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IMFUTURE: International Master's Degree for the FUrniTURE Sector

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IO4: Module materials

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Content

1 The aim of the IMFUTURE project

The aim of "IM-FUTURE" is to develop the content for an International Masters' Degree in the furniture sector

This activity was focused on breaking down the learning pillars into smaller and more manageable training modules and units. The objective is that the granularity of the modules will be such that student and companies can meet all their needs, assuring that no unnecessary training is received.

Each partner has participated in this definition according to their expertise and best practice training (face to face, on-line, slides, video, etc.). The training modules are going to be organised according to analysis of priority order and local requirements. It is going to be reflected the results of the research and survey that it was done in IO1

In previous IO, the partnership has received feedback about the necessities from the industry by surveys and workshops in UK, Spain, Poland and Italy. Finally, it was received more than 300 professional contributions. Moreover, the partnership has studied the current educational offer in HE in furniture sector in 22 countries (Austria, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, Italy, Latvia, Lithuania, Malta, Netherland, Poland, Portugal, Ireland, Romania, Slovakia, Slovenia, Spain, Sweden, UK) and, also it was studied in those 22 countries the educational offer in VET in furniture sector.

That information has been used to design the structure of the Master, training paths and training modules and units. Obviously, it was need a restructuration of the contents when the structure of the Master and modules, subjects and units were fixed because they had duplicate content and it was not organized in a comprehensible and training way.

In this report, you can find the structure of the Master, their modules, subjects and units with an explanation of each one.

Finally, it is using some terminology that it is necessary to know to understand properly the structure of the Master:

- Master is the whole content that we will develop

- Training paths, the different possibilities inside the Master – 60 ECTS

- Modules, are made to regularize the contents of the Master and make its structure and Training paths easier to be understood. For example: "Furniture design history" and "Design" is a Module

- Subjects, for example "Quality control". Subject is a branch of knowledge studied or taught. It will be referred to an important part of the contents of furniture sector. Inside a subject, the content will have a common structure. Each subject has a number of ECTS, depending the number of hours to acquire the required knowledge, skills and competences.

- Units, inside each subject, for example "Material properties, construction, product development including proto-types". Each unit could have a "powerpoint"

- ECTS: European Credit Transfer and Accumulation System. It is a standard mean for comparing the volume of learning based on the outcomes and their associated workload. It is considered 25 hours per credit point (because we are considering an academic year of 1500 hours of total workload and

60 ECTS credit). Moreover, the ECTS is split in 40% of teaching content, 40% of student work and 20% of tutorship and exam, in conclusion, 10 hours of teaching content, 10 hours of student work and 5 hours of tutorship and exams.

2 IO4 Short description

This is the main output of the project and it contains all the training materials needed to deliver the International Master Degree for the Furniture Sector. Initially, the consortium has structured the master degree around ten main pillars:

On one side, the modules for training in specific skills in the furniture industry:

Design, making a strong emphasis on issues related to Eco-Design (COSMOB).

- History of Furniture Design (BUCKS)

- Materials science and new materials (WULS).

- Production processes and technologies in the furniture manufacturing sector (COSMOB).

- Business Management (CETEM)

- Industrial Property Rights (UM)

- Technological surveillance and Information Management (UM)

Furthermore, the consortium has identified modules for providing "New Skills":

-Innovation: management and systems (CETEM)

-Entrepreneurship (WULS-WTD).

The high level description of the units including their contents and form of delivery have been previously decided in O2. O4 focused on the development of the learning, teaching and training materials. Each partner was responsible for developing the units closest to their expertise. Depending on the needs and contents, different types of materials was developed: slides, hands-on training sessions, bibliographic material, tests…

Each of the training modules contains material for e-learning such as slides, hands-on training sessions, bibliographic material, tests, etc. These activities run in parallel and the partners that are experts in the subject were involved in each activity.

All learning materials have been produced in English only. This decision was taken by the members of the consortium by taking into account the fact that the International Master's Programme will be delivered in each of the partner organisations in English. The idea is that students from different EU countries and other overseas territories will be enrolled and therefore the international aspect of the Master's programme is achieved by delivering it in English. Summaries of the modules have been produced in Italian, Polish and Spanish but the programme will be run in English.

In order to achieve these the following activities were conducted:

A1-Training of the Trainers

A2-Development of the learning materials

A3-Development of the E-learning components based on the learning materials developed in A2.

A4-Evaluation of the learning materials conducted by the academic experts and by the industry experts.

3 Training of trainers

This activity will enabled both teachers and content developers to improve their teaching skills, standardize methodologies, share teaching methods, pedagogical approaches and tools among both teachers and content developers. The intention was to improve students' perception of the unified team using a rigorous work methodology.

3.1 Forming basic competences for delivering digital content

This activity was aimed at developing a toll to enable trainers form essential competences and the motivation to contribute to the improvement of skills as trainers. In line with the European Training Strategy in the frame of Erasmus+ Youth in Action programme the ToT-course considers the following 6 competences to be essential when working as a non-formal education trainer:

- The competence to understand and facilitate individual and group learning processes.
- The competence to design educational programmes.
- The competence to direct one´s own learning (Learning to Learn)
- The competence to co-operate successfully in teams.
- The competence to communicate meaningfully with others.
- Intercultural competence.

The educational approach implemented in this ToT content intends to allow for these different learning needs to be identified and pursued.

The ideas presented below could be read by all those engaged in Master's as a standalone text that could guide the thinking and the practice of preparing young people for any profession at vocational level. The intention is to offer readers an opportunity to reflect on their own practice and to enrich it by exploring what others do successfully.

3.1.1 The competence to facilitate individual and group learning processes.

Teaching relationships

- It is widely admitted that teachers' commitments to their learners – the relationships they develop with their learners and the range of roles that teachers take – are crucial components in VET as well as in any other educational environment at all levels.
- Teaching relationships refer to the relationships teachers develop with their learners as well as how learners relate to each other. The tutor-learner relationships are identified as 'the most

important link in the learning process', (TLRP, 2006). A meta-analysis of learner-centred teacher-learner relationships confirmed its importance. It seems that positive teacher-learner relationships are associated with optimal, holistic learning with above average mean correlations when compared with other educational innovations for cognitive and behavioural outcomes (Cornelius-White, 2007).

- The way in which a teacher interacts with learners sets the scene for the subsequent learning to take place. Teachers felt that their relationships with learners were of prime importance for the teaching and learning to be effective. The features of effective teacher relationships included:

Getting to know learners, knowing which learners need more attention

Good rapport – listening, high expectations

Building trust

Humour – used appropriately and never descending to sarcasm

Relaxed atmosphere – relaxed learning with elements of fun

Mutual respect – respect of other people's opinions

Behaviour management – so that all of the group have the chance to learn.

Active learning, while carrying out assignments or projects, for instance, gives many opportunities for teachers to build relationships with learners. The teacher's role during this activity can take various forms: demonstrator, organiser, coach, mentor, facilitator, reflector and even co-learner. A relationship of trust between the teacher and learners is likely to develop while working together and discussing issues at various stages of the assignment, so that the teacher becomes an 'accomplice' in the learning process rather than the knowledge base.

3.1.2 The competence to design educational programmes.

Those involved in designing new educational programes need to have a good understang of the models commonly used in developing learning programmes. The way in which teaching takes place is strongly influenced by a series of circumstantial and educational factors. Models are prescribed structured sequences, which are designed to elicit a particular type of thinking or responses, to achieve specific learning outcomes. However, it is very useful for teachers to understand the concept of a teaching model and to comprehend the main features of the many existing models.

Teaching models are derived from theories about teaching and learning. Each model can be described as a structured sequence, which is designed to elicit a particular type of thinking or response, to achieve specific learning outcomes. The choice or use of the appropriate model, or combination of models, is influenced by the type of learning objective and nature of the learner as well as other factors such as teaching strategies and teaching skills. A strong body of research and practice suggests that the consistent use of specific models can make learning more effective (DfES, 2004, Hattie, 2009 and Marzano, 1998).

The term 'teaching model' has been used to describe many other approaches. In different documents a number of terms appear to be used interchangeably – models, strategies, approaches, techniques, and methods name just a few. Teaching models are not the 'real world' but merely a way of helping us understand and think about teaching. There are a vast number of teaching models – some are variations of others – and they come in many shapes, sizes, and styles. Some terms, such as 'demonstration', can be used for both a teaching model and also a strategy or method. To draw the distinction between a teaching strategy and a teaching model, the definition of a used teaching model has two distinctive features. The first distinctive feature is the nature of the learning objective and outcome required and whether the learning is related to:

- Acquiring and learning skills, procedures, knowledge, and the like, or
- Processing information, building concepts and rules, generating and testing hypotheses and thinking creatively, or
- Collaboration and learning together to construct new knowledge and understand concepts.

The second distinctive feature is the structured sequence of steps or phases (the syntax) used to achieve that particular type of learning objective. In teaching models, it is the tight linkage between these two aspects that defines a teaching model. Strategies do not have the same linkage and may be deployed more widely, as an essential part of a teachers' repertoire to achieve a range of learning outcomes.

- The term teaching model is also used in vocational teaching and learning to describe other different concepts. If these concepts lack the distinctive linkage between the two particular features above, then they are not what is mean here by a teaching model.
- In developing teaching models in the vocational context, it is useful to compare teaching models to find the similarities and differences between the models. This could then serve as a guideline to teachers when selecting or adapting a teaching model or combination of models. The work of Ji-Ping and Collis (1995) offers suggestions for comparing models using a set of appropriate questions to answer against each teaching model. With adaptation, this could provide a useful basis for further work in vocational learning. There are four aspects suggested: teacher aspects, learner aspects, the degree of flexibility or adaptability of the models and aspects related to effective theoretical and technological supports. The following are some specific questions for each aspect that can be used in a comparison of teaching models.

