

# Make your way

## Toolkit of Learning Materials

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## Partners:

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	<b>INOVA+ - Portugal</b>	<a href="http://www.inova.business">www.inova.business</a>
	<b>in.cubo - Portugal</b>	<a href="http://www.incubo.eu/">www.incubo.eu/</a>
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# MAKE YOUR WAY – what is it?

MAKE YOUR WAY project intends to support the promotion of work-based learning (WBL) in all its forms by developing relevant collaborations to open further opportunities for young VET students to apply knowledge in practical, “hands-on”, and “real life” workplace situations, at the same trying to enhance their entrepreneurial attitudes, in particular by working in LABs. Thus, the project takes benefit of the concept of “Fab labs”, or LAB, a small-scale workshop offering digital fabrication, proven to boost innovation and entrepreneurship, as they are platform for learning and innovation: a place to play, to create, to learn, to mentor, to invent.

Such laboratories (FAB LABs) help connecting a community of learners, educators, technologists, researchers, makers and innovators. There is World Bank data confirming that such LABs help multi-disciplinary teaching, learning, research, and entrepreneurship, and when there is close collaboration between the educational system and industry, based on the strength of all stakeholders this approach can successfully address local needs. LABs can help strengthen and expand VET-industry partnerships through prototyping joint research or products with digital fabrication machines. Also, access to modern equipment, digital modelling and design tools such as 3D printers and laser cutter soften unleash creative talents.

The project also aims to bring more innovation to VET system by contributing to the continuous professional development of VET teachers, trainers and mentors in both school and work-based settings, with a focus on developing effective digital, open and innovative education and pedagogies, by developing materials that can help those professionals assist young VET learners in taking the most benefit from using LABs and from other WBL solutions, as well as spreading the concept of LABs and promoting their closer collaborations with the VET system, while preparing both sides for such partnerships (VET teachers and LABs staff, who often become VET mentors/trainers).

## Toolkit of learning materials

This toolkit consists of self-study materials, tutorials, practical exercises and assignments, diagnostic tools, test, etc, which are covering 2 areas:

- entrepreneurial soft skills and knowledge needed to set up a business, start-ups, promotion of self-employment, e.g. **communication, problem solving, flexibility, planning and organizing, stress resiliency...**
- development of **technical skills** through experiential (work-based) learning, interconnected with creativity in order to boost innovation, e.g. additive technologies (3D printing), modern equipment, ICT in industrial context, techniques and trends in crafts, DIY basics, etc.

**In the first part** of this manual there are exercises chosen by the project partners for translation and dissemination in all the involved countries. **In the second part (appendices)**, there are extra materials in English language only, that were collected during the process, and can be used as additional tool within the process.

# Introduction

This training programme has been developed under the Erasmus+ Programme of the European Union (Project N°.: 2018-1-PL01-KA202-051166). Other training materials were used from the previous partners' programmes, especially: (EQUAL/011; CZ.04.4.09/3.1.00.1/0001), (CZ.1.07/1.1.00/14.0200).

Developing soft skills is an important way to increasing people's competitiveness in the labour market and their ability to adjust to the changing conditions.

The core of this manual consists of two main chapters:

1. Entrepreneurial soft skills - Communication, Problem solving, Flexibility, Planning and organizing, Stress resiliency and Customer orientation (the latter added as a result of discussion in the joint staff training event on methodology of experiential learning, organised by RPIC-ViP in Czech Republic, October 2019)
2. Technical skills

In our experience and based on a long-standing functional theory, students need motivating so they are willing to learn and develop. That is why the process cannot be passive, with the know-it-all trainer just lecturing and his audience just listening.

As far as the training methodology is concerned, it is based on the principles of efficient education, i.e. experiential liberalism. In real life, it means that objective and/or theoretical findings give way to subjective experience. So-called participation methods (group/team work; role playing; learning through action) are preferred to the traditional forms of lectures etc. Active learning is promoted, with communication between the trainers and participants, cooperation, quick action, improvisation being very important. The participants come in with various experiences from their school as well as personal lives; the group they form is a training tool in itself, and the trainer should bear this in mind.

