series of these questions for the example that the reader is elaborating during this course.

In the template of the programming and monitoring notebook of the training we include a couple of cells to ask the student to say what source of information he or she has used to answer these questions, it would be to cite the references used and to reflect on why he or she has chosen them or how he or she has found them. As we said before, in this aspect you will surely need help.

PART 2.- Workplace. Conceptual issues.
Explain the concepts clearly and concisely and solve the exercises collected in the following cells.
Question 1. Explain in 4 or 5 lines what you mean by...
Question 2. Why does it happen that...?
Question 3. How is xxxx different from yyyy?
Question 4. Mark the correct answer to the following questions among the 4 options that are posed: ....

Bibliographic search: *Include in this cell the reference where you have studied these concepts, it can be a website or a chapter of a textbook or some notes from a subject of your training center.*	Think and write very briefly how you have decided on one type of bibliographic source or another

10.6.1. Specifications

Another block of questions could be aimed at ensuring that the student performs well in the more technical issues of the job. Again, it is about presenting them with situations, here it will be in the form of a problem and making them reflect on where they can find resources to provide a solution. Always at the level of a person who is starting out in a new activity. Probably throughout the training period in the company they will encounter other similar situations and will gain fluency and effectiveness when responding to unexpected situations. Here are some examples that we can think of in relation to fused filament 3D printing.

1 **Which solvent is suitable for polyester filament?**

Here the search for information will be directed to the internet or to the technical documentation provided by the distributors of this product.

2 **What is the glass transition temperature of ABS (acrylonitrile/butadiene/styrene copolymer? Is it semi-crystalline or amorphous?**

3 **In order for the part, we are going to print to adhere well to the build platform and not move during printing, is it better to increase or decrease the temperature of the base?**

You will probably find that it depends on the polymer with which it is being printed and perhaps there will be some comment in this regard from the manufacturer.

4 **What can make a filament from one manufacturer better or worse than one of the same polymers, but produced by another manufacturer?**

To answer this type of question, the student will probably resort to forums on the internet, looking for more or less reasoned opinions and will have to judge the reliability of those comments. But the question is more about the student's own reflection on what they have learned in the more conceptual part and the questions they can ask their tutors or company staff.

5 Look for the printing recommendations of an ABS filament given by the manufacturer itself (nozzle temperature, bed temperature, printing speeds....) and try to reason why they make those recommendations and in what sense the process can be modified for better or worse by deviating from them.

6 We want to test a new printing material, a polypropylene filament. Look for potential suppliers and suggest one to the team. What do you base your decision on? Compose an e-mail to place the order.

A question that is not easy at all, not only for the student, but it is very interesting in terms of developing a critical stance in the face of the information you are given, not accepting a message just because it comes from someone to whom authority is granted but accepting it or not only after your own analysis.

We ask the reader who is following this course to outline a series of issues that are applicable to the job they are developing.
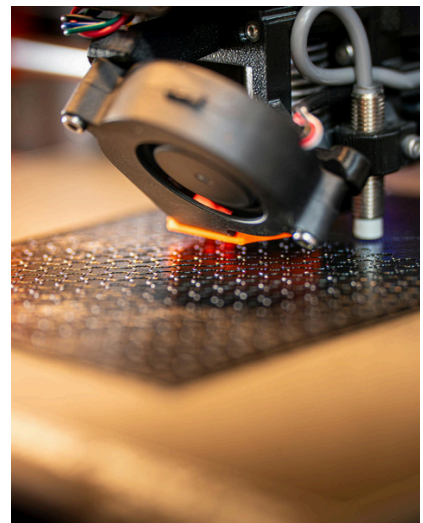
PART 2.- Workplace. Technical Information.
Look for the following data or technical characteristics.
Question 1. Look for the value of ......
Question 2. Find a procedure to...
Question 3. Find a supplier for .....
Question 4. Mark the correct answer to the following questions among the 4 options that are posed:
....

Bibliographic search: *Include in this cell the reference where you have studied these concepts, it can be a website or a chapter of a textbook or some notes from a subject of your training center.*	Think and write very briefly how you have decided on one type of bibliographic source or another

10.6.1.Processing, storage and presentation of results

Surely, we will be interested in the student not having doubts when it comes to handling different magnitudes, the units in which the data are presented, the conversion between the different systems of units in which one can find data in technical documentation or literature. You'll also want to master how to perform calculations in one of the most common applications or manage data files on a server, computer security routines, and other aspects of the work you do.

We propose below some exercises that can be considered, as always related to **our example:**

1 **We have deposited a line on the print bed by placing the nozzle at a height of 0.3 mm and moving the nozzle on the x-axis at a speed that varies between 1 and 20 mm/s. We measure the width of the deposited line and it turns out that for 1mm/s it measures 0.6 mm wide, for 2mm/s it measures 0.55 mm, for 5mm/s it measures 0.45 mm, for 10 mm/s it measures 0.4 mm and for 20 mm/s it measures 0.35 mm. Represent a diagram in an Excel spreadsheet that collects this information.**

2 **In a series of polymer spheres that have been produced in an emulsion, we measured the diameter of a total of 20 particles, resulting in the following values in microns: 30, 40, 32, 18, 40, 35, 36, 22, 61, 15, 32, 32, 32, 37, 28, 23, 35, 34, 38, 29, 33. It represents a histogram of particle sizes showing in a bar diagram the number of particles with sizes between 10 and 15 microns, between 15 and 20 microns, and so on.**

3 **Make a diagram showing the monthly consumption of filament spools in the machine. We have the following values for the months of January to December: 150, 140, 140, 185, 200, 175, 200, 160, 50, 170, 210, 240, 180.**

We want the student to be clear about the difference between an x/y numerical diagram, in which numerical values are being represented on the axis of abscisses, and a histogram or a statistical diagram in which texts are represented on the axis of abscisses.

4 A rectangular section and length L prismatic bar is hung vertically and a weight hangs from it. In which units are the applied force, the tension and the elastic modulus of the material measured, in the international system of SI units?

The student will have to understand well what each of these three magnitudes is.

5 Create a folder on your computer that will act as a server and a tree of subfolders to add the information you collect, the results you get on the machine, documentation related to quality control tests, etc.
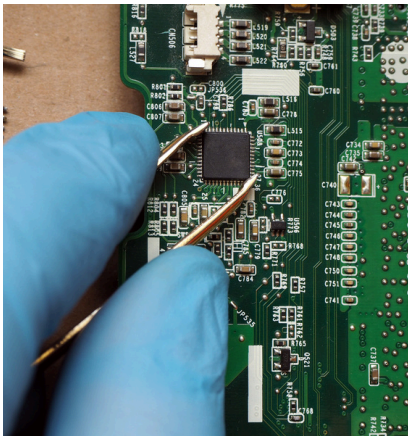
We pose very basic questions or simple exercises covering the range of situations that the student will have to face. As they will be actions that he will carry out on many occasions, he will master them over time, but it may be interesting to do a first exercise on which he reflects a little, rather than learning based on clashes.

Below is a table for the reader to include examples suitable for the job they are simulating.

PART 2.- Workplace. Processing and storage and presentation of results.	
Do the following exercises.	
Exercise 1. Plot the following data...	
Exercise 2. Perform the following operations on your server folders....	
Exercise 3. Data operations.	
Exercise 4. Mark the correct answer to the following questions among the 4 options that are posed:	
....	
Bibliographic search: *Include in this cell the reference where you have studied these concepts, it can be a website or a chapter of a textbook or some notes from a subject of your training center.*	Think and write very briefly how you have decided on one type of bibliographic source or another

With this we hope to complete basic training on the principles on which the production, control or management processes in which the student will be involved are based. It may be interesting to add other sections for other industrial sectors or other areas. It does not mean that this part of the training has to be done prior to the start of the tasks, it is probably preferable that the student is given some time each day to carry out the exercises, programming objectives to be met from time to time and adapting these milestones to the progress of the student, because each one will need more or less attention and will advance at different speeds in the work. It is important for tutors to monitor the work.

10.7.Experimental Protocols, Results

PART 3 of the notebook is the part where the student will collect their results day by day, like a laboratory notebook. This part of the notebook is designed to lead the student to reflect on each of the tasks they are in charge of. The notebook has an entry for each task. A degree will be given, and the student will write a brief description of the task they are going to carry out and that, naturally, their tutor or other technicians from the company will have explained to them. In line with critical thinking, the task will be presented as a problem to be solved, and the student will also be asked to explain it. One point that we consider important in this approach is the establishment of a hypothesis. With the experience of the company and with what the student can deduct from previous tasks or from conversations with his/her tutor and with other people in the company, before starting a task he/she must express in writing the result that is expected to be obtained. This is one of the keys to scientific thinking, to express a hypothesis and contrast it with the results obtained from experimentation and then accept it as valid or modify or reject it. In our case, we also use it as a way of forcing reflection on the result obtained from a given trial.

Let's take as an example that in our imaginary company a task entrusted to the student is to measure the mechanical resistance of a part produced by 3D printing based on a certain parameter of the printing process such as the volume of filler material. We decided to measure it using a tensile testing machine using a halterium-type specimen (in the form of bone). The specimens will be printed with a certain type of filler and with a double external wall. The testing machine will measure a stress-strain curve until the specimen breaks.