1. Teacher Aspects
    a) How easily can the average vocational teacher manage the model?
    b) To what extent does the model save teaching time (including preparation time for the lesson)?
    c) How likely is it that the model will be accepted and used by the average teacher?
    d) To what extent does the model give full play to the teacher's professional knowledge or skill?

2. Learner Aspects
    a) How much initiative is given to learners within the model?
    b) How adaptable is the model to individual differences in the learners?
    c) How well can the model be adapted for learners of different ages?
    d) How well can the model be adapted for different sorts of learning goals?
3. Flexibility and adaptability
    a) How easily can the model be adapted to the present organisational system in the vocational area and to the current standards for learner assessment?
    b) Can the model be well adapted to a variety of vocational areas?
    c) How easily can the model be combined with other models?
    d) To what extent is the model adaptable to cultural expectations for learner and teacher behaviour?
4. Theoretical and Technological Supports
    a) Was the model developed using an appropriate theory?
    b) How much research and evidence are available to show the model is internally valid?
    c) In what ways might the model be well supported by technologies and media?
    d) Are the technologies and media most suitable to the model readily available?

This structure for analysis of models could offer a good starting point to begin to identify which teaching models are most appropriate for the education and to identify the relevant aspect of each of the teaching models.

3.1.3 The competence to direct learning

Direct teaching, one of the 'classical' ways of teaching is particularly effective in enabling learners to acquire skills. It is a very structured approach involving a high level of interactivity which is teacher-directed and involves direct communication usually with a whole class, although it might be undertaken with an individual or a small group of learners. Direct teaching has the highest level of effect among the range of teaching strategies, though this may be in part because 'Direct Instruction' is a 'Russian Doll' that includes many other strategies such as active learning, reviews, and homework, so there is an additive effect (Petty, 2009). This model usually involves direct input from the teacher together with a strategy of modelling or demonstration and clear instructions to the learners. The teacher then checks the learners' skills or understanding, provides guided practice and ultimately the learners undertake independent practice.

Programmed learning is a self-paced, self-administered programme (computer based for example) presented in a logical sequence and with much repetition of concepts or skills.

- Sequence of Activities (syntax)

- The lesson starts with the learners all at the same stage and the teacher employs direct teaching.
- *Phase 1* – In the first session, the teacher logs on to the computer with the screen visible to the learners on the wall and the learners log on to their computers. The teacher draws the square first, as it's the easiest. The teacher clicks on the line tool and tells the learners to find and click on the line tool. The teacher draws a line of a given length, 45mm. As she demonstrates, she describes what she is doing.
- *Phase 2* – The learners select the tool and draw the line of 45mm and then draw a square.
- *Phase 3* – The teacher questions the learners and checks their progress, guiding them as required.
- *Phase 4* – Once they are confident, learners practise by drawing squares of different sizes on their own.
- The teacher demonstrates the tools necessary to draw a circle and the cycle of phases repeats. The session proceeds step-by-step until all the tools and skills have been covered. When an individual learner is stuck, the teacher sits next to the learner, takes the mouse, demonstrates and describes what to do, then asks the learner to do exactly the same. If the learner makes a mistake, the teacher explains what is wrong and makes the learner repeat the task correctly. The learner practices until the skill is established and the teacher does not take the mouse again but might point to the main screen or question and prompt the learner if required.

Direct teaching using physical guidance

In a design session, the teacher provides direct teaching with physical guidance to help learners acquire the learning objective of mastering the skill of modelling. In terms of context, the session takes place in a workshop. The teacher is also concerned with his relationship with the learner. He is very aware of the issues of personal contact and invading personal space so ensures that he has the learner's consent for physical contact. The teacher guides the learner and progressively removes his support, a process described as 'scaffold' learning.

- <u>Sequence of activities (syntax)</u>
- The teacher had previously demonstrated modelling.
- *Phase 1* – The teacher asks the learner if he minds if he guides his hands; the learner agrees. (The teacher points out that if the learner had objected, he would not have done so.)
- *Phase 2* – The teacher holds both of the learner's hands as he starts to model because the learner does not yet have the fine motor skills.
- *Phase 3* – The teacher tells the learner that she is slowly going to take her hands away and she wants the learner to carry on. (She explains that if she had just removed her hands without warning, the learner's hands would have gone up).
- *Phase 4* – The teacher removes her hands and the learner continues to model unaided.

The teacher comments that it is a contentious technique but it is an effective way of teaching someone to model. She points out that often they hold the mould too far away from the work.

Teaching them the right distance is important, as the learner needs to operate safely. 'If you tell them to go closer they might go too close and then the model could dip into the pool and splash.'

Direct teaching using demonstration

There are a number of ways of implementing the direct teaching model. The model presented here is known as the 'PAR' model: 'Present, Apply and Review', which is a structured-skills version that could be suitable for many vocational areas.

- There are three stages:

1. Present new material
2. Apply this new learning (learner activity)
3. Review the skills learned in this lesson.

The teacher in this session uses the teaching model of direct teaching and the strategy of demonstration as the tool, in this case, to present new material and achieve the learning objective of acquiring the skill of technical drawing.

- Sequence of activities (syntax)
- *Phase 1* – The teacher sketches a drawing on the white board. This is done in stages, to teach the learners how to do a technical drawing.
- *Phase 2* – The learners copy the drawings stage by stage, as the teacher does them.
- *Phase 3* – Once the learners have completed their drawings, the teacher talks about what they have copied, goes round to each learner and provides feedback, praising good drawings and indicating where they need to improve.

The teacher points out the importance of being able to draw so the customer can see exactly what the technical specialist is intending to do…'and this is why tradespeople should be able to express themselves not only in the written word but in sketches.'

3.1.4 The competence to co-operate successfully in teams.

Strategies for group and individual learning

Teachers use their skills in deciding how to manage the learning process. This section includes activity-based learning using the strategies of working in pairs or with a peer, small-group work, whole-group work, and individual work. Many of the strategies described could be used within teaching models that focus on group and cooperative learning and belong to the 'social' group of teaching models. Group work and cooperative learning can shift the responsibility for learning from teacher to learner.

Pairs

Working in pairs is a valuable way of promoting good learning experiences operating along with a set of other ways of learning. Pairings can be learner-chosen, friend-orientated, random or

chosen by the teacher related to abilities – both similar and diverse. For a role-playing session, the teacher picks the pairings having a good knowledge of the learners and enables effective pairings.

Pairing can be used to promote the development of communication and social skills as well as group cohesion as in this example of a plumbing session. Sometimes pairing a more able learner with a less able learner can benefit both, as can two learners that have complementary skills being paired.

Pairing can also be used to enable the development of other aspects of learning, such as attention to appropriate detail in planning. Peer explanation reinforces understanding of learning both for the recipient and the person explaining. It can really help some learners as a supplement to the teacher's information.

Peer help can also act as a role model in showing that something can be done – it provides motivation for others.

Small-group work

Splitting the whole group into smaller clusters can happen in many ways and is prevalent in vocational education. Apart from the curriculum learning aspects of group work there is also the valuable social interaction and motivation associated with working together. Small-group activities include:

- Production of a presentation with each person playing a part
- Putting together a piece of work, such as a questionnaire, or building something through group discussion to formulate ideas, decisions or content for pieces of work
- Groups competing against each other via quizzes, for instance, to promote learning during assessment
- Carousel activity where learners move from table to table
- Individuals coming together to complete a piece of work as a group
- Group work on a project followed by individuals then taking their version forward
- At the end of a session, reinforced learning via questions and answers.

This example illustrates the use of small-group work to make sure that everyone has all the information they need and interest and concentration is maintained.

- Role-play in small groups can be a useful learning tool to reinforce learning as explained in the example below. Role-play can also be used in a larger group with some observing and some playing their parts.

Whole-group work

Whole group activity can take many forms and includes:

- Discussion on a particular topic facilitated by the teacher, perhaps following a presentation or demonstration
- Debate carried out in formal debate mode or more informally
- Games (such as the domino illustration below)
- Whole group activity following individual, paired or small group activity to bring a topic/activity together: this might be individual research, for instance, followed by a whole-group debate activity where groups move around a space, for instance, moving to different corners of the room to answer questions or vote on a particular topic.

Carrying out a whole group activity can have advantages and disadvantages, as illustrated in the following example. Since all learners are working at more or less the same pace, it is easier to keep track of them and easier to control the group, but then some of the group may be relying on others and it is harder to ensure that all have understood. The following example involves a game of dominos with each learner having one card carrying a word and a description of a different word. The idea is to link the dominos so that words and their descriptions are next to each other.

Individual work

Individuals carrying out learning on their own are often a part of many other ways of learning. For group learning, part of it will be a learner writing, carrying out research or reading. There might be individual work that is then swapped with another for paired work. Learners might complete an audit sheet as they carry out an individual task, such as installing software onto a computer.

Individual work can also replicate working in industry by carrying out a task alone. Learning carried out outside the classroom/workshop at home or in the library is often an individual task.

An example would be a computer-aided design (CAD) session where the learners work on their own to become familiar and expert at using CAD for drawing diagrams for construction. Although there would be some collaboration, it is essentially a solo task. Although links with employers can be a group activity, it is also something that learners can complete on their own. This enriches the learning and provides experience of working outside the classroom as well as offering an insight into how the industry works. In this example, an employer wants a web site designed and the teacher encourages the learner(s) to take the 'job' from start to finish, including the initial contact.