# 1. ENTREPRENEURIAL SOFT SKILLS

## 1.1 Communication

From all the skills one needs to acquire, communication comes first. The ability to communicate effectively with people is one of our most important assets, be it in professional, social or private life. It is hardly surprising that it is one of the requirements all employers agree on when it comes to choosing new staff or colleagues. The ability to communicate belongs to key competencies presently demanded by the labour market. In order to communicate effectively we need to be ready and able to transmit information clearly and comprehensibly, consciously listen to others, differentiate between the significant and the insignificant, and empathise with the needs of others. When communicating effectively, partners respect each other. Not only do they exchange useful information, but they also influence one another.

Competency features

- Expressing oneself clearly and presenting well
- Written communication
- Conscious use of non-verbal communication
- Listening and feedback
- Dialogue and discussion
- Behaviour in difficult situations

## 1.2 Problem solving

We have to face a number of problems on an everyday basis; some of them are handled easily, while others are more difficult to resolve. They require time, effort, mental engagement, etc. Everyone is supposed to be able to face up to problems, not to be taken aback by them, and dispose of them sooner or later. This applies not just in the labour market but also in education; indeed, students also have to deal with a number of problems at school as well as outside of it. The ability to solve any problems they may come across should serve them well later in practical life, and it definitely is helpful during their studies.

Competency features

- Problem identification
- Searching and verifying information on how to solve a problem
- Consideration of alternatives and appropriate choice
- Problem solving
- Evaluation of solution

## 1.3 Flexibility

In the field of employment, the flexibility means closer cooperation, widening of the scope of different jobs and/or positions, and their fusion. The demands on employees' independence, responsibility, knowledge and skills are rising. Precise job descriptions have been losing ground; instead more general descriptions of the work to be done are taking their place, and so is job rotation. It is exactly in this way that our programme considers flexibility – namely one of the key competencies wanted in the labour market. We see it as adjustability and flexibility in thinking and behaviour as well as attitudes to situations and tasks life places in front of us. It is the ability to change or adjust our working habits, behaviour, and to work effectively under new or changing circumstances, meeting new tasks and new colleagues, partners and clients.

### Competency features

- Ability to accept new ideas and approaches – an open mind
- Ability to focus quickly on different tasks
- Willingness to change one's working style & procedures
- Creative approach – to be willing & able to handle issues & resolve problems in other than routine ways.
- Openness towards new ideas & solutions
- Lateral thinking (ability to see differently, devise unusual methods, etc.)
- Ability to innovate (create a new product, solution, execution of a task, etc.)

## 1.4 Planning and organizing

Planning and organising form an essential part of activities employed in the management of companies, but also any other organisations that are supposed to be functional. Good organisational skills and planning of work – these are certainly prerequisites for making effective use of working hours, achieving stable performance and quality results. We could also assume that with good organisation and planning we would avoid conflict, ambiguity, misunderstanding and stress.

### Competency features

- Ability to judge resources required to carry out work
- Ability to see the whole picture
- Ability to split the whole into sections and understand interactions
- Ability to coordinate individual parts of the work
- Ability to stick with plans (structure) or amend them as required
- Ability to set priorities
- Time management
- Ability to coordinate one's own work with the work of others

## 1.5 Stress resiliency

Generally, reaction to stress means adjustment to changes in our surroundings. From natural history we know that organisms that were unable to adapt, failed; those that could not comply with radical changes in the environment became extinct. Many people will freely disclose that they experience a high degree of stress nearly all the time. Excessive stress affects negatively our work performance and efficiency, not to mention its disastrous impact on our happiness and well-being. The competency for stress resiliency focuses on the ability and readiness of a person to perform reasonably well under pressure and in non-standard working conditions. It contains:

### Competency features

- Ability to concentrate while under stress
- Ability to overcome obstacles
- Ability to focus (routine tasks requiring constant attention)
- Ability to adapt to change and unexpected events, problems, situations and people's behaviour
- Ability to deal with failure and/or lack of success, and maintain performance regardless (resilience)
- Ability to control one's emotions