The data of the tensile strength of the filament that we use in the printing may have been provided by the manufacturer or we can measure it ourselves.
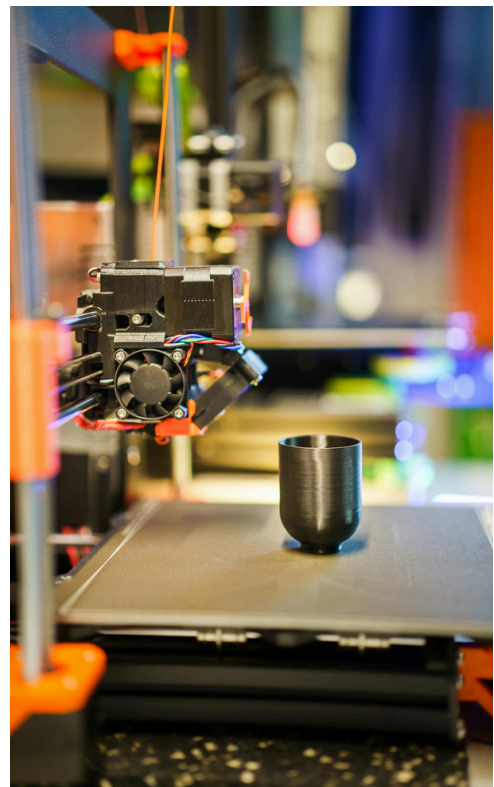
However, as our specimen is porous, we expect a lower resistance and the lower the pore volume fraction. We are going to ask the student to think about the extent to which the sample produced by 3D printing is less rigid than an equal sample, but without pores. You will need help to establish the hypothesis and surely the company can give you information in this regard. The idea is that when the student prints the pieces and makes the essays, he or she compares the values with those expected.

It happens that sometimes there are big differences that make you think of calculation errors, wrong dimensions or things like that, or errors when it comes to hypothesizing. But other times it can be another type of situation, for example, a clearly lower value can be representative of poor adhesion between layers or other printing defects or other material-dependent causes.

The student will also take note of the measurement protocol and other information on the trial methodology, or a reference to it if it already exists in the company. You can also write down references to other documents, such as essay standards, research articles, etc., that are already available and that you will add as separate files in the folder of the server where your notebook is hosted. In another cell, he or she is asked to write down references to additional information that he or she obtains himself. On subsequent pages you will write down the results obtained, including tables and graphs and references to data files that you will upload to your folder on the server.

Finally, they are asked for an evaluative note of the results, and some conclusions, to induce them to think about the results before taking them for granted and presenting them to other people in the company, for example, regarding reproducibility, agreement or not with the hypothesis raised and others.

The writing of the notebook takes a certain amount of time, especially at the beginning, but we hope that this time will be more than compensated by the advantages it implies in terms of the student's learning and the organization of the information that will remain in the company. It is advisable to make the task as easy as possible with regard to issues related to the editing of the results part. The notebook is a digital document but if it is more convenient that the notes made in the workshop or in the laboratory are taken on paper, with equations, drawings or diagrams, it is recommended to allow a photo taken from that notebook on paper to be pasted as an image in the notebook.

10.8.Training activities 2. Basic contents of the degree

As we have seen, the company, apart from contributing to the training of the student in the Training in the workplace module, will participate in the training in other modules of the degree. We propose that the methodology that we can follow in the company to achieve the learning outcomes that we specify in the training project is more or less the same as the one we have developed for on-the-job training in section 7.7.
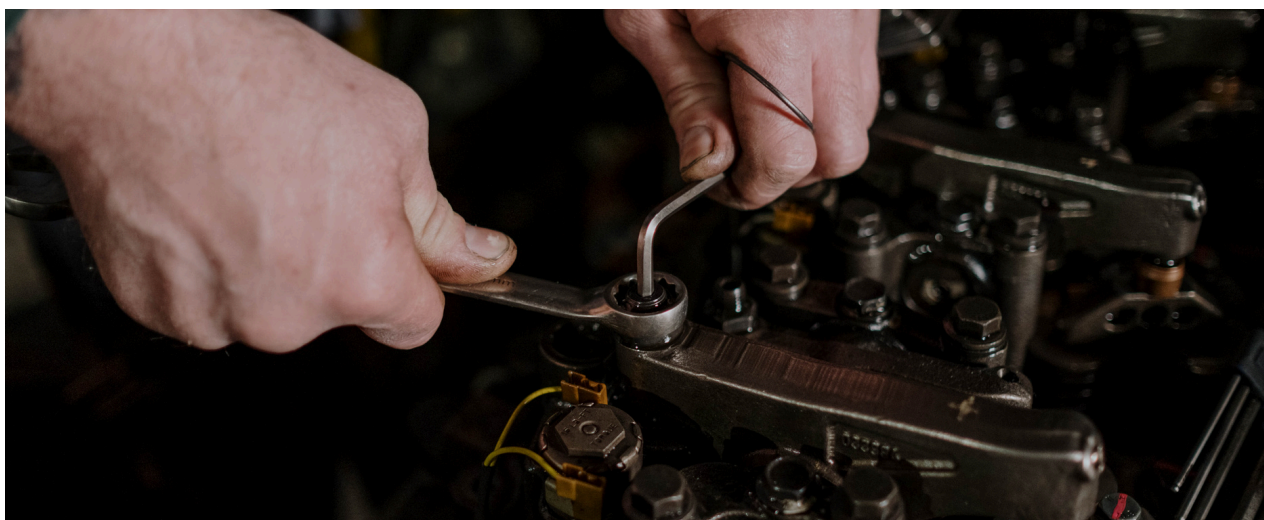
Probably, the student in his/her educational center will be following a methodology based on blackboard classes, study of subject notes taken in class or bibliography recommended by the teacher, problem solving individually or in groups and workshop or laboratory practices. During their stay in the company, the teaching methodology must necessarily be different, it cannot be expected, and it is not desirable that teaching in the company tries to imitate teaching in the educational center. A different methodology is expected, closer to the methods that the professional will have at their disposal when they seek to acquire training throughout their professional career. In this sense, the methodology that we propose here seeks to achieve the basic learning outcomes expected, but also to influence the competence of learning to learn.

Therefore, we continue with our training programming and monitoring notebook and in a PART 4 that we call Training Contents we are going to ask the student a series of questions, questions or problems that will lead them to look for information, analyze it and understand it. We would order these questions by learning outcome and include a cell for the student to collect the sources where they have studied, what they need to study this topic and the place for them to write down why they have earned them confidence.

> In our example, the company has chosen to contribute to module 0530 Characterization of materials and within that module to the learning outcomes.

- R01 Characterizes the influence of raw materials and polymeric processes on the production of parts by molding, relating their properties to the parameters of the transformation processes.

- R04 Identifies the influence of raw materials and composite processes on the production of parts by molding, relating their properties to the parameters of the transformation processes.

In the preparation for the job, we have already focused on issues related to the properties of polymers, but we have done so with questions aimed at the manufacturing process itself in which the student is going to collaborate. In this part of the training, we are going to look at more general issues. We are training a student for their entire professional career, not only for the job they are going to hold for a few months of their life. The approach is somewhat different from that in section 7.7, but the methodology would be the same. We would pose conceptual questions, problems to be solved, search for properties or technical characteristics, explanation of characterization protocols and others.

> **Some examples related to training in material characterization could be:**
>
> - Explain in ten lines what you mean by the glass transition of a polymer. How is it determined experimentally?
> - What is the elastic modulus or Young's modulus of a material? In what units is it measured in the International System of Units, SI?
> - What does it mean that a polymer has a molecular weight distribution? How is the average molecular weight by weight measured? What is polydispersity? How is it measured?
> - How can the mass fraction of mineral fillers contained in a commercial polymer be determined?
> - Explain the concept of viscoelasticity.
> - What is a hydrogel?

We would seek to raise a sufficient battery of questions that require us to acquire a global knowledge of what a polymer is and its basic properties. We can be guided by the list of evaluation criteria included in the Royal Decree that defines the degree. Here it is possible that the difficulty for the student lies, as we have mentioned before, in the availability of bibliography that he or she can understand. At school, he or she may study on the basis of the teacher's notes or notes that he or she takes in class. When looking for information on questions such as those posed in the previous paragraph, the books that are found on polymer science and technology may have a university level, here the student will need help. It would be good to select some general books in advance, perhaps with the help of the teachers at the school, and even buy them from the company if they are not already available.

The other source of information is the internet, but, in the same way, it is possible that the student may not have an easy time distinguishing the sources of information on the internet that are at their level. We have already seen in section 3 that being effective in the use of Artificial Intelligence tools such as ChatGPT can be very useful to solve these problems.

In our example we can also consider the understanding of characterization protocols based on UNE standards. It is interesting for the student to be confronted with the way in which these rules are written and how the tests are described and the magnitudes that are determined from them.

1 **We want to measure the elastic modulus of a thin sheet of plastic, which is around 100 microns thick. Look for the UNE standard that applies to this type of measurement, describe the shape and dimensions of the sample and the preconditioning it needs before the test.**

By posing calculation problems, we have an easier time adapting to the level of knowledge of each specific student.

2 **A bar made of a polymer with a rectangular section of 2 x 4 mm and a length of 100 mm is suspended from one end and a weight of 2 kg is hung at the lower end. The material is viscoelastic. When you hang the weight, the bar instantly lengthens by a certain amount and then slowly continues to lengthen until you reach an equilibrium. If the Young's modulus of the material in equilibrium is 43 MPa, it calculates the length of the bar in equilibrium with the applied load.**

10.9.Evaluation

In our case, we propose in the notebook a PART 5 in which the student self-evaluates. We base this part on the evaluation criteria that appear in the decrees that regulate the degree. For example, in the title of Higher Technician in Production Programming in Metal and Polymer Molding are expressed in sufficient detail for each of the learning outcomes, so for R01 the following are mentioned.

- Polymer materials have been classified by their chemical field, standardized structure, mechanical and thermal behavior, names and commercial forms.
- The process parameters of the different polymeric materials have been identified.
- The glassy behavior of thermoplastic polymers and their influence on transformation processes have been described.
- The different catalysts and additives in crosslinking reactions and their influence on the final properties of thermoset polymers have been described.
- The influence of the vulcanization process has been related to the improvement of the mechanical properties of elastomers.
- The different additives used to give special characteristics to polymers have been classified.
- The mechanisms of degradation and stabilization of polymers have been described.
- The criteria for the maintenance of the materials in service have been selected.
- The possible effects that surface treatments can cause on the properties of polymers have been identified.
- The different mechanisms for the treatment and recycling of waste generated by polymers have been selected.
- The risks and means of prevention and protection that have to be applied in the handling of polymers have been identified and for R04 a similar list.