Constructivism, group investigation

Group investigation attempts to recreate a democratic atmosphere in the classroom where the learners work together to solve a problem. The contribution of each member of the group makes the outcome better than if individuals do it. Group investigation puts the learners in charge of the learning and allows them to investigate what interests them most. (Sharan and Sharan, 1989).

- Group investigation goes beyond cooperative learning and follows the following six steps:

- Learners are given a problem
- They discuss ways to solve it
- They plan how to carry out the investigation in a group and assign roles
- They work together and independently
- They analyse progress and report findings, and the process is evaluated (Abordo and Gaikwad, 2005).

The example below shows some of the elements of constructivist learning and group enquiry while not following the entire model. The learning objective is for learners to be able to identify the country and age where a certain furniture object is located. The teacher in a history of design session helps learners to construct knowledge about the history of furniture design and where in the world objects are located. The teacher initially draws on learners' current knowledge and experiences. She then introduces concepts of known and unfamiliar furniture object and then arranges a series of tasks to enable learners to construct their knowledge of both location and period of time when these were produced.

- By asking the learners to produce displays, the teacher could assess the learners' new knowledge by seeing what they had found and by asking them questions.
- Sequence of activities (syntax)
- *Phase 1* – To introduce the topic, the teacher provides the learners with a sheet giving an overview of pieces of furniture and their location in time and space. She then leads a discussion by picking out one of the destinations and asking who has seen similar pieces. The discussion is split between European and worldwide attractions and includes famous furniture objects such as the thrones of different monarchs – objects with which learners are familiar, even if they have not seen one.
- *Phase 2* – The teacher shows a short video of an unfamiliar furniture style – the rocking chair of Churchill – and indicates where it is located.
- *Phase 3* – The teacher gives the learners an A4 copy of the map of the world and lots of furniture brochures and magazines. The task is to find pictures in the brochures of as many famous furniture artefacts as possible, to indicate on the world map where these objects are located, and to make a display on a large sheet of paper. The learners look at the Atlas to identify the locations and the year.
- *Phase 4* – The learners have to research two interesting facts about each furniture piece to add to their displays. They also have a furniture design guide that they can use.

Using debate in groups

In this case, the teacher used a learning activity in the form of a debate to enable learners to develop their concepts and understanding of the differences between two different types of tools.

There was a subsidiary learning objective to this activity, developing the skills necessary for a debate. The functional skills of communication and listening were thus embedded in the activity.

- Sequence of activities (syntax)
- *Phase 1* – The teacher gives each group of learners' specifications of different carving tools together with the advantages of each.
- *Phase 2* – Each group has to decide how to present the advantages of the carving tool.
- *Phase 3* – The teacher explains and writes up the rules for the debate: listening, not butting in, keeping eye contact etc.
- *Phase 4* – Each group has 5 minutes to decide how to use their tool and the others then have to work out what the advantages and disadvantages of it might be.
- *Phase 5* – The teacher chairs and opens the debate to the floor for questions. The teacher then employs teaching skills to ensure that every learner contributes.

Cooperative learning using scenarios

In cooperative learning, groups of learners work in small groups to maximise their own and each-others' learning. Derived from the work of Slaving (1995), the elements in the cooperative learning teaching model are: clear and positive interdependence between learners, face-to-face interaction, individual accountability, an emphasis on interpersonal and small-group skills, and group review to improve effectiveness.

The teaching model in this example has elements of cooperative learning and the strategy employed is the use of a scenario. The learning objective of the session is, for example, to use the information provided in a scenario to produce a typical risk assessment. As part of the context for this session, the learners are employed and the activity requires them to draw on their experience to identify the hazards in a furniture-manufacturing workshop.

Sequence of activities (syntax)

Phase 1 – The teacher introduces the session and provides a scenario of a workshop hosting a series of tools and machines in which there are many hazards.

Phase 2 – In groups of three the learners complete the first two columns of a chart – identifying what the hazards are, who might be harmed, and how. They draw on their own knowledge and experience to do this.

Phase 3 – Each group presents their findings in turn and they are all merged into a single composite document. By the end of the session, they have all contributed – each group providing something different or a new slant on things and the whole class has a detailed document.

The teacher's role in this model is to set up the scenario and environment, then to guide the learners, who then take responsibility for working together and for each others' learning.

Role-play

Role-play is a model that focuses on social interaction, improving social skills and developing a personal understanding of values and behaviour. Located in Joyce's social family, the role-play model has its

roots in both the social and personal dimensions of learning. The purpose of role-playing is to assist learners to understand an issue from different points of view by acting it out, either taking different roles or observing. It allows learners to look at a situation through someone else's eyes, to take a different perspective and empathise. Role-play offers an effective way of exploring feelings, attitudes, values and solving problems. It actively involves learners' and draws on their experiences.

There are nine stages in role play, as defined by Shaftel (1970): (a) warming up the group, (b) selecting participants, (c) setting the stage, (d) preparing observers, (e) enacting the role play, (f) discussing and evaluating, (g) re-enacting, (h) further discussion, and (i) sharing experiences/ generalisation. Each of these stages has a specific purpose that contributes to the richness and focus of the learning activity. According to Joyce et al (2000), role-playing provides an opportunity for 'acting out' conflicts, collecting information about social issues, learning to take on the roles of others, and improving learners' social skills. The teaching model of role-play emphasises both intellectual and emotional aspects. The analysis and discussion following the role-play are as important as the role-playing itself.

The teaching model of role-play could be found in all the occupational areas; however, the model tends to be less employed in traditional furniture workshops.

The learning objective in the session used as an example below is to find out about quality assurance and the teacher uses the teaching model of role-play.

- Sequence of activities (syntax)
- *Phase 1* – The teacher uses PowerPoint slides to introduce the topic of quality assurance and the benefits of quality assurance followed by questions and answers.
- *Phase 2* – The teacher pairs the learners and gives them a card with a scenario on carrying out quality assurance of a product. The scenario requires one of the learners to be the employee and the other to be the customer. The teacher explains why the process is important and also the importance of writing things down formally. She defines what the roles are for the two people taking part in the role-play and gives clear instructions about who should be asking the questions and that feedback they provide should be constructive. The teacher shows another PowerPoint slide with the rules for the quality assurance – that it should be motivational, positive and so on.
- *Phase 3* – All the learners carry out the role-play in pairs.
- *Phase 4* – The teacher gives a handout containing a quality assurance role-play checklist. There are two columns to it – one column involves questions for the employee and one for the customer. They include questions such as, 'Did the customer check the quality of the product?' 'Did you feel satisfied?' 'Why?'
- *Phase 5* – The teacher asks the learners about the role-play, including how they felt about it.
- *Phase 6* – The teacher recaps on the session.

3.1.5 The competence to communicate meaningfully with others.

Strategies for giving information

Presentation

Presentation encompasses giving information in a number of ways, including:

- Teacher explanation often at the start of a session – 'this is what we are going to do, these are the objectives for the session'
- Giving information/instruction and checking that learners understand by, for instance, use of questioning
- Clearly presenting information at the start of a session and then linking to other teaching strategies – presentation followed by immediate activity
- Guest speaker input – from the relevant vocational sector
- Providing information through different sensory modes: visual, audio, kinaesthetic
- Providing information through a variety of mediums – video, board, paper, work-book, actual demonstration, verbal explanation, questions and answers and practical activity
- Short PowerPoint or other computer-based presentations for information, recapping on a previous session, setting exercises or structuring a session.

  Some teachers use PowerPoint presentations as a convenient way of structuring their sessions and as an *aide memoire* to ensure that they cover everything.

  Slides cover the learning objectives for the session and instructions for tasks or activities and can be printed to give to learners during or after the session.

Demonstration

Demonstration has the added dimension of an explanation by example, a display of some sort – often accompanied by verbal explanation, though not always. It is usually important to follow the demonstration with a related activity. A teacher can use a variety of technological aids.

- Demonstration examples include:
- The physical demonstration of a skill such as holding and using a blow torch, or how to decommission and reassemble a computer
- A means of showing how something is done and that the tools being used are adequate for the job.
- Demonstration of an activity, showing how to develop a planning process – for instance, with a sample of what the end result could be like

- Using technology such as Moodle and/or Storyboard to show what is required as well as giving information to set the scene, and use of Smart Board to demonstrate tasks such as putting a joint together in construction.
- While showing the way to do something, ensuring that learners understand that there are different ways of doing things and that if the end result is successful then that is alright.

With demonstration, impact is an important factor: the following example as described by a senior manager shows how a simple demonstration can really help the learning process.

Strategies involving technology

Educational technology is the study and practice of facilitating learning and improving performance by creating; using and managing appropriate technological processes and resources.

Use of technology in the delivery of teaching and learning for any vocational area is increasing all the time. It is also one of the ten approaches described by LSIS as effective in promoting effective learning. Examples drawn from the literature include:

- Interactive whiteboards
- Computer(s) in each learning room for various uses
- Web pages for storing and accessing learner work
- Multimedia learning
- H5P: free and open-source content collaboration framework to make it easy for everyone to create, share and reuse interactive HTML5 content: Interactive videos, interactive presentations, quizzes, interactive timelines and more. To use HTML5 ensures that can be displayed by all LMS (Learing Management Systems) platforms independly of the operative system, device and the navigator.
- Moodle (Modular Object-Oriented Dynamic Learning Environment) providing an organised interface for e-Learning, or learning over the internet
- OPIGNO: Open Source e-learning platform based on Drupal (broad used Content Management System) that allows you to manage your online trainings, and efficiently ensure that student, employee and partner skills remain up to date.
- E-Learning through applied packages and on-line learning
- M-Learning – learning on the move including use of mobile phones
- IT-based packages for self-assessment
- Computer-generated quizzes and games
- Internet research
- Podcasts
- Mobile-phone technology

- Computerised tracking.