## 1.6 Customer orientation

Customers are essential to any business, and the same might be said about the whole society. There is a lot of competition all around and customers' satisfaction can have a significant impact on a company's success. Thus the competency for meeting customers' needs is one of the key requirements placed on workers. But we can also make use of it in our personal lives. While developing the training tools for this project and with special regard to this competency and its development, we defined a set of singular abilities that as a whole, produce the works:

### Competency features

- Ability and willingness to meet customers' wishes
- Ability to understand customers' needs and interests (empathy)
- Ability to use 'win-win' negotiation strategies and be able to find a compromise between the company's (own) needs and those of the customers
- Ongoing customer care (not just sell-and-forget)
- Ability to adapt to customers, adjust services and/or products according to their needs
- Ability to deal with one's hostile feelings towards the customer or his/her demands

## 1.7 Exercises

### 1.7.1 Target Audience

<b>Soft skills</b>	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Customer orientation</li> <li>• Flexibility</li> <li>• Stress resiliency</li> </ul>
<b>Aim</b>	<ul style="list-style-type: none"> <li>• to develop the ability of expressing oneself clearly</li> <li>• to develop the ability of presenting oneself and the results of one's work</li> <li>• to learn how to choose appropriate communication tools with regard to target audience and circumstances</li> <li>• to develop vocabulary and its application</li> </ul>
<b>Timing</b>	45 – 60 minutes
<b>Location</b>	indoors / outdoors
<b>Resources and materials</b>	preparation of topics to be used (cards)
<b>Description</b>	
<ol style="list-style-type: none"> <li>1) Teacher lets the students split into pairs.</li> <li>2) Each pair is given a card with their topic, specifying the target audience (see Help for teachers). If there are three target audiences, three pairs shall receive the same topic, but each will have a different target audience (see Help for teachers).</li> <li>3) Teacher instructs: <i>"Each pair of you is to prepare in writing a short news item processed for the target audience."</i></li> <li>4) Teacher leaves enough time for preparation before calling on the first pair to deliver. Pairs read out their news items, the rest of class provide feedback to each. Teacher probes: <i>"Did you make the right choice of words in view of your target audience? What register, volume of voice, and stress on particular features of your item did you opt for?"</i></li> </ol>	
<b>Risks and recommendations</b>	No special considerations necessary.
<b>Feedback</b>	<p><u>Questions for discussion:</u></p> <p>What was easy about the task, and what was hard? Why so?</p>

	<p>Where did you fail?          Could some of the items be delivered to any audience?          What arguments did you use with children, old-age pensioners, and adults?          Would the looks of a recipient affect your delivery? How so?</p> <p><u>Help for teachers</u></p> <p><u>Sample topics:</u></p> <p>3D printing          3D scanning          FabLabs          The Coolest Technical Innovations          The Great Inventions          Etc. (according to the subject)</p> <p><u>Target audience:</u></p> <p>pre-school children          experts          old-age pensioners          adolescents</p>
<p><b>Notes</b></p>	

### 1.7.2 Can I Fill One Minute?

<b>Soft Skills</b>	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Stress resiliency</li> </ul>
<b>Aim</b>	<ul style="list-style-type: none"> <li>• to learn how to maintain eye contact</li> <li>• to learn how to respond quickly</li> <li>• to learn how to listen</li> <li>• to boost the ability of holding other people's attention</li> <li>• to develop communication skills</li> <li>• to learn how to adhere to ethical rules of communication</li> <li>• to develop vocabulary</li> </ul>
<b>Timing</b>	30 minutes (depends on the number of students)
<b>Location</b>	indoors / outdoors
<b>Resources and materials</b>	cards with topics (e.g., as per Worksheet below)
<b>Description</b>	
<p>1) Teacher lays down the rules of the game:</p> <ul style="list-style-type: none"> <li>• You are expected to speak on a chosen topic for one minute.</li> <li>• Topics will be drawn by lots. Should anyone find the topic too difficult, there is the option of drawing another, but that is it.</li> <li>• There is one minute for preparation.</li> <li>• It is good to think about what needs to be mentioned in the speech, what may be omitted due to the time limitation, how one wants to handle the topic and/or what escape route to take so as to talk about the subject matter while not really addressing it. This may be handy with uncomfortable topics.</li> <li>• Accustomed structure of speech delivery has to be complied with: <ul style="list-style-type: none"> <li>Introduction – Briefly explain what it is all about.</li> <li>Own description and/or handling of the topic.</li> <li>Conclusion – Provide a summary, give personal view and/or experience of the topic.</li> </ul> </li> </ul> <p>2) A minute for preparation of the speech, and another for its delivery.</p> <p>3) Assessment as well as self-assessment of performance; done by the class, with the teacher commenting.</p> <p>4) Discussion about the key principles of presentation can follow (optional) – what makes one presentation more powerful than the other one...</p>	