These assessment criteria will also help us to check whether the set of questions we have prepared in PART 4 actually covers the content that the expected learning outcomes are expected to have. Possibly the wording of these evaluation criteria is not designed for the student to read, and it is possible that the student does not really understand what is meant. It would be convenient to adapt it to the student's level and to a more colloquial language. For example, instead of

- Polymer materials have been classified by their chemical field, standardized structure, mechanical and thermal behavior, names and commercial forms.

It could be said.
- If they tell you about a common polymer such as polymethyl methacrylate, would you know how to write its standardized chemical formula? Do you know how to find data on its mechanical behavior or its glass transition temperature?

The reader following the course can try to focus on what this part might look like in the case he is making.

PART 5.- Self-assessment	
The following questions are based on the evaluation criteria set out in the Royal Decree establishing the title of your training cycle. Think about whether what you have studied in relation to each question and the exercises you have done seems sufficient for you to master each of these aspects. Enter a comment to this effect in the box on the right.	
Evaluation criterion CA1	
CA2	
CA3	
.....	

SHARED EVALUATION MECHANISMS

The programming and monitoring notebook of the training plan can be very useful for this

The evaluation of the educational process has two aspects: on the one hand, the learning of each specific student must be assessed in relation to the levels set out in the degree and, on the other hand, it must assess the capacity of the training plan and the methodology used for the training of students as a whole and the way in which it has been adapted to each specific student.

Organic Law 3/2022 [BOE 2022] leaves the first of these aspects in the hands of the educational center, in relation to the internship period in the company the second aspect should be carried out by the company itself. A good number of studies can be found in the literature on how to evaluate the internships of vocational training students in companies and different rubrics have been proposed to carry out the evaluation of students [Yusop 2022[39].

For an evaluation of the achievement of the learning objectives in the company that helps to continuously improve the educational methodology, it is surely necessary to develop a rubric that is specifically adapted to specific aspects of the activities that we propose to students, both in terms of the tasks that are entrusted to them in the company and in terms of the content of the subjects of their degree. The programming and monitoring notebook of the training plan can be very useful for this since it will collect in writing and day by day the experimental results carried out, the searches for information, the posing of important problems or questions, the self-evaluation by the student of the results obtained and the learning and others.

In the context of Vocational Training and mobility programmes of the Erasmus+ Programme, the assessment of students undertaking trains/mobilities in technology companies is carried out through the European Credit Transfer System for Vocational Education and Training (ECVET). This system is a common framework to facilitate the transfer, recognition and accumulation of learning outcomes of students participating in mobility projects. It is designed to ensure that the knowledge, skills and competences acquired by students during their in-company training are valued and certified in a standardized manner across Europe.

Before the student begins their training in the company, a Learning Agreement is signed between the educational center, the company and the student, which specifies the competences and learning outcomes that the student is expected to develop during the mobility, as well as the methods and criteria for assessment.
At the end of the internship period of a VET student in the company, the company's technicians will be in charge of filling out an evaluation report provided by the educational center in which they will evaluate the student according to the technical skills acquired, the transversal skills and the fulfillment of the objectives. Subsequently, it will be the educational center that will be responsible for validating the assignment of ECVET credits to students.

TEMPLATE OF THE PROGRAMMING & MONITORING NOTEBOOK OF THE TRAINING PLAN

We hope that the time and work necessary to complete the notebook will be compensated by the formative value and personal growth provided by reflection and in-depth analysis of the task at hand

This workbook includes the programming of the training period in the company and is considered a transcendental tool both to achieve the results of your training and to comply with the quality standards of the company's production processes.

In order to meet this objective, the notebook must be above all an aid to reflection both when programming a specific experimental task and for the study and understanding of concepts related to the expected learning outcomes, the search for bibliographic or technical information, the resolution of problems that arise at work or problems or questions of an academic nature. It must also facilitate the monitoring and evaluation of work and the acquisition of skills both specific to the training degree or specialization course or certificate of professionalism and transversal skills for the development of professional life.

We hope that the time and work necessary to complete the notebook will be compensated by the formative value and personal growth provided by reflection and in-depth analysis of the task at hand. To guide this reflection, the notebook is organized by sections or cells in which you must include all kinds of information for which certain indications are given in the cell itself.

They are cells of different types, some examples are:
- Objectives of the student's activity in the company.   - Machine handling protocols.   - Results obtained from a given trial.   - Quality control results.   - Explain certain concepts related to the tasks undertaken.   - Solve problems or issues related to the expected learning outcomes and the tasks entrusted to them in the company.   - Search for technical information.   - Bibliographic searches

We consider especially valuable the exercise of understanding each of the aspects that have to be collected in the notebook, reflecting on them and writing the answers in your own words. In this sense, it should not be copied verbatim from any source for the elaboration of the texts.

We especially insist that the training period in the company helps you acquire the basic tools of critical thinking. We understand that an essential point in this sense is reflection on one's own thought. If you don't stop to think about the mechanism by which you accept as true something you are told or that you find on an Internet page or a result you get on a machine, it is very easy that you are deceiving yourself or allowing yourself to be deceived by others. In the same way, when making a decision, it is necessary to stop and think about why it is being done, if the information you have is sufficient, if you are not letting yourself be carried away by what is customary around you or by what is most comfortable for you. It is long to explain, and we hope that situations will gradually appear that teach you to set goals, propose hypotheses, ask yourself relevant questions, search for and analyze information, express yourself effectively orally and in writing, be intellectually honest and persevering. An effective way to guide this reflection is to force yourself to write down the ideas or arguments, it is a way to see if they are really convincing for yourself and if you are clear about them, it is the way in which the notebook is prepared.

How to complete the notebook

The schedule and tracking notebook is the property of the company, which will determine which parts of its contents must be kept confidential and which others you can make copies of for your personal use. The notebook is in electronic format, is stored on a server and will be backed up in accordance with the protocols established in the company. The notebook has five parts:

Part 1

PART 1 contains the summary of the Training Plan agreed between the educational center and the company, including the personal and contact details of the student and their tutors in the company and in the educational center, and the learning outcomes for which the company is responsible and which must be developed during the training period in the company.

Part 2

PART 2 includes in a very brief way the description of the job, its objectives, the working hypotheses, the equipment to be used, etc. These cells, like all the rest of the notebook, will be filled in by the student.

The tutor in the company will explain all these aspects of the work and then he or she will be the one to write this description once he or she has made sure that he or she understands all the details, asking the necessary questions to the tutor himself or to other company personnel.

PART 2 of this workbook also contains a series of questions, exercises or technical issues that want to guide you in this study and that you must answer or solve. To do this, you will have to search for information, organize it and understand it, your tutors will guide you on how to decide on the appropriate sources of information that sometimes will be notes from the subjects of the center itself, other books available in the educational center, in a library or in the company and in other cases Internet pages or technical documentation of the company's teams. The issues are classified into three sections: some are more conceptual, others are related to technical characteristics and others refer to the treatment of data of physical magnitudes and their presentation in the form of graphs and tables.

Part 3

PART 3 is the one in which the results of the experiments, or of the production or in general of the student's activity in the company are collected day by day. Each task will have a set of pages in the notebook, it is preferable to clearly separate one task from another, give them different titles and add the information or analyses on the pages of each of them. For certain activities, such as when making a diagram of a piece, proposing equations or drawing a flow diagram, it may be more comfortable to write or draw on paper. In these cases you can take a photo of that drawing or text and paste it as an image in the notebook, it is important that the work of completing the notebook is comfortable and not load it with tasks that may require a lot of time without adding anything in the background.

It may also be the case that in the workplace it is difficult to have the computer or tablet at hand and it is better to write on paper, you can also photograph complete pages and paste them as an image. If you need to include results in the form of spreadsheets, or in the form of original photographs or videos, the files will be added to the same folder in which the digital notebook is stored and the name of the file will be referred to in it with a brief summary of what it contains.

It is important to note that nothing should be deleted from the contents of the notebook, in case it is necessary to correct something for any error that has been made, the wrong text will be marked, making an annotation that says that it is replaced by what has been written on the page where the new text or the new cells have been entered.

The task will begin, logically, with a meeting with the tutor in the company and perhaps with other colleagues in which the essential aspects of the problem to be solved or the work to be done will be outlined. Then it will be the student who must write all that in the notebook in the corresponding cells. The fact of having to write aspects such as the objectives, the methods, the protocols established for the tests, the occupational risk prevention measures will show them that they have really understood the task they have entrusted to you. The format of the notebook template, the cells into which it has been divided can be adapted to each specific task, maintaining the essential, that is, collecting its objectives, hypotheses, methodology, prevention measures, results obtained and the analysis of these results.

The length of the texts written in the notebook is free, but it is better that they are concrete, clear and precise. It is important to note that they are texts that other people must be able to understand, so you have to reflect on whether they contain everything necessary for it. Many times it seems clear to you what you have written, but you have left to write down data that he or she has in his or her head but that the reader does not know and makes him or her misunderstand or not understand the text at all.

In everything related to the prevention of occupational risks, reference will be made in the notebook to the specific sections of the existing protocols in the company, reference will also be included to data such as safety sheets for reagents, or personal protective equipment, PPE and either the corresponding files will be copied into the folder or the place where they are archived will be mentioned.

The results obtained are noted in the notebook, any incident that arises will also be noted. Negative results are also helpful. If you have tried to do something in a certain way and you have come to the conclusion that it is not a right path, it is very useful to write it down so as not to repeat that work in the future. It is very important to analyze the reproducibility of the trials and to write down in the notebook the conclusions reached. At the end, the person who has done a certain task is asked to judge for themselves whether they consider it valid or not. Throughout this analysis, it may be necessary to consult with more experienced colleagues or with the tutor and a note about it can be included in the notebook.

The training plan programming and monitoring notebook is not only a tool to guide your training, it is also a fundamental tool of the company's work. In these notebooks, the accumulated experience is collected and transmitted to the workers who will be in charge of similar tasks in the future. It is also an essential element of traceability of the products or services made. The writing of the notebook requires a certain amount of time dedicated daily that must be foreseen within the working day.

Part 4

PART 4 of the workbook deals with concepts and exercises related to the contents of the degree that we are going to cover during the stay in the company.