Learning organisations are changing at different rates. Some have utilised state-of-the-art technology, which has been useful in the engagement of learners, and some are lagging behind. Funding is one issue here, along with cultural change.

The learning materials developed within IMFUTURE contain English, Spanish and Italian all the training materials developed during this project:

The teacher can take this Platform as supporting tool for his/her teaching activity selecting the more according for his teaching activity.

The Platform supports mobile environments and it is prepared to contain future training materilas about design of products different from the furniture.

Strategies for reinforcing learning

Opportunities to practice-repetition

Practice and repetition help to ensure that the learning undertaken is remembered. Opportunities for this can be provided in different ways and include the examples below taken from the observations and interviews:

- Repetition of practice with regard to usage every time learners use computers
- Practice combined with questioning to memorise information about, for instance, 49 countries for a furniture history unit
- Facilitating discussion to ensure that everyone understands what they are doing and how they can go back to an example to assist them if they get stuck
- Learners writing about what they have achieved to show that they understand what they have learned and recognise the importance of being thorough when, for example, writing a plan and being able to follow instructions
- The teacher checking on each learner as they progress: each time there is a repetition task, the learner should need less intervention
- Referencing back to objectives to reinforce learning
- Recapping sessions at the end of lessons to see what knowledge has been retained
- Weekly recapping to make sure of correct understanding – through Moodle, for example – by creating crossword questions, automatic marking, and an assessment grid to show individual progress.

Questioning

Effective questioning can be used to reinforce learning and includes a combination of low-level and high-order questions for deeper learning and can be used to keep learners at work and to check their understanding (Redfield and Rousseau, 1981). Examples of questioning drawn from the fieldwork visits include:

- Use at the beginning of a session and throughout to ascertain prior knowledge and links to advance organisers
- Use to check understanding and identify who is not fully engaged with the task
- Use to encourage evaluation by learners of their work and their learning, through the use of appropriate questions applied in a variety of forms; mainly open – and not just superficial but going beyond the initial response to probe deeper
- Use to check understanding by returning to a learner who may not have fully understood previously in response to questions asked: the teacher does not supply the answer, but challenges the learner to work it out – involving other learners to supply the answer if appropriate.

For questioning, it is helpful to involve all learners, not just the assertive and self-confident who want to answer the questions all the time. Sometimes learners will wants not to offer an answer when they may be uncertain. One teacher solved this issue by using learners to nominate someone to answer the next question. Questioning can be used in an elimination strategy so that learners move towards the right answer.

Strategies to develop learning skills

Assisting learners to become more effective learners, to 'learn how to learn', enables them to learn knowledge and skills more efficiently – a valuable skill in itself for life. Active control over the thinking processes involved in learning is referred to as metacognition. Activities such as planning how to approach a given learning task, monitoring comprehension, and evaluating progress toward the completion of a task are metacognitive in nature. Because metacognition plays a critical role in successful learning, it is important for both learners and teachers. Metacognition is often referred to as 'thinking about thinking' and can be used to help learners to 'learn how to learn'. In some interviews, teachers explicitly described their intention to develop higher-order thinking skills.

If the culture of the organisation in which learning takes place systematically cultivates habits and attitudes that help learners to be confident of their own learning ability and to be creative, then learners are likely to learn faster, concentrate more, be more resourceful, more imaginative and more collaborative, so learning can become more enjoyable. Activities that encourage effective learning and higher-order thinking include:

- Asking questions that encourages the development of imagination
- Evaluation activities
- Researching to prepare for an assignment, particularly with peers

- Tasks in which learners need to reason and apply learning in a way that requires higher-order thinking
- Considering new information and making sense of it
- Investigative and experimental tasks
- Taking part in role-play sessions – looking at it from another person's point of view
- Simulations to give experience of work situations
- Adopting step-by-step approaches – building one-step at a time cumulatively.

In order for learners to become more effective and develop higher-order thinking they need to be exposed to activities such as research and analysis.

3.2 How to develop digital educational assessment content

Assessment 'of' learning can take a number of forms and may depend on the curriculum design and/or delivery methods. It includes self-assessment, peer assessment and teacher assessment by using questions, paper-based or computer-generated tests, demonstrations, or games. Assessment methods are not always under the control of the teacher as they might be specified by the awarding organisation.

Assessment 'for' learning is recognised as an effective way of assessing that also contributes to learning. Assessment is: 'about assessing progress and analysing and feeding back the outcomes of that assessment positively and constructively to agree actions to help the learner improve and adapt teaching methods to meet the learner's identified needs.' (QIA 2008). Ten principles of assessment for learning have been identified as being: (a) part of effective planning, (b) focused on how learners learn, (c) central to classroom practice, (d) a key professional skill, (e) sensitive and constructive, (f) capable of fostering motivation, (g) a promoter of understanding the goals and criteria, (h) an assistant for learners to know how to improve, (i) a developer of capacities for self-assessment (and peer assessment), and (j) a recogniser of all educational achievement (DfES 2002). It is about the teacher and the learner working together to assess progress and contribute to effective learning.

In practice, teachers tend to use a variety of methods of assessment including:

- Assessment as a learning tool – assessment for learning
- Self-assessment and teacher evaluation/feedback with assignments written on Moodle or OPIGNO, avoiding too much paperwork and automatically generating an achievement grid for learner/teacher assessment of progress, and hence feedback
- Self-assessment of understanding through the traffic-lights method
- Checklists to self-assess
- Peer feedback to provide assessment
- Workbooks

- Mock tests
- Quizzes, crosswords and games as sources of fun
- Learners being empowered to choose their own assessment format.

Different modes of testing keep the learners interested, as does the use of incentives.

Teacher reflection

Teacher reflection is a three-fold process comprising direct experience, analysis of beliefs, values or knowledge about that experience, and consideration of the options that should lead to action as a result of the analysis.

As work progressed against the framework, it became clear that there was one additional, distinctive feature that in part defined vocational learning and that was the context within which it takes place. Effective teachers are reflective; they constantly review their practice, discuss it with their colleagues, consider their learners' responses and seek to develop new and better ways of teaching. The concept of reflective practice was introduced by Donald Schon (1983) and given currency by Kolb (1984) in his experiential learning theory. It involves thoughtfully considering one's own experiences as one makes the connection between knowledge and practice, under the guidance of an experienced professional within a discipline (Schon, 1996). Moon (1999) defined reflective practice as 'a set of abilities and skills, to indicate the taking of a critical stance, an orientation to problem solving or state of mind.' In essence, it is a readiness to constantly evaluate and review one's practice in the light of new learning (which may arise from within the context of professional practice). After its introduction, many VET organisations started to incorporate reflective practice into their educational and professional development programmes. It was evident from practitioners in this study that reflection was an important and well-established part of their professional practice.

Examples are provided of reflective practice in terms of responding to learner feedback, improving practice through personal reflection and sharing with colleagues to improve practice. Teachers used a number of different ways of developing their repertoire of skills. These included: learning from experience, observation of teaching, as well as learning from the support of colleagues.

Reflective practice

There was considerable evidence from observations and interviews that good teachers are always learning, building their own skills and teaching themselves. They undertake lots of research to inform their planning and delivery. They are self-critical, recognising when things do not go well, trying to understand why, and formulating ideas about how to improve.

Teachers evaluate their practice and reflect on how they might improve aspects of their sessions. They reflect on the way that they teach something so that they do not necessarily just teach it the way they were taught but think about how it might be improved.

Responding to learner feedback

The importance of learner feedback is evident from the literature with examples of teachers sharing practice with colleagues and collecting and using learner feedback:

It is experience really and assistance from my colleagues. You need to exchange practices so you do not stagnate to the same routine. I also give feedback sheets to students. I want to see through their eyes because sometimes as teachers we think of how we want to learn or what we would like but that doesn't mean that this is what the students like. Some approaches might suit me but that doesn't mean that they suit them.

Feedback from students

It is reaction from students that is important. You can walk out of a class and think to yourself: "that was brilliant but the students didn't think it was brilliant, so it's not brilliant". The students are your judges so if students are enjoying it and they're taking part, they're keen, they're answering questions, then you can say it's reasonably successful, you've achieved what you need to achieve.

If they're not, then there's an issue and one has to think of other ways. This teacher also reflected on the session from a learner's perspective, asking questions such as: "If I was a learner in that lesson, how would I have assessed it? Would I have enjoyed it? Would I have been interested throughout?"

Teaching context

Teaching context covers a mixture of elements and includes the nature of the vocational subject, the setting where teaching and learning takes place, the objectives and desired outcomes for a session, plus specifications of the qualification, the nature of the learners, their level, and how they learn best – including their learning styles. Context is such an important factor in vocational learning that it warrants separate consideration. Vocational context is largely responsible for defining the nature of the learning that will take place. Consequently this new (fifth) component emerged to add to the Framework.