<b>Risks and recommendations</b>	<p>Some students may make fun of it.</p> <p>The exercise needs repeating.</p> <p>At the beginning of the school year, students themselves may write down the topics on cards provided by the teacher. Subsequently, they may take a vote on which to keep and which to delete from the "database". The advantage is in their having a positive attitude to topics thus chosen.</p> <p>When choosing the topics themselves, boys tend to mention their favourite, possibly lesser known sportsmen who could be a closed book to girls. Then it is necessary to record the names on, say, the blackboard so that everyone could prepare properly. Without the slightest knowledge of a subject, it is hard talking about it.</p>
<b>Feedback</b>	<p><u>Questions for discussion:</u></p> <p>How did the student do with his minute of speech? What use did he make of the one-minute preparation? Was it enough? Was it too much?</p> <p>Speech assessment:</p> <ul style="list-style-type: none"> <li>• Did the student introduce the topic – what was it like? Could it have been done better?</li> <li>• How did he do with the actual description? Did he mention all the important points? What could have been also mentioned?</li> <li>• Did the speaker mention both pluses and minuses of the subject?</li> <li>• Was there a proper conclusion – did the speaker provide a summary and/or express his own thoughts? Could there be another way to finish the speech?</li> <li>• How good was the speech overall? Is the speaker happy with his performance?</li> </ul>
<b>Notes</b>	

**WORKSHEET: Cards With Topics (Sample)**

<b>FRIENDS</b>	<b>SCHOOL</b>	<b>WEATHER</b>
<b>SPORT</b>	<b>NATURE</b>	<b>FABLAB</b>
<b>MONEY</b>	<b>LANGUAGES</b>	<b>MOTHERLAND</b>
<b>CULTURE</b>	<b>MATH</b>	<b>CAPITAL CITY</b>
<b>BOOKS</b>	<b>LOVE</b>	<b>OUR TOWN</b>
<b>INNOVATIONS</b>	<b>FAMILY</b>	<b>RIVER</b>
<b>CHEMISTRY</b>	<b>MY BUSINESS IDEA</b>	<b>TREES</b>
<b>SUN</b>	<b>ANIMALS</b>	<b>FLOWERS</b>
<b>COSMOS</b>	<b>PC GAMES</b>	<b>TV</b>
<b>MOBILE PHONE</b>	<b>COMMUNICATION</b>	<b>FACEBOOK</b>
<b>YOGHURT</b>	<b>FRANCE</b>	<b>HARRY POTTER</b>
<b>SLEEP</b>	<b>MY ROLE MODEL</b>	<b>SHOPPING</b>
<b>3D PRINTING</b>	<b>VIRTUAL REALITY</b>	<b>BEAR</b>