Theoretical questions are posed, which try to help you understand the fundamental concepts of the subjects you are studying. The student must look for bibliographic information on these concepts, understand it and write in their notebook the answer to the questions that are posed. They must write with their words, it is not enough to copy verbatim from an internet text or a book. There are also questions or problems that you must solve. They are asked for an analysis of the result you obtain, what reasons if that result is logical.

They must try not to leave an answer written in the notebook that has no head or tail. Of course they can consult the answers with their fellow students, with teachers, with colleagues in the company or their tutors, again, what is not worth it is copying. This part of the workbook will also contribute to your evaluation at the end of the course.

Part 5

In PART 5, the student is asked for his impression of his progress in acquiring the competences and learning outcomes expected in his vocational training studies. The questions that are raised have been drafted following the recommendations of the evaluation guides that are contained in the regulations that regulate your vocational training studies. That is, what those who prepared the curriculum expect them to understand or know how to do. It is interesting that the student looks at these questions from time to time to see if he or she is progressing in these aspects with his or her study and your work in the company. If you see that any of these points is not sufficiently covered in the material you have or in the tasks you do, you can consult your tutors who will guide you with their explanations or give you complementary information to the one you have found or suggest other exercises. This will also help us to improve our teaching materials for students who come in successive years.

Programming and monitoring notebook of the training plan

Student:

Educational center:

Technology company:

Training start date:

PART 1	TRAINING PLAN		
Course	Company		
Training degree/specialization course/professional certificate			
Student		Email:	Telephone
Training Center		Email:	
Tutor at the training center		Email:	Telephone
Tutor in the company		Email:	Telephone
Particular features			
In company training period	Calendar/Schedule/Period		
Total hours			

Learning outcomes in in-house training periods			
Professional Module	Code	Learning Outcomes	Activities
		Lo1	
		Lo 2	
		Lo 3	
Signed: Tutor in the company	Signed: Student		Signed: Tutor at the training center

PART 2.- Workplace. Overview			
Task Title:		**Folder/Server**:	**Date**:
Short Description			
Area of the company or project in which it is framed:			
Objectives			
Hypotheses, solutions that can be anticipated and expected results.			
Equipment / Machinery			
Elements of occupational risk prevention:			
Waste management.			
Available procedures (include a brief summary or notes of the documents already available, include the documents in annexes in the work folder indicating here the name or reference of the file) *Include pages as needed*			

PART 2.- Workplace. Conceptual issues.	
Explain the concepts clearly and concisely and solve the exercises collected in the following cells.	
Question 1. Explain in 4 or 5 lines what you mean by...	
Question 2. Why does it happen that...?	
Question 3. How is xxxx different from yyyy?	
Question 4. Mark the correct answer to the following questions among the 4 options that are posed:	
....	
Bibliographic search: *Include in this cell the reference where you have studied these concepts, it can be a website or a chapter of a textbook or some notes from a subject of your training center.*	Think and write very briefly how you have decided on one type of bibliographic source or another

PART 2.- Workplace. Technical Information.	
Look for the following data or technical characteristics.	
Question 1. Look for the value of	
Question 2. Find a procedure to...	
Question 3. Find a supplier for	
Question 4. Mark the correct answer to the following questions among the 4 options that are posed:	
....	
Bibliographic search: *Include in this cell the reference where you have studied these concepts, it can be a website or a chapter of a textbook or some notes from a subject of your training center.*	Think and write very briefly how you have decided on one type of bibliographic source or another

PART 2.- Workplace. Processing and storage and presentation of results.
Do the following exercises.
Exercise 1. Plot the following data...
Exercise 2. Perform the following operations on your server folders....
Exercise 3. Data operations.
Exercise 4. Mark the correct answer to the following questions among the 4 options that are posed:
....

Bibliographic search: *Include in this cell the reference where you have studied these concepts, it can be a website or a chapter of a textbook or some notes from a subject of your training center.*	Think and write very briefly how you have decided on one type of bibliographic source or another

PART 3.- Activities. Task 01		
(any tasks will be added as needed)		
Task Title:	**Folder/server *:**	**Date:**
Short Description		
The problem that arises.		
Hypotheses, solutions that can be anticipated and expected results.		
Methodology and work plan:		
Initial information available (include a brief summary or notes of the documents already available, include the documents in annexes in the work folder indicating here the name or reference of the file) *Include pages as needed*		

PART 3.- Results of task 01		
Title:	**Folder/server** :	**Date**:
Additional information obtained during the performance of the task: Alternative test methodologies, sources in which to compare the data obtained, etc. Include the related files as annexes in the folder, indicating here the name or reference of the file.		
Experimental protocol (if there is already a written protocol in the company, simply indicate its reference, if not briefly detail the steps of the experimental procedure)		

PART 3.- Results of task 01		
Title:	**Folder/server** *:	**Date:**
Experimental results (if taken by hand or printed by the team, can be photocopied or scanned and copied here as an image. Videos, photographic images and other material will be added as attachments to the working folder, with the name or reference of the file here.) Add as many pages as needed, copying the entire table		

PART 3.- Analysis of the results of task 01		
Title:	**Folder/server *:**	**Date:**
Assessment of the result: Assess the reproducibility of the trial, does it match what was expected? If so, what is the reason why a result very different from the one found was expected?	**Is the result accepted?**	
Notes on conversations with supervisor or other team members		
Conclusions (here the solution to the problem posed must be proposed, but also detailed conclusions about the task itself, about the experimental procedure, suggestions for new tests, etc.)		

PART 4.- Training content
Explain the concepts clearly and concisely and solve the exercises collected in the following cells. The questions are sorted by topics related to the training outcomes we hope to achieve during your time at the company. Before you start writing, you'll need to look up information about the topic and study that information.

Topic 01 (Module xxxxxxxxxx learning outcome RA01)	**Bibliographic search:** *Include in this cell the reference where you have studied this topic, it can be a web page or a chapter of a textbook or some notes of a subject from your training center.* Think and write very briefly how you have decided on one type of bibliographic source or another

Conceptual question: Explain in 4 or 5 lines what you mean by...
Conceptual question: How is xxxx different from yyyy?
Conceptual question: Build a table with the following material properties....
Mark the correct answer to the following questions among the 4 options that are posed:
Problem: Calculate....
Characterization protocols: Look for the test standard... and briefly explains the shape and preparation of the test specimens and the magnitudes that are measured.
Technical Information Search: Find the value of..... (e.g., of the electrical conductivity of copper)
To program this part of the training plan, it is suggested to include one topic per learning outcome. The concepts and exercises admit enormous variability, the types of content of the question and exercise cells are just a few examples of the types of questions that can be raised.

PART 5.- Self-assessment	
The following questions are based on the evaluation criteria set out in the Royal Decree establishing the title of your training cycle. Think about whether what you have studied in relation to each question and the exercises you have done seems sufficient for you to master each of these aspects. Enter a comment to this effect in the box on the right.	
Evaluation criterion CA1	
CA2	
CA3	
…..	

Download the modifiable training plan

VOCATIONAL TRAINING IN EUROPE

Faced with the challenges experienced since 2020, the European Commission decided to boost Vocational Education and Training by making it a reference for economic and social reconstruction, as well as to achieve the objectives expressed through the Council Recommendation of November 24, 2020 (2020/C 417/01) and coinciding with the 2030 Agenda and the OECD proposals.

Member countries have started to adapt their Vocational Education and Training educational laws to the new guidelines in order to achieve the proposed objectives.

Member countries have started to adapt their Vocational Education and Training educational laws to the new guidelines in order to achieve the proposed objectives.

Vocational training in Portugal

In Portugal, the implementation of reforms of the Vocational Training education system with the aim of guaranteeing the right to quality education and equal opportunities, began in 2007, when the Government, under the supervision of the Ministry of Education, the Ministry of Labour, Solidarity and Social Security and in coordination with the Ministry of State,The Ministry of Economy and Digital Transition implemented a reform in which it reorganized VET into a National Qualifications System (SNQ). [40]

In 2020, the Government of Portugal, marked by the consequences of the COVID19 pandemic and considering VET as a key tool to promote employability, social inclusion and economic development, identified 16 reforms in the field of resilience through a Recovery and Resilience Plan (RRP) (2020).[41] Among these reforms, this Plan identifies the reform for the "Modernization of Vocational Education and Training (RE-9 -), through the improvement of the training offer, adapted to the needs of the territories, the technological equipment of vocational training establishments, the encouragement and support of young people in professional itineraries and adults to continue their studies, also promoting a robust articulation with polytechnic and university higher education."[42]

In this sense, it established a set of objectives for the Education and Training System for the modernization of Vocational Training, among which we find:

- Promote quality Vocational Training.
- To provide students with the necessary skills to support the transition to a digital and greener economy.
- Encourage collaboration with the business world.
- Increase the percentage of students in vocational training.

In Vocational Training in Portugal, companies must have the figure of **"Trainers in companies",** known as tutors. These are usually company workers who have been selected for their professional and pedagogical skills.

Main functions of the tutors

- Develop an individual plan of activities for each student.
- To support the student's integration into the company.
- Assess learning outcomes.
- Maintain communication with the educational center.

With the start of each student's training program, the training period in which the company welcomes students is planned, as well as the schedules[43]. Vocational Training programs in Portugal cover general, scientific, technological and work-based training at the following levels[44]:

Basic vocational training level (CEF, CITE 254; QEQ 2). These are education and training courses for young people over 15 years of age who have completed the first cycle of basic education and are at risk of dropping out of school.