The literature in this area refers to context and its importance in vocational learning. In a recent publication, the Institute for Learning stated that brilliant teaching and training comes from the combination of a deep understanding of learning and the use of 'learning to learn' strategies applied within the context of a vocational subject and workplace setting (IfL, 2010). Kerka also commented on the importance of context on the effectiveness of learning, 'other key features of knowledge construction are: (a) functional context, (b) social context, and (c) usefulness. The process works most effectively when it is embedded in a context in which knowledge and skills will be used.' (Kerka, 1997). Other research findings support the value of contextualised learning that provides opportunities for knowledge acquisition and construction, practice and reinforcement, in 'natural settings', such as the workplace (Billett, 1993).

The concept of situated learning, developed by Lave and Wenger (1991), that 'knowledge is created and made meaningful by the context in which it is acquired' (Farmer et al., 1992), is deeply embedded in work-based vocational learning and in teaching models derived from constructivism. Two basic principles underlie situated learning. First, knowledge needs to be presented in an authentic context: i.e., in the setting where knowledge would usually be applied. Second, learning requires social interaction and collaboration: context is a broader concept.

In addition to the setting or location where the learning takes place, we include within this context:

-Learning objectives and desired outcomes for a session or part of a session;

-Nature of the learning such as the vocational subject area, and whether is it theoretical or practical;

-Level of the learning;

-Specification and requirements of the qualification or course;

-Nature of the learners: how they learn best, including their learning styles or any particular difficulties they might have in learning;

-Composition and size of the group of learners and the learning environment, including the resources and facilities available.

Analysis of trainers' needs

VET aims at preparing learners effectively for real workplaces, which means that the acquisition of competences should take into account the requirements of companies and industry. It is now widely accepted at a European level that VET should be competence-based. Competence-Based Education and Training should enable employees not only to increase their knowledge and skills at the workplace, but also to gain nationally accredited certificates for workplace-based learning. The self-paced and flexible structure of CBET programmes should encourage learners to become responsible for their individual learning process. The modular structure allows for individual combinations of competences limited only by certain 'packaging rules', which refer to accredited national vocational qualifications.

The purpose of nationally endorsed competence standards being at the core of CBET is on the one hand to transform the requirements of industry and enterprises into the world of learning. On the other hand, standards provide transparency of competences underlying vocational qualifications.

Competence-Based Education and Training (CBET) is an approach to VET, in which skills, knowledge and attitudes are specified in order to define, steer and help to achieve competence standards, mostly within a national qualifications framework. Deisingler, (2011,p.6) defines CBET as "a way of approaching (vocational) training that places primary emphasis on what a person can do as a result of training (the outcome), and as such represents a shift away from an emphasis on the process involved in training (the inputs). It is concerned with training to industry specific standards rather than an individual's achievement relative to others in the group". Six criteria are currently used to describe the typical structure of CBET programmes. These criteria specify both the micro-structure of CBET (i.e., its learning and assessment dimension), and the macro-structure (i.e., its institutional framework).

Outcome criterion

Persons demonstrating all prescribed competences in an accredited course or training programme should obtain a credential or statement of attainment that is recognised within the national framework. Reports of competences gained should be provided to learners. Reporting may be in terms of completed modules provided that the relationship between competences and modules is understood. The course is recognised to meet national competence standards that have been endorsed by a national authority. In the absence of national standards, course outcomes should be

based on the authority's definition of competence and endorsed by industry training boards or by relevant industry parties where industry training board coverage is not appropriate.

Curricular criterion

The curriculum gives learners a clear indication of what is expected of them in terms of performance, conditions and standards. Also, if appropriate, subsequent workplace and off-the-job training and assessment responsibilities should be identified.

Delivery criterion

Delivery is flexible and learners can exercise initiative in the learning process. Learning materials used by providers indicate the degree to which programme delivery is learner-centred.

Assessment criterion

Assessment should:

- Measure performance demonstrated against a specified competence standard;
- Be available for competences gained outside the course;
- Include workplace or off-the-job components if appropriate.

Reporting / recording criterion

Reports of competences gained should be provided to learners. Reporting may be in terms of completed modules provided that the relationship between competences and modules is understood.

Certification criterion

Persons demonstrating all prescribed competences in an accredited course or training programme should obtain a credential or statement of attainment that is recognised within the national framework.

4 Modules

http://imfuture.cetem.webfactional.com/

4.1 Module 1

Production technology, process and maintenance module is exploring engineering: origins, methods and context. It explores some key principles of engineering, while helping you to improve your study skills and develop as an independent learner. Scientific and mathematical skills are both essential tools for engineering. They form a major part of this module and are included and practiced throughout, with the engineering topics providing a clear context for their application. Engineering is all about innovation, engineers are also required to work to many standards, and health and safety are essential considerations. This module examines examples of standards and introduces some key principles of production technology and process. The module explains how the materials used in manufacturing products are obtained and transformed, from extraction from natural resources

through to final use. This module also includes aspects of engineering analysis, design and modelling methods, and uses appropriate mathematical software for each. Analytical, communication and learning skills necessary for all engineering disciplines are developed in a context that provides grounding for higher-level, more specialised study

4.2 Module 2

The Production-Scheduling and Planning module is a basic material for the management and direction activities in companies that work in the furniture sector, and therefore its knowledge is fundamental for the training of the students that take this course.

The main objective of the subject is to transmit the knowledge of the production area, which is the heart of the company, and that if it can be handled properly; it can achieve great competitive advantages.

The Production Scheduling and Planning module aims to be a subject that shows the main types of Production Programming problems at an operational level both for a long-time horizon (year or year and a half), and for a relatively short time (weeks or days) and that gives the student tools and capabilities to solve them.

The module has a theoretical and practical approach since, on the one hand is intended that students understand the complexity of the problems to solve it and difficulties to address it and on the other you are offered tools, both academic and originating in the business reality, to obtain solutions to them.

4.3 Module 3

Innovation, production & process improvement systems. In a globalized environment like the current one, in which the importance of information and knowledge inside the organization is increasingly important, managing them efficiently can be the greatest of our competitive advantages.

This growing complexity of the business environment is forcing both commercial and scientific organizations, private and public, to have suitable information management systems according their information needs environment. However, organizations are affected by their ability to manage and take advantage of both information and strategic knowledge, so it is vital to identify what they really need, know it, catch it, analyze it, and disseminate and prioritize correctly in the organization, in order to guide, in a proper way, the policy-making and detect new business opportunities.

Technological surveillance is, therefore, an essential tool for detecting opportunities about technological innovation and new ideas to facilitate the introduction of improvements in the processes, products and / or organization services.

Technological surveillance is a systematic business practice, oriented to the search and to the analysis of scientific and technological information, that information about the environment could be useful in

the moment of taking certain decisions, and increasing the chances of anticipating possible changes and improving the business.

It is an indispensable practice that is often perform without being totally aware of it, and, therefore, it is made in an unstructured way, for that, learning to manage it is crucial for the s organization strategy

4.4 Module 4

Fundamentals of enabling technology applications

The goal of a higher industrial automation, integrating new production technologies to improve working conditions and to increase productivity and quality of the plants, is summed up with the term Industry 4.0. This latter applies to a set of rapid transformations in design, operation and service in the area of manufacturing systems and products. Designation 4.0 indicates that it is the fourth world industrial revolution, the successor to the three previous industrial revolutions that brought about great advances in productivity and changed the lives of people around the world. More in detail, the objective is the complete transformation in few years of the entire spectrum of industrial production, through the fusion of digital technology and the Internet with the conventional industry. In short time, everything in or around manufacturing operations (suppliers, plant, distributors, even production itself) will be digitally connected, offering a value chain with a high level of integration. The concept of a new industrial revolution originated in Europe, but it overlaps extensively all over the world each time we speak about smart factories, the Internet of industrial goods, smart industry, advanced manufacturing and so on. Industry 4.0 depends on a series of new and innovative technological developments:

- The application of information and communication technologies (ICT) to digitize information and integrate systems at all stages of product creation and use (including logistics and procurement)
- Physical Cyber-Systems that use ICT to monitor and control physical processes and systems
- Network communications involving wireless and Internet technologies that serve to link machines, labour products, systems and people, both within the manufacturing plant and with suppliers and distributors
- Simulation, modelling and virtualization of product design and installation of production processes
- Collection of large amounts of data, and their analysis and exploitation, either immediately on the ground or through analysis of big data and cloud computing
- Broader ICT-based support for workers, including robots, augmented reality and intelligent tools

The transformations planned for the coming years will bring about changes in different areas and several issues will be faced such as high costs for SMEs, big data management, web security, property rights and new professional skills: about this latter issue, Employers will need personnel with creativity and decision-making

By 2020, labour markets in the EU could need as much as 825.000 ICT professionals; this shortage may be even more pronounced in advanced manufacturing settings where big data analysts and cybersecurity experts are required.

The objective of Module n. 4 is trying to provide a general overview of all new technologies suitable for a furniture company dealing with the current industrial revolution.

4.5 Module 5

Quality Control. Generally the consumer who wants to buy a new product gets information by sellers, advertisements and people. In parallel, information concerns aesthetical features (shape and colour) and prices.

On the other hand, the consumer does not know if a product is dangerous for health, its weight resistance, if there is an associated risk for children, the response to safety tests; moreover, the technical fiche related to a specific product is not so easy to be understood. For these reasons, the European Union, since 30 years, has been defining a project of economic politics with the aim to increase the level of trust between consumers and producers and in order to have a progressively higher quality level of products. The necessary subjects for the realization of this project are: regulatory boards, testing laboratory and institutions for system and product certification. The regulatory boards for the issue of the Technical Standards in national and international spheres are recognized by the public authorities and charged with the aim of ensuring the participation of all stakeholders: producers, traders, consumers, research institutes, governments, etc.