### 1.7.3 Pacific Railroad

<b>Soft Skills</b>	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Problem solving</li> <li>• Stress resiliency</li> </ul>
<b>Aims</b>	<ul style="list-style-type: none"> <li>▪ to participate in tackling a common goal actively</li> <li>▪ to make use of knowledge by applying it practically</li> <li>▪ to find one's way through information</li> <li>▪ to share information</li> <li>▪ to solve a mathematical problem</li> </ul>
<b>Timing</b>	30 – 45 minutes
<b>Location</b>	indoors
<b>Resources &amp; materials</b>	Pacific Railroad Worksheet – Group Instructions; Pacific Railroad Worksheet – Information Set; pens, paper, scissors
<b>Description</b>	
<ul style="list-style-type: none"> <li>• Advance preparation: Teacher cuts the Pacific Railroad Worksheet – Information Set into slips in such quantities as to satisfy the demand (number of group members).</li> <li>• Teacher splits the students into groups (4 or 5 strong) and lets them take up seats so that one group does not disturb another. Each group gets a copy of the Pacific Railroad Worksheet with instructions. Once they have read it through, teacher will pass onto each group the prepared information slips, distributing them evenly among members.</li> <li>• Teacher observes how the groups at work without interfering; he only makes notes to use for feedback. He allows for the task to take certain time.</li> <li>• When the time is up, all work must stop. Groups make their presentations, solutions are being checked, and ideally explained and elaborated on by the successful group(s).</li> <li>• Teacher rounds off the activity with feedback and discussion. He makes clear to the students that except for the mathematical task everything else has come from real life.</li> </ul>	
<b>Risks &amp; recommendations</b>	<p>The suggested time for finding the solution is 30 minutes. If delivering in English, it is good to introduce the activity by watching a short online:</p> <p><a href="http://www.youtube.com/watch?v=dA8FpBGJ4Yg&amp;feature=related">http://www.youtube.com/watch?v=dA8FpBGJ4Yg&amp;feature=related</a></p>
<b>Feedback</b>	<p><u>Questions for discussion:</u></p> <p>How did you approach the task?</p> <p>How long did it take you to realize some information is irrelevant?</p> <p>How did you proceed when tackling the tasks?</p>

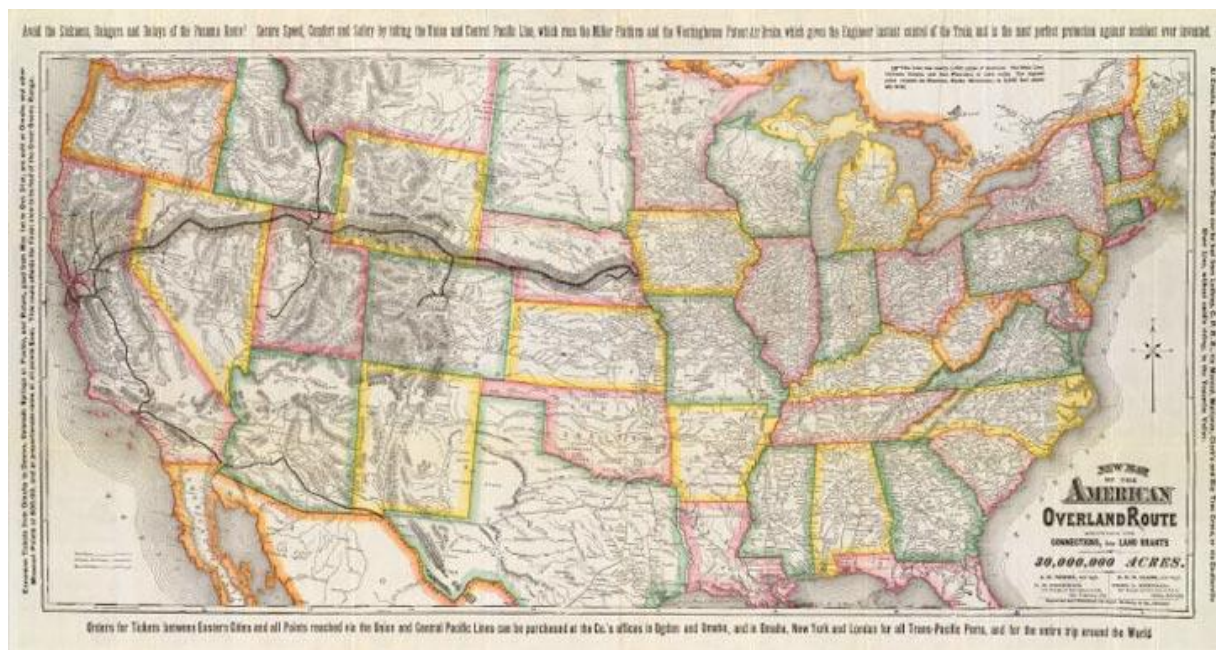
	<p>What helped and what prevented reaching consensus?</p> <p>What made your group come out tops?</p> <p>What made your group fail? What would you do differently next time?</p> <p>Is there anything you have realized due to this activity?</p> <p><u>Solution:</u></p> <p>Correct answer: 10<sup>th</sup> May, 1869.</p> <ul style="list-style-type: none"> <li>○ The rectangular area taken up by the Four Corners is 4,800 square miles; on the long side, it is 80 miles (horse speed times 8 hours, i.e. what the chieftain needs for the journey). Accordingly, the short side takes up 60 miles (4800: 80).</li> <li>○ Based on the rule of Pythagoras, diagonal of the rectangle comes to 100 miles.</li> <li>○ For one mile of railroad, 2,500 sleepers. Union Pacific Railroad workers moving from the east will lay down 8,750 sleepers daily, i.e. 3.5 miles of railroad (8750 : 2500). Central Pacific Railroad workers moving from the west will lay down 3,750 sleepers (8750 – 5000), i.e. 1.5 miles of railroad (3750 : 2500) daily.</li> <li>○ Five miles of railroad is built every day, which means that 100 miles is built in 20 days (100 : 5). If the construction started on April 21, the rail lines will be joined on May 10.</li> </ul>
Notes	