Secondary Vocational Training level (CITE 354, QEQ 4). Vocational Training courses. This level is optional for secondary education and begins after completing 9 years of basic education at school. The training offer at this level is focused on preparation for employment or higher-level courses. At this level, there are several types of vocational education schools and programs:

- **Professional courses.** They have a duration of 3 years and train students for access to the labor market (including a training module of practical training in the work environment).
- **Apprentice system**. These are courses of different durations for people between 15 and 25 years of age whose training offer covers various fields of employment (electricity, commerce, finance...). One of the relevant characteristics of these courses is that the student must sign a contract with the educational center and the company.
- **Education and Training Courses.** These are short courses (125 to 276 hours) for students over 15 years of age.
- **Specialized art courses.** They are three-year courses that provide a training offer in visual and audiovisual arts.
- **Technology courses.** Professional Courses that offer technical, scientific and technological training for 3 years.
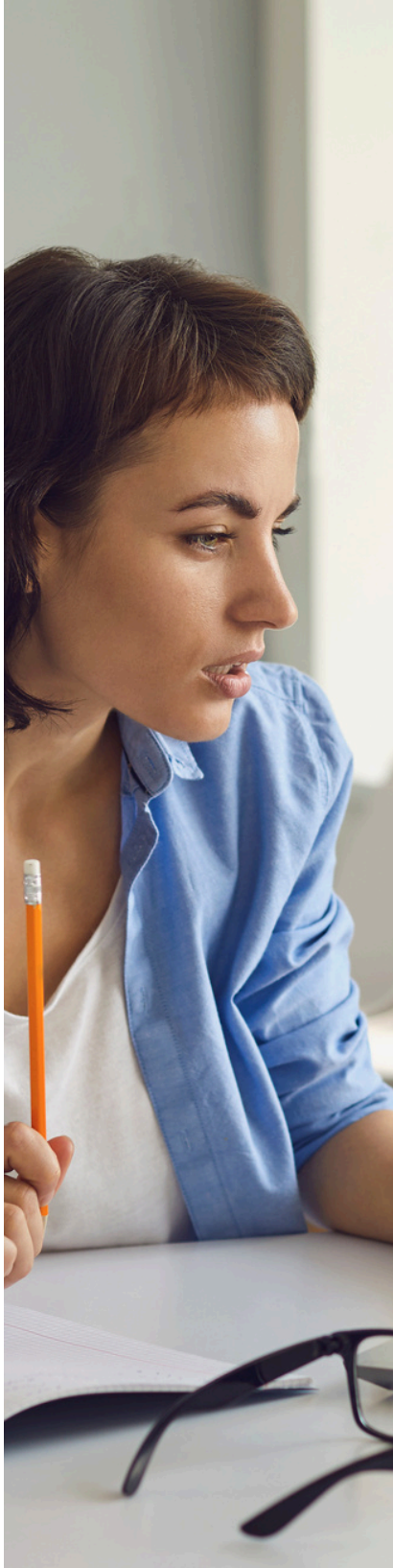
Post-secondary vocational training level (CET, CITE 454; QEQ5). This level is optional to university academic education. Professional schools in Portugal have Technological Specialization Courses (CET) lasting 1 year or 1 year and a half, with a specialized training offer for access to the labor market, as well as internships in companies. By completing and passing this course, students obtain the diploma of technological specialization.

Higher level (non-tertiary). These are 2-year professional technical courses offered by polytechnic institutes. By completing and passing these courses, the student obtains the title of Higher Professional Technician (it is not a university degree).

Therefore, as companies, you will be able to host internships for students at the secondary and post-secondary vocational training levels.

Vocational training in Italy

VET in Italy is characterized by multi-level governance involving national, regional and local governments.Vocational training, aimed at those who have completed the compulsory years of schooling and are going to enter the labour market, has three degrees: initial, continuous or permanent[45].

- Initial training: aimed at young students who are going to enter the labour market for the first time.
- Continuous training: aimed at training in the skills necessary to access the labour market.
- Lifelong learning: aimed at acquiring knowledge during your working life.

In recent years, the Government has carried out educational reforms that make Vocational Training more flexible and responsive to the needs of the labour market[46]. To this end, training itineraries have been implemented characterized by a greater number of hours of training in the company (they must complete at least 400 hours per year) or the virtual simulation of training in the company, as well as individualized training plans. [47]

Vocational Training is taught in two types of centers[48]:

Instituti professionali. It is a type of vocational secondary school run by the government and organized at the national level. The training courses taught in these schools have a duration of five years; Upon completion and completion of these courses, students obtain a diploma and the possibility of continuing their education at the university.

Instituto de Formazione Profesionale (IeFP). These are public schools that offer three-four year training programs (depending on the area of training chosen)[49] for the technical and professional preparation necessary for access to the labor market. IeFP courses are administered by the regions and are characterized by practical training that is superior to the courses of vocational schools and a lower number of theoretical teaching hours. After completion and completion of these courses, students obtain a professional degree or a technical diploma (depending on the area of training chosen) and do not have the possibility to continue their education at the university. To do this, they must first be trained in technical or vocational institutes.

The role of the tutor

During the training periods in the company, students have a company tutor who must be an employee who works in the same place. However, in companies with fewer than 15 employees, the company tutor may be the boss/director.

To be a company tutor you must have at least 3 years of work experience, as well as a job with the same level or higher than the student at the end of the period in the company.

You must have the appropriate training, according to regional legislation or the national collective agreement. This training is characterized by training programmes that define the regions and are aimed at the development of technical and transversal skills[50] to promote that the training periods of students in the company are carried out successfully and that they receive the necessary training.

Specifically, the tutors' training programme focuses on:

- Know the regulatory context.
- Understand the role of the company tutor.
- Manage the hosting of students and promote their insertion in the work environment.
- Encourage the student to acquire the skills required by the job.
- Evaluate the student's training period in the company.

Vocational training in Greece

In Greece, the Ministry of Education and Religious Affairs is responsible for regulating education and vocational training in cooperation with the Ministry of Labour and Social Affairs.

Vocational Training lasts for 3 years and is taught at the vocational education school (Epalgematiko Lykeio, EPAL). This training, which leads to a specialization degree, accounts for more than 25% of work-based learning. For the hosting of these training periods in workplaces, companies can receive financial support to offer training places to VET students, as they contribute to their education.

One of the main priorities of the Greek government in education policy is to adapt training to the needs of the labour market. In this regard, in 2020, the Ministry of Education and Religious Affairs introduced a new Law (4763/2020) [51] with the aim of regulating Vocational Training and establishing it at the national level at levels 3, 4 and 5 of the European Qualifications framework (EQF). With this new law, they seek to offer more labour market-oriented training that facilitates the transition from education to the labour market and contributes to reducing youth unemployment. In this context, companies offer training in accordance with the standards implemented by the Ministry of Education with the contribution of the social partners.

On the other hand, with this new law, the Hellenic Qualifications Framework has been established and advisory bodies have been created at both national and regional level with the aim of supporting Vocational Training.

Thus, the main characteristics of the new Law (4763/2020)[52] are:

- The introduction of vocational schools (LEGs) at upper secondary level.
- Introduction of experimental vocational training institutes (IEKs) at the post-secondary education level.
- The social partners are involved in the design and implementation of vocational training and lifelong learning.
- The improvement of synergies between the national VET system and the labour market.
- To allow VET graduates to access higher education by taking an entrance exam.
- Establish a certification process based on the needs of the labor market.
- Offer professional advice and guidance.
- It expands the possibility of carrying out internships in companies.

The role of the tutor

In 2016, the Greek government introduced a set of provisions on the requirements and training that workers of a company must acquired for the hosting of VET students. Later, the figure of the company tutor/trainer would emerge[53].

In companies there must be at least one tutor, who must carry out a short training program in which they acquire the pedagogical knowledge, skills and training techniques for the hosting and training of students during their period in the company.

GRANTS FOR INTERNATIONAL MOBILITIES

In the case of Vocational Training, these programmes promote the mobilization of VET students and teachers

14.1. The Erasmus Plus programme.

The Erasmus+ programme offers mobility programmes aimed at study, training, work experience or volunteering abroad for students and teachers. These programs are offered for school education, vocational training, and higher education.

Specifically, in the case of Vocational Training, these programmes promote the mobilization of VET students and teachers, as well as the creation of strategic networks between companies and educational centers. These mobilities can be intended to carry out very diverse activities such as practical training periods, courses and training, learning by observation...

There are two types of mobility projects: short-term and accredited projects for mobility.

Short-term

Short-term projects are intended to carry out activities in a simple way and to gain experience within the E+ programme. These are projects of between 6 and 18 months that can be applied for by VET educational institutions, local and regional public authorities, coordinating bodies, companies and other public or private organizations that host or work with VET students.

Accredited projects for mobility

These are projects that can be requested by organizations that have Erasmus accreditation for Vocational Education and Training, whose initial duration will be 15 months (extendable to 24 from 12 months). These applications are based on an Erasmus plan that has been previously approved.

The main purpose of the student mobilities funded by the Erasmus+ Programme is to support internationalization, increase employability, develop skills and competences, as well as improve their job prospects, thus contributing to the improvement of the quality of education and Vocational Training. In addition, they reinforce the European dimension of teaching and learning through the promotion of the values of inclusion, diversity, tolerance and democratic participation and knowledge of European heritage.

14.2. National support

In addition, in the specific case of Spain, on 29 August 2023, the Ministry of Education and Vocational Training, in the <u>Resolution of the General Secretariat for Vocational Training dated 29 August 2023,</u> announced grants for the development of innovation and research projects in the field of Vocational Training led by vocational training centers supported by public funds and with the participation of companies or entities.

The project requested must be made up of a minimum of 2 vocational training schools from different autonomous communities or cities and 1 company or entity.

In this sense, the following may be beneficiaries of these grants:

- Public Vocational Training Centers.

- Private centers that have an educational agreement with the education administrations to provide vocational training.

- Public or private companies.

- Public bodies.

- National Reference Centers.