For each reference context, there is a specific of technical standards (World: ISO; European EN; Italy: UNI; France: ANFOR; Germany: DIN; UK: BS; U.S.A.: ANSI / BIFMA)

The importance of technical standards is related to identify, define and uniform the measurement criteria of technical features of products. Technical Standards is therefore a common language made available to technical and commercial operators in order to facilitate the free movement of products with defined and agreed characteristics.

It should be borne in mind and emphasized that the technical standards, national or international, are not a law; their legal force takes over when they are included as a clause in a supply contract or when national legislator organs turn them into laws, decrees and regulations of the state.

About quality control, the testing laboratory is generally an internal or external supporting structure, strictly connected with the company: each phase of the internal process such as design and manufacturing, in fact, can be related to a specific activity carried out by the laboratory.

This latter, operates to ensure the quality of manufacturing processes and finished products according to the technical standards. In this regard, in 2001 a European directive on general product safety was published; from that point, the subsequent legislative decrees on different issues (emissions of toxic substances, safety of workers, children and students, etc.) strengthen the bond with the technical rules, in order to increase the benefits both for producers and for consumers. A product, in fact, can be considered as safe when it complies with national and sectorial laws, as well

as technical European standards; in case this latter are missing, the main reference are the national standards in force within the country where a product is commercialized.

This specific module will be focused mainly on quality processes to be implemented in a furniture company, a necessary prerequisite to manufacture quality products and then for a higher competitiveness on the market.

4.6 Module 6

Subject1-Furniture design history. Any engineer who is involved in furniture industry should have a basic understanding of the history of furniture design and manufacturing. Furniture design has been a part of the human experience since the beginning of history. Evidence of furniture survives from as far back as the Neolithic Period in the form of paintings, wall Murals discovered at Pompeii, in sculpture and examples have also been excavated in Egyptian Pyramids and found in tombs in Ghiordes (modern day Turkey).

Subject 2-Furniture design. This module outlines the main advancements, developments, styles and materials in furniture design highlighting the identifying features of each period, the materials used and show images of some of the most significant pieces of furniture ever designed. The concept of Design Movement" is understood here as a tendency or style in art with a specific common philosophy or goal, followed by a group of artists during a restricted period of time, or, at least, with the heyday of the movement defined within usually a number of years.

Integrated product policy (IPP) is an initiative at the European Union (EU) level aimed at reducing the environmental burden of products and services throughout their life cycles by using a toolbox of policy instruments to 'green' markets through 'greening' both the demand side (consumption) and the supply side (product development). IPP is part of a growing trend within environmentally advanced countries in Europe towards product-oriented environmental policies. As such, it represents a new shift in thinking towards 'front-of-pipe' solutions (e.g. the greening of product development and design). Generally, existing environmental policy approaches have tended to focus on point sources of pollution (i.e. production sites and production processes), using 'end-of-pipe' technologies and 'middle-of-pipe' solutions such as waste minimisation, cleaner production and pollution prevention. By focusing on the product development and design phase, IPP aims to tackle the stage at which many of the environmental burdens of products are determined, thus reducing non-point source problems further in the lifecycle. IPP considers the product development process from idea generation to product management and reverse logistics (i.e. 'end-of-life' management [EOLM]).

4.7 Module 7

Subject 1 Materials. Materials are an indispensable element of the furniture making process. Due to their significance in that framework, they are classified as: Basic: materials of fundamental importance, which create the basis for final product, i.e. a ready piece of furniture (they include

materials of solid wood such as sawnwood, veneers, glued furniture panels), composite wood materials (wood-based panels), and wood composites (wood and wood-based materials combined with non-wood materials) Complementary: finishing materials, which improve functional and aesthetic properties and design of furniture (foils, lacquers, wood stains etc.).

The selection of appropriate materials for the production of furniture has a bearing on the quality, durability, the possibility of renovation and application of final product.

Materials for the furniture industry can contain "novelties" of different nature. They can be connected with the changes of the production technology and material structures or properties and applications. T

It's important to highlight that technical specification are required: in case of materials or final products a document containing technical requirements must be available. Sometimes technical specification also contains procedures for the evaluation whether the requirements are fulfilled.

Materials can also benefit of the application of digital technologies to improve logistics efficiency and operator activity through systems for their identification and location in warehouse operations, thus facilitating the preparation of production orders, storage of goods, replacement management, inventories, etc.

Subject 2 Furniture production techniques. This subject describs general information about whole process of furniture manufacturing. At the beginning, the basic materials used for the production of furniture are presented, it means solid wood and its delivery. Main characteristics of structure and properties of softwood and hardwood towards their use is explained. Wood based materials (panels / boards) form less to most transformed are distinguished. There are described: block-board, plywood, oriented strandboard (OSB), particleboard, medium density fibreboard (MDF), lightweight panel, high density fibreboard (HDF). Next tools and machinery are presented. The presentation of tools and machinery it is connected with their application. There are wood chip-less cutting and wood chip cutting in raw wood, dry wood and panels processes. Furthermore, particular subject of solid wood processing is described. Hence the next topic related to solid wood furniture follows. Basing on subject of wood based materials most popular furniture are presented: kitchen, office and children room. Decoration of wood based materials together with technology of their use is described. Then finishing of materials is in the next chapters: sending, gluing and furniture components. The subjects end with the last stages of furniture production: assembling and safe handing with storage. Units are connected with each other if they concern a similar topic.

4.8 Module 8

Subject 1. Logistics, warehouse, distribution and supply chain management. The subject of "Logistics, Warehouse, Distribution and Supply Chain Management" is a basic material for the exercise of activities of management and direction of the logistics department in companies that work in the

furniture sector, and therefore their knowledge is fundamental for the training of the students who take this course.

The area of Logistics currently represents one of the areas of greatest growth and interest for the furniture sector. Logistics includes all the activities necessary to move products and the flow of information among the members of a supply chain. These chains, which in complex cases become real networks, are the system used by companies to provide goods, services and information to their external and internal customers. The efficient management of this chain or logistics network is today a great challenge for most companies given its importance in business competitiveness. For this reason, logistics has advanced to the operational management of warehouse and transportation to the strategic direction of the company.

In the current supply networks, there is a tendency to reduce manufacturing centers and increase warehouses; this can be clearly seen in the furniture sector. Therefore, the purpose of this module is to provide the student with a global and practical view of the operation of the stores, so that they can take responsibility for its management and improvement.

Subject 2. Marketing, sales in furniture sector. In this module we have established a rationale for responsible marketing and look at some of its components. Responsible marketing, at its most fundamental, means to consider carefully and deal responsibly with any ethical issue arising from marketing practice. At one level, it can be viewed in terms of the duty manufacturers have towards their customers to ensure their products are safe and reliable and live up to the promises made before sale. But more broadly – and more commonly – responsible marketing can be considered as a subset of CSR; and the basic rationale that applies to CSR also applies to responsible marketing. It is this aspect of responsible marketing that we will consider next. We will be discussing 'What do we mean by responsible marketing?' before looking at the rationale for—and key dimensions of— CSR. We will then make a link between brand reputation and responsible marketing

4.9 Module 9.

Subject 1. Workplace, leadership & personal effectiveness competences. This subject familiarizes the students with basic concepts of the workspace, leadership and service management theories and the evolution of management processes. It provides knowledge on basic management functions, and thru some synthetic information on soft skills related to the topic, helps to solve problems related to the management of the most important areas of business.Goal: Provide theoretical background to manage company's workspace as a leader in accordance to current knowledge on human communication, interpersonal skills and leadership practices. Objectives: (specific objectives in connection with competences) Learn to recognize others' strength and weaknesses and build a work team; Learn how to to build and maintain professional relationship;A bility to lead the group

Subject 2. Industrial Property Rights. In all legal systems, intellectual property law is related to the field of civil law, because these are intangible personal goods. In addition, already 150 years ago the need to harmonize the provisions relating to the outcome of human thought was noticed and thanks to the Berne, Paris or Stockholm Conventions it was possible to introduce supranational regulations. The above agreements established certain international standards and provided for all signatories of

those legal acts in the scope of intellectual property protection with the principle of equal treatment of all entities assembled in it. According to the principle that "each Member shall grant entities of other Members a treatment no less favourable than that which is granted to own entities in the field of protection of intellectual property" [Paris Convention, art. 2]. Therefore, intellectual property law is a specific field which system of sources of international law currently covers 191 countries, regardless of their geographical location.

4.10 Module 10.

Subject 1 Information search and retrieval. The purpose of the subject is to familiarize the student with basic concepts and principles related to the information search and retrieval, such as the different models of indexing the information, ways to search and retrieve it, evaluation procedures, etc. *Adequate language skills:* Student is able to acquire, critically evaluate and creatively process information from the scientific literature databases, and other properly chosen sources.

Adaptability: acknowledgement of the constant need to learn new skills and new concepts in a changing environment;

Logical reasoning abilities: problem identification, creative search for solutions (both well-known ones and new ones), ability to follow logical inferences and elaborate formal reasoning in issues related with the information search and retrieval. Student is able to identify different model of information indexing; Student has knowledge of the methods of input and output information;

Student has the ability to distinguish all categories of documents; Application of the tools of information search and retrieval; Student is aware of the importance of the normalization procedures; Student understand and can use impact indexes.