## WORKSHEET 1: Pacific Railroad

**Group Instructions** North America, the Gold Rush, second half of the 19<sup>th</sup> century. A transcontinental railroad is under construction; it will connect the Atlantic East Coast with the Pacific West Coast at long last. There is little but wilderness in between.

From the west, Central Pacific Railroad does the job, hiring many Chinese workers for the tough job. From the east, Union Pacific Railroad strikes forth. This enormous project has been put into motion by the 16<sup>th</sup> president of the United States, Abraham Lincoln, formerly a railroad lawyer.

At last the two ends meet, and the line is complete. On hearing the agreed signal, "Done! Done! Done!" telegraphed from Utah, a wave of excitement floods the whole country.



**Your group task:** Establish on what day exactly would the so far separate rail lines interconnect at the Promontory Summit, Utah.

## WORKSHEET 2: Pacific Railroad

### Information Set



*This worksheet needs to be cut into slips that will be evenly distributed among the group members. Once they have them, they must not show their slips to anyone.*

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The railroad under construction cuts through endless prairie, desert, ridges, canyons and gorges.

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To build the railway, thousands of tonnes of gunpowder and thousands of workers are needed.

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The Sioux and the Cheyenne, two of the most combative tribes, feel threatened by the construction. They fight the "white raiders" and "iron horses" mercilessly.

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While building the railroad, more than 20,000 people will have lost their lives.

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Central Pacific Railroad employs mainly Chinese coolies to start toiling in Sacramento in the west and cut tracks across the Sierra Nevada mountain chain at considerable altitudes.

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Rails, carriages, and locomotives necessary for the railroad traffic are transported by sea from the East Coast all the way around Cape Horn and up through the Pacific to the West Coast.

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Only a week after finishing the railroad, people could travel from New York to San Francisco in seven days.

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Both railroads are to connect in the state of Utah.

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In Utah, the railroad passes through the territory of Ute Indians. The area here is called the Four Corners since it is shaped as a rectangle.

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The territory of the "Mountain People", which the railroad intersects, has 4,800 square miles.

Ute means the "Mountain People".

Should a Ute chieftain follow one of the longer sides of the Four Corners land on an unsaddled horse, it will take him 8 hours to ride the distance.

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The rail line will cut through the Four Corners territory diagonally.

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Ute chieftain's horse's body is painted with symbols that according to Indian tradition, affect its fate.

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The "Mountain People" chieftain rides his horse at 10 miles per hour.

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Union Pacific Railroad workers coming from the east daily lay down 8,750 sleepers.

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To construct one mile of railroad, 2,500 sleepers are needed.

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Both the railroad companies – one in the east, the other in the west, started laying down sleepers in the Four Corners on the same day: April 21, 1869.