These are projects "*with the capacity to generate, share and mobilize knowledge, products and resources of social and economic utility between vocational training centers, companies and participating entities*".[54]

As established in the fifth section of this resolution[55], the projects may have the following thematic lines:

Line 1. *Technological, environmental, production process or service provision innovation. Transfer of knowledge between companies or entities and vocational training centers and, through the exchange of innovative experiences or R+D+i, at national, regional or local level.*

Line 2. *Development of professional skills linked to digitalization, such as those related to industry 4.0. or the development of 5G communication networks, and the circular economy, among others.*

Line 3. *Promotion of gender balance in women's access to vocational training profiles directly or indirectly related to STEAM vocational training qualifications and their professional insertion.*

Line 4. *Creation of structures for the promotion of entrepreneurial competence, linked to vocational training centers (incubators, business incubators, etc.), which stimulate entrepreneurial competence, and which facilitate the transition to the labour market from the training environment, providing the necessary framework, standards, support and accompaniment.*

Line 5. *Design and testing of challenges or training projects, which allow methodological innovation towards challenge-based learning, with special attention to the incorporation of transversal competences, including design-type of technical and structural adaptations of training spaces to new methodologies.*

Line 6. *Development of stable innovation ecosystems between the main agents of each professional sector, strengthening and guaranteeing collaboration, the excellence of the talent of their professionals and the transfer of knowledge between vocational training centers, companies and/or entities specializing in innovation in the same.*

CONCLUSIONS

We think that this effort and work time will be amply compensated by a better integration of the student into the company's team

We think that with the proposed methodology, based on the preparation of a digital notebook for programming and monitoring the student's training plan, the company, even medium or small companies, can collaborate effectively in the training of vocational training students.

The success of this methodology will require the student to dedicate some time each day, within his/her working hours, to study and to record in the notebook the results of his/her tasks in the company and his/her progress in the understanding of the concepts and technologies related to that work and to the learning outcomes for which the company is responsible. We think that this effort and work time will be amply compensated by a better integration of the student into the company's team, with greater interest in their work and greater ability to contribute to the company's objectives. The student will acquire really valuable autonomous learning tools for the rest of their studies and for their professional life in general.

BIBLIOGRAPHY

Barron, P., Baum, T., & Conway, F. (2007). Learning, living and working: Experiences of international postgraduate students at a scottish university. Journal of Hospitality and Tourism Management, 14, 85–101. https://doi.org/10.1375/jhtm.14.2.85

Dolga, L., Filipescu, H., Popescu-Mitroi, M. M., & Mazilescu, C. A. (2015). Erasmus Mobility Impact on Vocational training and Personal Development of Students Beneficiaries. Procedia - Social and Behavioral Sciences, 191, 1006–1013. https://doi.org/10.1016/j.sbspro.2015.04.235

Engel, C. (2010). The impact of erasmus mobility on the professional career: Empirical results of international studies on temporary student and teaching staff mobility. Belgeo, 4, 351–363. https://doi.org/10.4000/belgeo.6399

Erasmus+ Programme Briefing Sheet. (n.d.). Https://Www.erasmusplus.is/. https://www.erasmusplus.is/media/et_2020/Erasmus-Programme-Briefing-Sheet-2020.pdf

Greenhaus, J. H., Callanan, G. A., & Godshalk, V. M. (2018). Career Management for Life. Routledge. https://doi.org/10.4324/9781315205991

Lesjak, M., Juvan, E., Ineson, E. M., Yap, M. H. T., & Axelsson, E. P. (2015). Erasmus student motivation: Why and where to go? Higher Education, 70(5), 845–865. https://doi.org/10.1007/s10734-015-9871-0

Maiworm, F. (2001). ERASMUS: Continuity and Change in the 1990s. European Journal of Education, 36(4), 459–472. http://www.jstor.org/stable/1503696

Mol, V. (2013). ERASMUS student mobility and the discovery of new European horizons (pp. 163–174).

Navarrete Moreno, L., Díaz-Catalán, C., Díaz-Chorne, L., Fernández Araiz, V., Lorenzo Rodríguez, J., Pallarés i Cardona, E., & Suárez-Lledó, V. (2017). Mapping mobility - pathways, institutions and structural effects of youth mobility: Descriptive Analysis Report. In SSOAR. Illustrious National College of Doctors and Graduates in Political Science and Sociology. https://www.ssoar.info/ssoar/handle/document/56954

OECD. (2022). Education at a Glance 2022. Education at a Glance. https://doi.org/10.1787/3197152b-en

Oppegaard, B. (2016). Mobility Matters. Advances in Multimedia and Interactive Technologies Book Series. https://doi.org/10.4018/978-1-4666-8838-4.ch011

Papatsiba, V. (2006). Making higher education more european through student mobility? Revisiting EU initiatives in the context of the bologna process. Comparative Education, 42(1), 93–111. https://doi.org/10.1080/03050060500515785

Rodriguez, C., Bustillo, R., & Mariel, P. (2011). The determinants of international student mobility flows: An empirical study on the erasmus programme. Higher Education, 62, 413–430. https://doi.org/10.1007/s10734-010-9396-5
Rodrigues, M. (n.d.). Does student mobility during higher education pay? Evidence from 16 european countries. https://doi.org/10.2788/95642

Urry, J. (2007). International student mobility: Patterns and trends. https://nccastaff.bournemouth.ac.uk/hncharif/MathsCGs/Desktop/PGCertificate/Assignment%20-%2002/International_student_mobility_abridged.pdf

Vassilopoulos, A., Karachontziti, E., Nikolaou, G., & Kamarianos, I. (2021). Effects of student mobility: The case of erasmus students at the university of patras (journal of internationalisation of higher education - policy and practce). 38–53. https://doi.org/10.36197/INT.2-2021.03

Andrianopoulou, A. (2019). The influence of erasmus on the professional life of Greek students [Thesis]. https://dione.lib.unipi.gr/xmlui/bitstream/handle/unipi/13463/Andrianopoulou _OEK1903.pdf?sequence=1&isAllowed=y

Order EFD/657/2024, of 25 June, which determines the curriculum and regulates certain organizational aspects for medium-level training cycles in the field of management of the Ministry of Education, Vocational Training and Sports.

L. Gómez Estrada, L. Pietra, S. Randaccio, C. Zoli, V. García Ortuño, R. Navarro Cerverò, P. Carrolaggi, P. Karampelas, J.S. Nunes, C. Solano Martínez, L. Gómez Estrada, J.L. Gomez Ribelles (2022) VIRTUAL INTERNSHIPS IN TECH CENTERS, EDULEARN22 Proceedings, pp. 1931-1938.

L. Gómez Estrada, L. Pietra, L. Gómez Estrada, S. Randaccio, C. Zoli, V. García Ortuño, R. Navarro Cerveró, J. S. Nunes, P. Carrolaggi, P. Karampelas, C. Solano Martínez, J.L. Gómez Ribelles, A. Soriano Martínez (2022) CREATING INNOVATIVE METHODOLOGIES FOR VET STUDENTS TO CARRY OUT VIRTUAL INTERNSHIPS IN TECHNOLOGY COMPANIES, ICERI2022 Proceedings, pp. 1574-1582.

L. Gómez Estrada, L. Pietra, L. Gómez Estrada, S. Randaccio, C. Zoli, R. Sixto Iglesias, R. Navarro Cerveró, J. Nunes, P. Carrolaggi, P. Karampelas, J. Tormos Capilla, J.L. Gómez Ribelles (2023) TECHVETLAB: TURNING THE VET CLASSROOM INTO A VIRTUAL DEPARTMENT OF A TECHNOLOGY COMPANY, EDULEARN23 Proceedings, pp. 1257-1264.

L. Gómez Estrada, L. Gómez Estrada., L. Pietra, S. Randaccio, C. Zoli, R. Sixto Iglesias, R. Navarro Cerveró, J. Nunes, P. Carrolaggi, P. Karampelas, J. Tormos Capilla, J.L. Gómez Ribelles (2023) THE "BEING A PART OF IT" METHODOLOGY: VET STUDENTS PARTICIPATING IN RESEARCH PROJECTS FROM THE CLASSROOM, ICERI2023 Proceedings, pp. 2337-2341.

Cedefop (2021). The system of vocational education and training in Portugal: brief description. Luxembourg: Publications Office.

http://data.europa.eu/doi/10.2801/359964

Portuguese Republic, 15 October 2020. PRR Recovery and Resilience Plan. Preliminary plan.

Cedefop (2021). VET in focus PORTUGAL. Thessaloniki (Pylea), GREECE Europe 123.

Clicllavoro. Ministry of Labour and Social Policies. https://www.cliclavoro.gov.it/pages/it/my_homepage/focus_on/formazione/formazione_professionale/

Angotti, R.; (2019). Vocational education and training in Europe: Italy. Cedefop ReferNet VET in Europe reports 2018.

http://libserver.cedefop.europa.eu/vetelib/2019/

Vocational_Education_Training_Europe_Italy_2018_Cedefop_ReferNet.pdf

Cedefop; INAPP- National Institute for Public Policy Analysis (2022). Vocational education and training in Europe - Italy: system description [From

Cedefop; ReferNet. Vocational education and training in Europe database]. p6https://www.cedefop.europa.eu/en/tools/vet-in-europe/systems/italy-u2 https://italiahello.it/en/articolo/educational-and-vocational-training-iefp/

Cedefop; INAPP- National Institute for Public Policy Analysis (2022). Vocational education and training in Europe - Italy: system description [From Cedefop; ReferNet. Vocational education and training in Europe database]. https://www.cedefop.europa.eu/en/tools/vet-in-europe/systems/italy-u2

Angotti, R.; Fonzo, C. (2022). Teachers and trainers in a changing world – Italy: Building up competences for inclusive, green and digitalised vocational education and training (VET). Cedefop ReferNet thematic perspectives series. http://libserver.cedefop.europa.eu/vetelib/2022/

teachers_and_trainers_in_a_changing_world_Italy_Cedefop_ReferNet.pdf

Cedefop; EOPPEP - National Organization for the Certification of Qualifications and Vocational Guidance (2022). Vocational education and training in Europe - Greece: system description [From Cedefop; ReferNet. Vocational education and training in Europe database]. https://www.cedefop.europa.eu/en/tools/vet-ineurope/systems/greece-u2

https://www.cedefop.europa.eu/en/tools/vet-ineurope/systems/greece-u2

Cedefop; EOPPEP - National Organization for the Certification of Qualifications and Vocational Guidance (2022). Vocational education and training in Europe - Greece: system description [From Cedefop; ReferNet. Vocational education and training in Europe database]. P.6

Cedefop; EOPPEP - National Organization for the Certification of Qualifications and Vocational Guidance (2022). Vocational education and training in Europe - Greece: system description [From Cedefop; ReferNet. Vocational education and training in Europe database]. https://www.cedefop.europa.eu/en/tools/vet-ineurope/systems/greece-u2

Resolution of the General Secretariat for Vocational Training, calling for grants for the implementation of applied innovation and research projects and knowledge transfer in Vocational Training in 2023, within the framework of the Recovery, Transformation and Resilience Plan - Financed by the European Union - NextGenerationEU.