Subject 2 Research methodology. The purpose of the subject is to familiarize the student with basic concepts and principles related to the scientific research methodology, such as the different research methods, their stages, the ethics of scientific research, the information retrieval from the Internet, etc. On successful completion of the module, the students are expected to acquire a number of generic and specific competences: Generic competences: *Adequate language skills:* Student is able to acquire, critically evaluate and creatively process information to analyse it. *Adaptability:* acknowledgement of the constant need to learn new skills and new concepts in a changing environment; *Logical reasoning abilities:* problem identification, creative search for solutions (both well-known ones and new ones), ability to follow logical inferences and elaborate formal reasoning in issues related with the information search and retrieval. Specific competences: Student is able to identify and apply different methods of scientific research; Student has knowledge of the research process from its beginning until the publication; Student has the ability to elaborate a research in any field; Student knows how to write a scientific publication; Student understand and respect the ethics of research; Student is aware of the importance of the normalization procedures; Student understand and can use impact indexes.

5 Modules digital format for online learning (cosmob)

Within IMFUTURE E-learning materials have been developed for each of the modules in the form of:

1. A manual edited in Word that contains text, images, a glossary, and references for further reading.

2. PowerPoint documents containing text, images and links to relevant webpages. These are available for trainers using either a face-to-face or a blended learning approach for the delivery of the modules that are relevant to them.

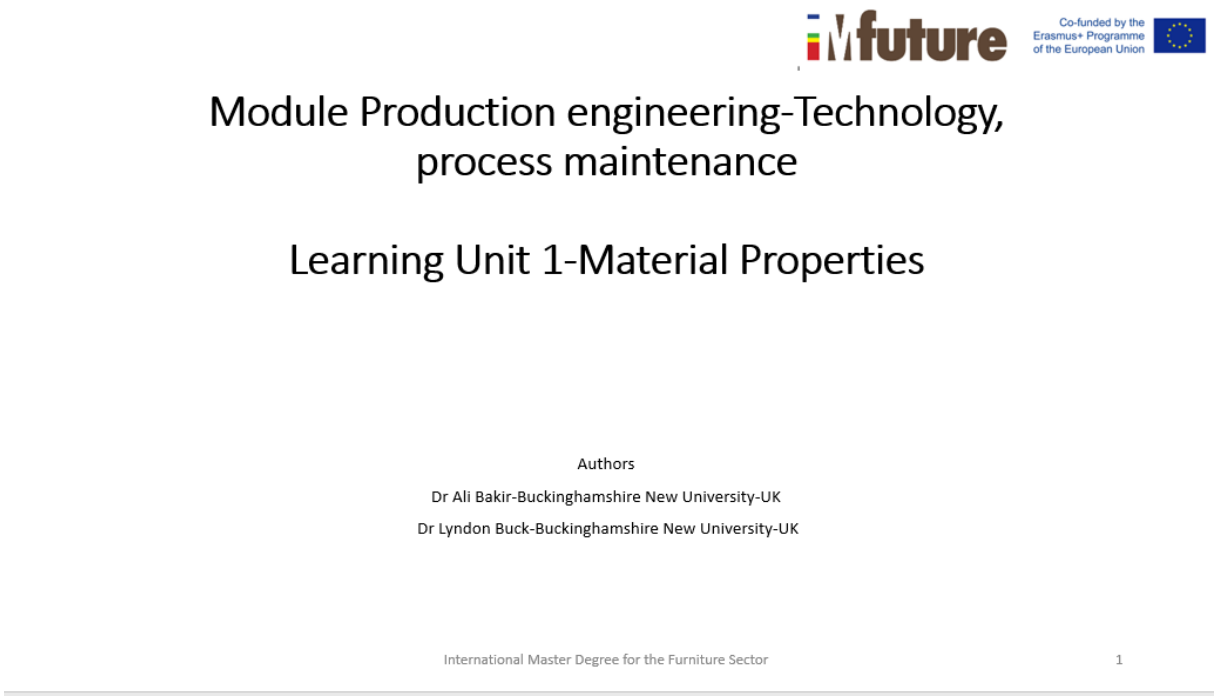
3. Questions that the individual learner can use in the interactive platform to test their knowledge and understanding on the e-Learning platform.

The e-Learning platform is available through the IMFUTURE webpage: http://www.im-future.eu/

5.1 Digital learnng materials -example

An example of the digital material developed within IMFUTURE is presented below. In total there were 76 similar materials developed. They are accessible through the E-platform.

Module 1 (Production engineering) Learning unit 1. (Materials properties)



IMfuture

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Module Production engineering-Technology, process maintenance

Learning Unit 1-Material Properties

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- The project is implemented within the framework of the **Cooperation for Innovation and the Exchange of Good Practices** Key Action and is funded by the **Erasmus+ Programme** of the **European Union**.

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Learning outcomes

- This module will enable you to:
  Understand the importance of materials and the connection between materials' properties and engineering technologies required to process them.
- Understand and critically evaluate aspects related to production organisation and optimisation
- Understand and critically evaluate aspects related to automation in furniture manufacturing
- Ability to understand and critically analyse the eco-sustainability aspects in furniture production

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How to learn?

- This course could be taken using a "self directed" learning approach.
- For those attending "full time" courses a lecturer will be directing your learning using the learning materials available.
- For those enrolled on a "part time" basis a mixed approach could be employed.
- Please see below recommendations for each of the situations:

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How to learn? Self directed approach

- We suggest the following sequence:
- Read the slides, watch the videos and reflect on the content.
- Read the additional text available where information is more detailed.
- If possible discuss with a colleague or register for a “Forum” and express your views.
- Test your understanding by taking the test at the end of the PowerPoint Presentation. Aim to score at least 70%
- If there are aspects that you find interesting and want to explore further access one of the texts recommended in the Bibliography

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How to learn? Full time approach

- Attend all classes and the lecturer will provide explanations while showing the slides.
- Read the additional text available where information is more detailed.
- The lecturer will organise opportunities for you to discuss the content of the course so that you understand.
- Test your understanding by taking the test at the end of the PowerPoint Presentation. Aim to score at least 70%
- The lecturer will present a task for you to complete that will enable you to better understand the topic. The nature of the task depends on particular circumstances.
- If there are aspects that you find interesting and want to explore further access one of the texts recommended in the Bibliography

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How to learn? Mixed approach

- Read the additional text available before attending the face to face classes.
- Attend all classes and the lecturer will provide explanations while showing the slides.
- The lecturer will organise opportunities for you to discuss the content of the course.
- Test your understanding by taking the test at the end of the PowerPoint Presentation. Aim to score at least 70%
- The lecturer will present a task for you to complete that will enable you to better understand the topic. The nature of the task depends on particular circumstances.
- If there are aspects that you find interesting and want to explore further access one of the texts recommended in the Bibliography

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Why study Production Technology?

- Production technology, process and maintenance module is exploring engineering: origins, methods and context.
- It explores some key principles of engineering, while helping you to improve your study skills and develop as an independent learner.
- This module will outline the main advancements, developments, styles and materials in furniture design highlighting the identifying features of each period, the materials used and show images of some of the most significant pieces of furniture ever designed.

Wooden Furniture Manufacturing Process

- Video link: https://www.youtube.com/watch?v=x4t5jRGt3M0

- Short description: This short video clip shows how production is organised for the manufacturing of wooden furniture. It shows materials, different processes and gives a viewer a good idea of the operations involved from the beginning to the end.
- Duration: 7.08 min

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A brief history of materials

- In the early days of human civilisation, people used only naturally occurring materials: stones and wood, but also animal hides, hair, grease and bone, and other vegetable products, like bark, leaves and fibres.
- All the processes used at that time worked with the natural properties of the materials. Shapes were changed (by cutting, breaking or grinding) and parts were assembled (using thread, for example), but no attempts were made to change the properties of the materials themselves..

Video Basic materials used in furniture

- Video link: https://www.youtube.com/watch?v=LzYTKzS40xg
- Short description: Do you know the difference between particle board, MDF, plywood and solid wood? Do you get confused by these terms when you are buying furniture? This short introductory video from Adona Woods will show the difference between engineered wood (particle board, MDF, plywood) and solid wood (hardwood and softwood). You will also know what costs more and what should be cheaper.
- Duration: 1:45 min

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Iron and steel

- The extraction of iron from iron ore provides another useful material, with different properties. The advantage of iron over copper or copper alloys like bronze is that iron ore is very common.
- Higher temperatures are needed to melt iron, and the carbon used for the chemical process of extraction dissolves in the iron, which affects its properties. Not all the ore reacts, leaving slag within the metal.
- Because of this, the initial result of the early attempts at extraction of iron (around 2000 BCE) was a dull, brittle metal, not much more use than the ore from which it had been extracted.

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Modern materials-aluminium

- Essentially, right up to the twentieth century, there were just two structural metals: copper (and its alloys) and iron (including steel). Now, wherever you look you find aluminium: in saucepans, kitchen foil, drink cans, window frames, power cables, aeroplanes, cars, and many more.
- Aluminium is the metal used for building aircraft; it is also finding use in some lightweight car bodies. It is light, strong, doesn't corrode easily, and is easily formed and machined. It can be hardened by alloying with a little copper.

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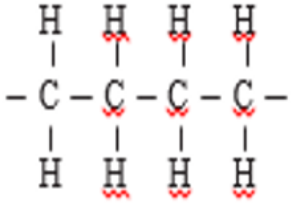
Polymers

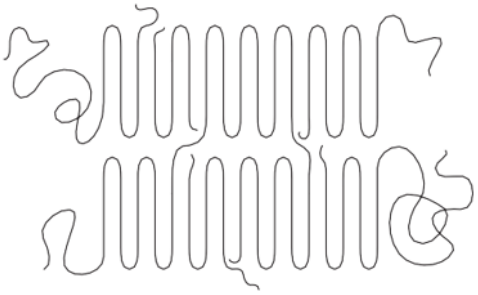
Plastics and other polymers consist of very long molecules, usually based on chains of several hundred to a few thousand carbon atoms with various other atoms, or groups of atoms, hanging off the sides.