Resolution of the General Secretariat for Vocational Training, calling for grants for the implementation of applied innovation and research projects and knowledge transfer in Vocational Training in 2023, within the framework of the Recovery, Transformation and Resilience Plan - Financed by the European Union - NextGenerationEU.

Resolution of the General Secretariat for Vocational Training, calling for grants for the implementation of applied innovation and research projects and knowledge transfer in Vocational Training in 2023, within the framework of the Recovery, Transformation and Resilience Plan - Financed by the European Union - NextGenerationEU.

REFERENCES

[1] Ministry of Education, Vocational Training and Sports (2024a). All FP https://todofp.es/inicio.html accessed Sept 2024

[2] Ministry of Education, Vocational Training and Sports (2024b). Incual. https://incual.educacion.gob.es/bdc

[3] BOE 2011a. Royal Decree 387/2011, of 18 March, which establishes the title of Technician in Metal and Polymer Moulding and sets its minimum teaching. Permalink ELI https://www.boe.es/eli/es/rd/2011/03/18/387

[4] BOE 2011b. Royal Decree 882/2011, of 24 June, which establishes the title of Advanced Technician in Production Programming in Metal and Polymer Moulding and sets its minimum teachings. Permalink ELI: https://www.boe.es/eli/es/rd/2011/06/24/882

[5] BOE 2023. Royal Decree 659/2023, of 18 July, which develops the organization of the Vocational Training System. Permalink ELI: https://www.boe.es/eli/es/rd/2023/07/18/659

[6] BOE 2022. Organic Law 3/2022, of 31 March, on the organization and integration of Vocational Training. Permalink ELI: https://www.boe.es/eli/es/lo/2022/03/31/3/con

[7] Fuller A, Unwin L (2011) Workplace learning and the organization. In: Malloch M, Cairns L, Evans K, O'Connor BN (eds) The sage handbook of workplace learning. Sage, London, pp 46–59

[8] Mikkonen S, Pylväs L, Rintala H, et al (2017) Guiding workplace learning in vocational education and training: a literature review. Empirical Res Voc Ed Train 9, 9.

[9] de Bruijn E, Leeman Y (2011). Authentic and self-directed learning in vocational education: Challenges to vocational educators. Teaching and Teacher Education, 27(4), 694–702.

[10] Jossberger H, Brand-Gruwel S, van de Wiel M W J,Boshuizen HPA (2020). Exploring students' self-regulated learning in vocational education and training. Vocations and Learning, 13, 131–158.

[11] Khaled A, Gulikers J, Biemans H, Mulder M (2015) Occurrences and quality of teacher and student strategies for self-regulated learning in hands-on simulations. Studies in Continuing Education, 38(1), 101–121. https:// doi. org/ 10. 1080/ 01580 37X. 2015. 10407 51

[12] Pylväs L, Nokelainen P, Rintala H, (2022) Vocational Students' Perceptions of Self-Regulated Learning in Work-Based VET Vocations and Learning 15, 241–259

[13] Smith PJ (2003). Workplace learning and flexible delivery. Review of Educational Research, 73(1), 53–88.

[14] Virtanen A, Tynjälä P, Eteläpelto A (2014). Factors promoting vocational students' learning at work: Study on student experiences. Journal of Education and Work, 27(1), 43–70.

[15] Zimmerman BJ (1990). Self-regulated learning and academic achievement: An overview. Educational Psychologist, 25(1), 3–17
[16] Zimmerman B J (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekarts, P. R. Pintrich, & M. Zeidner (Eds.), Handbook of self-regulation (pp. 13–39). Academic Press.

[17] Zimmerman B J (2001). Theories of self-regulated learning and academic achievement: An overview and analysis. In B. J. Zimmerman & D. H. Schunk (Eds.), Self-regulated learning and academic achievement: Theoretical perspectives (2nd ed., pp. 1–38). Erlbaum.

[18] Ministry of Education, Vocational Training and Sports National Institute of Educational Evaluation Subdirectorate General of Statistics and Studies (2024c) State System of Education Indicators 2024 Ed. General Technical Secretariat Subdirectorate General of Citizen Services, Documentation and Publications

[19] Navas Saurin AA, Abiétar López M, Bernad i García JC, Córdoba Iñesta AI, Giménez Urraco E, Meri Crespo E, Quintana-Murci E (2020), Student involvement in Vocational Training: differential analysis in the province of Valencia. Journal of Education 394, 189-213

[20] Sureda-García I, Jiménez-López R, Álvarez-García O, Quintana-Murci E (2021), Emotional and Behavioural Engagement among Spanish Students in Vocational Education and Training. Sustainability 13, 3882.

[21] Archambault I, Janosz M, Fallu JS; Pagani LS (2009) Student Engagement and Its Relationship with Early High School Dropout. J. Adolesc. 2009, 32, 651–670.

[22] Fredricks JA, Blumenfeld P, Paris A (2004) School Engagement: Potential of the Concept, State of the Evidence. Rev. Educ. Res. 74, 59–109.

[23] Wang MT, Eccles JS (2011) Adolescent Behavioral, Emotional, and Cognitive Engagement Trajectories in School and Their Differential Relations to Educational Success. J. Res. Adolesc.22, 31–39
[24] Elffers L (2013) Staying on Track: Behavioral Engagement of at-Risk and Non-at-Risk Students in Post-Secondary Vocational Education. Eur. J. Psychol. Educ. 28, 545–562.

[25] Schwab S (2018) Who Intends to Learn and Who Intends to Leave? The Intention to Leave Education Early among Students from Inclusive and Regular Classes in Primary and Secondary Schools. Sch. Eff. Sch. Improv.29, 573–589.

[26] Truta C, Parv L, Topala I (2018) Academic Engagement and Intention to Drop Out: Levers for Sustainability in Higher Education. Sustainability 10, 4637.

[27] Order EFD/657/2024, of 25 June, which determines the curriculum and regulates certain organizational aspects for medium-level training cycles in the field of management of the Ministry of Education, Vocational Training and Sports.

[28] L. Gómez Estrada, L. Pietra, S. Randaccio, C. Zoli, V. García Ortuño, R. Navarro Cerverò, P. Carrolaggi, P. Karampelas, J.S. Nunes, C. Solano Martínez, L. Gómez Estrada, J.L. Gomez Ribelles (2022) VIRTUAL INTERNSHIPS IN TECH CENTERS, EDULEARN22 Proceedings, pp. 1931-1938.

[29] L. Gómez Estrada, L. Pietra, L. Gómez Estrada, S. Randaccio, C. Zoli, V. García Ortuño, R. Navarro Cerveró, J. S. Nunes, P. Carrolaggi, P. Karampelas, C. Solano Martínez, J.L. Gómez Ribelles, A. Soriano Martínez (2022) CREATING INNOVATIVE METHODOLOGIES FOR VET STUDENTS TO CARRY OUT VIRTUAL INTERNSHIPS IN TECHNOLOGY COMPANIES, ICERI2022 Proceedings, pp. 1574-1582.

[30] L. Gómez Estrada, L. Pietra, L. Gómez Estrada, S. Randaccio, C. Zoli, R. Sixto Iglesias, R. Navarro Cerveró, J. Nunes, P. Carrolaggi, P. Karampelas, J. Tormos Capilla, J.L. Gómez Ribelles (2023) TECHVETLAB: TURNING THE VET CLASSROOM INTO A VIRTUAL DEPARTMENT OF A TECHNOLOGY COMPANY, EDULEARN23 Proceedings, pp. 1257-1264.

[31] L. Gómez Estrada, L. Gómez Estrada., L. Pietra, S. Randaccio, C. Zoli, R. Sixto Iglesias, R. Navarro Cerveró, J. Nunes, P. Carrolaggi, P. Karampelas, J. Tormos Capilla, J.L. Gómez Ribelles (2023) THE "BEING A PART OF IT" METHODOLOGY: VET STUDENTS PARTICIPATING IN RESEARCH PROJECTS FROM THE CLASSROOM, ICERI2023 Proceedings, pp. 2337-2341.

[32] Paul R, Elder L (2005) Critical Thinking Competency Standards. Standards, Principles, Performance Indicators, and Outcomes With a Critical Thinking Master Rubric. Foundation for Critical Thinking 2005, Retrieved fromhttp://www.criticalthinking.org/ accessed 3-3-2019

[33] Ennis R (2011). Critical Thinking: Reflection and Perspective Part I, Inquiry: Critical Thinking Across the Disciplines, F Fair Ed. Sam Houston State University 2011

[34] Pithers RT (2019], "Boosting 'Good' Thinking in Vocational Education and Training", 1999 Faculty of Education, University of Technology, Sydney, Australia, Retrieved from http://www.leeds.ac.uk/educol/documents/000001054.htm accessed 11-3-2019

[35] Solano Martínez C, Clara-Trujillo S, Guillot-Ferriols MT, Gómez Estrada L, Gómez Ribelles JL (2019) "Critical thinking as a step forward in Vocational Training. Vocational Training students immersed in high-tech centers." IN-RED 2019 Universitat Politècnica de València Doi:http://dx.doi.org/10.4995/INRED2019.2019.10340

[36] Blumenfeld PC, Soloway E, Marx RW, Krajcik JS, Guzdial M, Palincsar A (1991) Motivating project-based learning: sustaining the doing, supporting the learning, Educational Psychologist 26, 369–398.

[37] Fontenla-Romero O, Bellas F, Sanchez-Marono N, Becerra JA (2022) "Chapter 8 - Learning by Doing in Higher Education: An Experience to Increase Self-learning and Motivation in First Courses" in Advances in Intelligent Systems and Computing 1400. (J.J.. G Prego, J.. G de la Puerta, P.G. Bringas, H. Quintian, E. Corchado eds), pp. 336-345, Warsaw: Springer 2022

[38] Herreid C, Schiller N, Herreid K (2011) Science Stories : Using Case Studies to Teach Critical Thinking, National Science Teachers Association, 2011.

[39] Yusop SRM, Rasul MS, Yasin RM, Hashim HU, Yusop NAJ (2022) An Assessment Approaches and Learning Outcomes in Technical and Vocational Education: A Systematic Review Sustainability 14, 5225

[40] Cedefop (2021). The system of vocational education and training in Portugal: brief description. Luxembourg: Publications Office. http://data.europa.eu/doi/10.2801/359964

[41] Portuguese Republic, 15 October 2020. PRR Recovery and Resilience Plan. Preliminary plan.

[42] Portuguese Republic, 15 October 2020. PRR Recovery and Resilience Plan. Preliminary plan. P.16.

[43] Cedefop (2021). The system of vocational education and training in Portugal: brief description. Luxembourg: Publications Office. http://data.europa.eu/doi/10.2801/359964

[44] Cedefop (2021). VET in focus PORTUGAL. Thessaloniki (Pylea), GREECE Europe 123.

[45] Clicllavoro. Ministry of Labour and Social Policies. https://www.cliclavoro.gov.it/pages/it/my_homepage/focus_on/formazione/formazione_professionale/

[46] Angotti, R.; (2019). Vocational education and training in Europe: Italy. Cedefop ReferNet VET in Europe reports 2018. http://libserver.cedefop.europa.eu/vetelib/2019/Vocational_Education_Training_Europe_Italy_2018_Cedefop_ReferNet.pdf

[47] Cedefop; INAPP- National Institute for Public Policy Analysis (2022). Vocational education and training in Europe - Italy: system description [From Cedefop; ReferNet. Vocational education and training in Europe database].p6 https://www.cedefop.europa.eu/en/tools/vet-in-europe/systems/italy-u2

[48] https://italiahello.it/en/articolo/educational-and-vocational-training-iefp/

[49] Cedefop; INAPP- National Institute for Public Policy Analysis (2022). Vocational education and training in Europe - Italy: system description [From Cedefop; ReferNet. Vocational education and training in Europe database]. https://www.cedefop.europa.eu/en/tools/vet-in-europe/systems/italy-u2

[50] Angotti, R.; Fonzo, C. (2022). Teachers and trainers in a changing world – Italy: Building up competences for inclusive, green and digitalised vocational education and training (VET). Cedefop ReferNet thematic perspectives series. http://libserver.cedefop.europa.eu/vetelib/2022/teachers_and_trainers_in_a_changing_world_Italy_Cedefop_ReferNet.pdf

[51] Cedefop; EOPPEP - National Organization for the Certification of Qualifications and Vocational Guidance (2022). Vocational education and training in Europe - Greece: system description [From Cedefop; ReferNet. Vocational education and training in Europe database]. https://www.cedefop.europa.eu/en/tools/vet-ineurope/systems/greece-u2

[52] Cedefop; EOPPEP - National Organization for the Certification of Qualifications and Vocational Guidance (2022). Vocational education and training in Europe - Greece: system description [From Cedefop; ReferNet. Vocational education and training in Europe database]. P.6 https://www.cedefop.europa.eu/en/tools/vet-ineurope/systems/greece-u2

[53]Cedefop; EOPPEP - National Organization for the Certification of Qualifications and Vocational Guidance (2022). Vocational education and training in Europe - Greece: system description [From Cedefop; ReferNet. Vocational education and training in Europe database]. https://www.cedefop.europa.eu/en/tools/vet-ineurope/systems/greece-u2

[54] Resolution of the General Secretariat for Vocational Training, calling for grants for the implementation of applied innovation and research projects and knowledge transfer in Vocational Training in 2023, within the framework of the Recovery, Transformation and Resilience Plan - Financed by the European Union - NextGenerationEU.

[55] Resolution of the General Secretariat for Vocational Training, calling for grants for the implementation of applied innovation and research projects and knowledge transfer in Vocational Training in 2023, within the framework of the Recovery, Transformation and Resilience Plan - Financed by the European Union - NextGenerationEU.

AUTHORS

Luis Gómez Estrada – Ikasia Technologies SL

Luis Gómez Estrada, was born in Valencia in 1980, with a Bachelor's degree in Industrial Design by "Universidad Politécnica de Valencia", experienced in the research field at the "Instituto de Biomecánica de Valencia" (UPV). Actually is CEO of Ikasia technologies and has experience as head of the 3D department in an engineering services companies. He has a broad experience in European and international project's management and coordination.

José Luis Gómez Ribelles – Ikasia Technologies SL

José Luis Gómez Ribelles is a full professor at the Universitat Politècnica de València, carrying out his research work at the Centre for Biomaterials and Tissue Engineering, CBIT, of that university. He is currently the principal investigator of one of the research units of the CIBER-BBN of the Instituto de Salud Carlos III. His current line of research focuses on the development of biomaterials for tissue engineering and regenerative medicine.

Laura Gómez Estrada – Ikasia Technologies SL

Qualified as a VET Technician, Laura has been incorporated in Ikasia in 2018 in the scientific and educational project development team. Having exhibited organization and managing skills, has since been responsible for projects coordinated by Ikasia included in the Erasmus + Programme in the field of professional education. Laura is a easygoing, and hardworking person. Her diverse professional parkours led to the development of a broad range of skills, from organization to and interpersonal skills, which she transposes to her professional everyday life.

Luis Amaro Ribeiro Martins – Ikasia Technologies SL

Luis Martins is a Phd student at the Universitat Politècnica de València. After graduating applied biology from the Universidad e do Minho took a master in Biophysics and Bionanosystems on the same university. Additionally, has pedagogic competences and advanced english from Cambridge University and competences aided design, 3D printing and basic programming. Luis has experience in tutoring, orienting students projects or laboratorial internships.

Raquel Navarro Cerveró - Redtree Making Projects

Raquel Navarro Cerveró is a social worker, an equality agent and has a Master Degree in Labour Risk Prevention, and she have worked with the association movements in Valencia for more than 15 years. Through her professional and associative career, Raquel has fulfilled responsibilities that have allowed her to develop a broad experience as Social Worker and Projects Technician, creating and managing associative and social economy projects to promote equality and social justice.

Ricardo Sixto Iglesias - Redtree Making Projects

Ricardo Sixto Iglesias was born in Valencia in 1967. He graduated in Geography and History from University of Valencia in 1990. Medievalist, specialized in archives, library science, and documentation. He has devoted a good part of his experience to public work in various institutions such as the city councils of Burjassot and Valencia, the Valencia Provincial Council, and the Spanish Congress of Deputies.

Carlo Zoli - Smallcodes

Electronic Engineer; CEO of Smallcodes Ltd. Founder of Smallcodes Ltd as a social and technological company focused on education and linguistic technologies, with a special interest in minority languages and cultures, dialectology studies and historical linguistics.

Silvia Randaccio - Smallcodes

Silvia Randaccio has a degree in European and Extra-European languages, with a thesis in computational linguistics for the Arabic language. She currently follows numerous projects for the development of linguistic software, teaching materials, e-learning platforms and digital archives, for minority languages but also for other product sectors. She also manages digital marketing, SEO and web graphics.
 She has also undertaken several external collaborations as a consultant, teacher and project partner for various entities that have allowed her to learn about new realities and work sectors.

Luca Pietra - Smallcodes

Engineer and new member of SMALLCODES through ScarabLab. He is currently involved in deepening his knowledge of the various programming languages and supporting senior programmers in the implementation of software for health informatics.

Jivago Nunes - Somatica, Materials & Solutions

Jivago Nunes have a degree on Optoelectronics and Lasers, and a Master in Materials Engineering, and worked as a scientific researcher during 5 years. After that, he has been the CTO of the company Somatica, Materials and Solutions, Lda. for the last 10 years and, as an entrepreneur, he have created 5 companies during the last 7 years.

Panagiotis Karampelas - 1st Epalgematiko Lykeio Kato Achaias

He works as a teacher in secondary technical education with specialization in computers and design implementation circuits and also the design and development of algorithmic structures. Now days is the Headmaster in VET Secondary School. He has 2 Masters, Ecomomics in Education and In School Managment.
 Also, Manage and Organize Erasmus Plus Projects (KA1-KA2) and E-Twinning.

Dimitrios Fligos- 1st Epalgematiko Lykeio Kato Achaias

Dimitrios Fligkos has studied IT in Athens University of Economics. He started his teaching career at 1st Epagelmatiko Lykeio Kato Achaias in 2002. He teaches IT and technology. Since 2002 he has taken part in many national and EU projects. He is responsible to organise students and teachers mobilities as well for the projects documentation. He has worked a lot to integrate ECVET system in the mobilities. He is also responsible to organise training activities for foreign students in the area. He has a key role to apply the mobility charter for vet high quality standards in projects planning and implementation.

Juan Tormos Capilla - IES Enrique Tierno Galván

VET teacher by the specialty of Electrotechnical Facilities since 1991.Tiene the linguistic training in foreign languages. He has participated as coordinator in three transnational projects, as well as in national innovation projects, linguistic immersion by the University of Paris, in the promotion of curricular enrichment and attention to students. He has held the position of deputy director of the IES, Head of Department, coordinator / tutor of FCT and member of several School Councils.

Miltiadis Liamis - Ergastiriako Kentro Kastorias

Teacher Mechanical Engineer with a master's degree in Educational Sciences: Organization and Management of Education - Educational Leadership.

Maria Georgiou - Ergastiriako Kentro Kastorias

Graduate of the department of Applied Informatics, University of Macedonia in Thessaloniki. She specialized in Computer Science and Technology: problem solving using computers, software development databases, web applications e.t.c. She also has a master's degree in Graphic Arts – Multimedia. She works as an IT teacher in Secondary Education, with exprerience in VET Education. As a Director of Ergastiriako Kentro, She also organizes and implements Erasmus+ Projects.

José Juan Seijo Solaz - IES Enrique Tierno Galván

Industrial engineer. Teacher of Vocational Training in the branch of electricity. A sports and nature enthusiast, I am also passionate about new technologies.