The chemical structure of the simplest of all plastics, polyethene (often called polyethylene or Polythene), is shown in Figure 2. The molecules consist of a long, long string of carbon atoms with hydrogen atoms linked onto the sides of the chain.



Complex polymers

- There are typically many thousands of atoms in a polyethene chain: the open bonds at the end of the section shown indicate that this is not the whole structure, but that it continues in the same pattern, repeated many times.
- String is a good analogy, because these long molecules of polyethene are flexible. When the solid forms, they can organise themselves into regular structures by folding back on themselves.



Polyethene

- High density polyethene (HDPE) consists of long individual chains, which may crystallise or be tangled together but remain essentially separate.
- This is a strong, tough and lightweight material widely used for household items like food containers, as well as in more sophisticated applications such as providing a hard-wearing surface for bearings in artificial joints for hips and knees.
- In low density polyethene (LDPE) the chains are chemically linked together (known as crosslinking) to form a loose network. This results in a very flexible transparent material used, for instance, for wrapping food.

Video Furniture manufacturing process-plastic furniture

- Video link: https://www.youtube.com/watch?v=ezdJNR2stog
- Short description: ATC Furniture Furnishings is leading manufacturer, vendor and exporter in Vietnam. ATC Furniture provides complete outdoor and indoor solutions. ATC Furniture Furnishings uses the latest development in lacquering, water hyacinth treatment, Polyethylene UV and Water Resistant materials to make a high quality versatile range of exterior and interior patio, lounge and dining furniture
- Duration: 3.50 min

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Carbon-based materials

- Carbon is one of the most common elements on our planet. As well as providing the backbone for polymers, it exists in several different forms in a pure, or almost pure, state.
- Coal, diamond and graphite have very different physical properties. Coal is a weak and brittle material, not much use for making things.

(a)

(b)

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Carbon based materials 2

- More sophisticated carbon-based materials are also under development. Tiny particles shaped like balls and tubes (Buckminsterfullerene, a molecule containing 60 carbon atoms in the shape of a football, is probably the most well-known) are of great interest to chemists, but have yet to find bulk applications.
- Graphene, which consists of a layer of carbon atoms just one atom thick, has more potential for engineering. It is exceptionally strong (about 200 times stronger than steel by weight) and a very good conductor of heat and electricity, while being reasonably flexible and almost transparent.

(a) (b)

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Material resources for engineering

- The word 'material' is used here in the general sense of a substance, which will usually fall into the category of metal, ceramic, polymer, or some combination of the three.
- Different materials are carefully chosen for various purposes in engineering, depending on the requirements of the situation and very specific terms are used to distinguish certain properties to help engineers to select the appropriate material for a particular job.

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Product property, process and price

- Many of the outputs of engineering are physical products, either for a consumer to use directly (cars, televisions, washing machines, clothing) or as steps towards a wide range of other products (tools, machinery, chemicals, fabrics). Such products are made of some form of material.
- To fulfil the proposed function of a product, whatever it is, materials are chosen for their particular properties. For instance, a pen has to be rigid, a floor beam has to be stiff, and clothing needs to be flexible.
- These four words – product, property, process and price – are all interlinked. The final choice of material for a given situation will usually be a compromise between all four.

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Describing materials

- The range of words used to describe materials, and the associated properties used to measure them, is vast.
- Strength and stiffness are examples of mechanical properties, which are generally connected with how a material responds to an applied force.
- Other characteristics of materials, such as their electrical and magnetic properties, are not so easy to see but may be equally important for some applications.
- In modern engineering, quantification of such properties, by measurement and tabulation, is essential to help select the most appropriate material for a specific application.

Describing materials

Term	Meaning	Example	Opposite
Strong	Capable of withstanding large forces before failing (and the way it fails depends on what it is).	Metals like iron are strong; an iron bridge can withstand considerable weight of traffic without breaking.	Weak
Tough	Not easily broken, resistant to cracking.	Wood is a tough material – trees may sway in high winds but they rarely break.	Fragile
Hard	Does not deform easily under a compressive force. Resistant to scratching or denting.	Stone is a hard material, often used for buildings and structures that need to stay the same shape.	Soft
Stiff, rigid	Not easily bent, or changed in shape.	A material can be stiff without being hard – for instance, a plastic CD case is stiff, but quite easy to scratch or dent.	Floppy, flexible
Elastic	Can be deformed, and will return to its original shape once the force is removed.	Rubber can stretch a lot and recover, without being permanently deformed.	Plastic
Dense	A dense material is one that has a large mass for a given volume.	Lead is a particularly dense metal, often used to add mass to something.	Light (for its volume), low density

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Describing materials

- Some of the words commonly used in engineering to describe the mechanical properties of materials.
- Some of these words may seem very similar and the differences between them can be quite subtle. To confuse matters, some of the words are used in everyday language in a slightly different way. For instance, 'plastic' is used here to describe a physical property, not a class of material.
- A material behaves in a plastic way if it is deformed by a force and does not return to its original shape when the force is removed. You might not immediately think of describing a metal as either 'elastic' or 'plastic', but in fact most metals can display either of these properties, depending on the size of force they are subjected to.

Term	Meaning	Example	Opposite
Strong	Capable of withstanding large forces before failing (and the way it fails depends on what it is).	Metals like iron are strong; an iron bridge can withstand considerable weight of traffic without breaking.	Weak
Tough	Not easily broken, resistant to cracking.	Wood is a tough material – trees may sway in high winds but they rarely break.	Fragile
Hard	Does not deform easily under a compressive force. Resistant to scratching or denting.	Stone is a hard material, often used for buildings and structures that need to stay the same shape.	Soft
Stiff, rigid	Not easily bent, or changed in shape.	A material can be stiff without being hard – for instance, a plastic CD case is stiff, but quite easy to scratch or dent.	Floppy, flexible
Elastic	Can be deformed, and will return to its original shape once the force is removed.	Rubber can stretch a lot and recover, without being permanently deformed.	Plastic
Dense	A dense material is one that has a large mass for a given volume.	Lead is a particularly dense metal, often used to add mass to something.	Light (for its volume), low density

Video Furniture production and materials

- Video link: https://www.youtube.com/watch?v=8vuCst3X2hg
- Short description: A documentary about the different processes at a furniture industry. Made at the Rawat Furniture Factory in Pune.
- Duration: 6.58 min

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Describing materials

- It is the combination of different properties that differentiates one material from another. Metals are usually hard and strong, but are also tough and flexible.
- Glass is hard and strong, but is also brittle and stiff. Nevertheless, glass has the useful property of transparency!

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Prototyping

- The use of realistic looking 3D computer models has, in many instances, removed the need for physical prototypes, particularly where designs are incremental changes on existing design solutions.
- Many CAD modelling systems are so sophisticated that videos and walkthroughs of products or buildings are very realistic.
- In other design situations it is important to create and evaluate prototypes within the design team or with potential users to find out their responses to the product in terms of feel, size, features and other factors.

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Computer Numeric Controlled prototyping

- CNC is widely used to manufacture components or to create the tools to manufacture furniture products. However, it may also be used to make prototype parts and components if the design is appropriate for the techniques used.
- The basis of CNC is that the machine shapes a block (billet) of material using cutting tools such as lathes, milling machines or routers.
- The limitations of CNC are that complex shapes may be very difficult or expensive to achieve if special equipment is needed.

Video Full automatic Intelligent CNC Router S2 for Cabinet furniture production

- Video link: https://www.youtube.com/watch?v=GDZIhkJMyZg
- Short description: Full automatic Intelligent CNC Router S2 for Cabinet furniture production has multi-functions of carving, engraving, milling, slotting, grooving, cutting, chamfer edge. Full automatic Intelligent CNC Router S2 is mainly used in furniture making industry, furniture decoration industry, wood craft industry, wood decoration industry, automotive tooling industry, solid wood furniture, solid wood door, classical furniture, decoration material, door cabinets, computer tables, plate furniture, office furniture, wooden sound box, wooden kitchen furniture and other processing.
- Duration: 6:50 min

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Additive prototyping

- Prototyping, uses the build-up of layers of material to create physical prototypes and products. The range of materials that can be used in this way is growing all the time.
- Early machines used nylons and plastics to build prototypes, but the results were often very fragile.
- Additive techniques are now being used with plastics, metals, ceramics, concrete and even sand to create products that range in scale from small pieces of jewellery to furniture and buildings.

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6 Testing of knowledge tools

The E-learning Platform contains interactive elements allowing students to test their understaning and knowledge. http://imfuture.cetem.webfactional.com/

7 Evaluation of modules (unicam-bmf)

The aim of this activity was to design a Monitoring and Evaluation system for all learning contents developed in this project. It allowed partners involved to maintain a reflection upon whether they have met the strategic goals of this International Master Degree.

The Monitoring and Evaluation process kept the project focused on the project beneficiaries and assessed whether the appropriate learning contents and the training paths have been developed.

This was conducted with a flexible approach allowing adjustments and enhancements in order to maximize the quality of the outcomes and increase the potential of the long-term impact.

UNICAM, at academic level, and BFM, at industry level, have evaluated and validated the developed learning content. During the development phase ontent which has been identified as requiring