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Central Pacific Railroad workers, mainly Chinese coolies, have to struggle with difficult geography, which is why they are much slower than their colleagues coming from the other side.

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Central Pacific Railroad workers lay down 5,000 fewer sleepers than the workers of Union Pacific Railroad.

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The passage of cargo ships circumnavigating South America takes four months over 14,000 miles.

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The railroad is under construction seven days a week, both from the east and west.

### 1.7.4 One's Own Boss at Last!

<b>Soft Skills</b>	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Planning and organising</li> <li>• Customer orientation</li> </ul>
<b>Aim</b>	<ul style="list-style-type: none"> <li>• to formulate a simple business plan</li> <li>• to assess one's personality in connection with a suitable field of business</li> <li>• to develop skills specific to entrepreneurship</li> </ul>
<b>Timing</b>	45 - 90 minutes
<b>Location</b>	indoors
<b>Resources and materials</b>	<p>flipchart sheet (one per group)</p> <p>Worksheet: Business plan (each group; if advisable, for every individual)</p> <p>sticky tape and highlighters for each group</p> <p>chronometer (mandatory; e.g., kitchen timer - for elapsed time signal)</p>
<b>Description</b>	
<p>1) Teacher introduces the exercise by way of brainstorming, mind mapping and/or lecture on entrepreneurship. He delivers concisely, within 3 – 5 minutes. Next, he splits his charges into groups, at least 6-strong; groups of 8 are optimal. How he creates the groups is subject to his purposes and goals. All together then prepare the classroom for the activity, and teacher announces what is up for the rest of the lesson. Students will have to create a business plan, and present it to a “committee”.</p> <p>2) <i>“Imagine the government in a drive to support small business creation would offer school-leavers a grant of 1 cool million to start up their companies. However, applicants, i.e., would-be entrepreneurs have to quickly present a tangible business plan to become eligible. They have to state what products and/or services they propose to supply. They also have to describe their company structure. The committee will want to see how each team member would contribute to the business. That is why you need to consider your personal capabilities and goals as well as limitations; where will you fit it the company's hierarchy? Obviously, the committee will look hard at the chances of your new company to succeed in business, and how well-prepared the business plan is. You are about to receive worksheets from me providing instructions. In them, you will make notes pertinent to your business plan and its presentation. You have 20 minutes to work on it, which is not much, I can tell you. That is why I suggest that after you have had an initial discussion about the task, roles are assigned to individual members of your group.”</i> Teacher hands out the worksheets (Business plan), making sure that everyone is clear on what to do. He may deal with queries, rephrase the task to make it more comprehensible, and start the</p>	

clock. In the meantime, he writes the main points of making a good business plan on the board and/or flipchart. Throughout, he observes the activity and gives advice if needed.

- 3) Once the time is up, teacher stops all the work, saying: *“So now you have a business plan, but that is not the end of it. In the next 10 minutes, you need to write up the presentation of your plan on flipchart sheet. The actual presentation in front of the committee should not exceed 3 m minutes, and you can practise the delivery. How you will present is entirely up to you. Just keep in mind that a lot of money is at stake, and without the grant you are unable to execute your business plan. You do not know who sits on the committee, but can assume that apart from some creative guys, there will also be number crunchers and devil’s advocates. Do not waste time – you have very little left of it!”* Teacher tellingly starts the clock again.
- 4) As soon as 10 minutes are over, teacher stops all the work. He bids the groups to come forth with their business plans and present them to the committee. He reminds them of the criteria set and encourages everyone to follow the presentations closely. The audience should be ready with questions and/ or objections. Teacher makes clear that the final assessment of presentations and discussion on the plans will only take place at the end of the lesson. He posits that the committee’s existence is only token, and in fact all the students will be judging the plans. No one will interrupt the presentations or heckle the presenters. At the outset of each presentation, teacher starts the clock, minding the time so that every group has a fair crack at it.
- 5) Teacher devotes the last 5 minutes of the lesson to discussion with those who have managed to meet the criteria.

### **Risks and recommendations**

For both parties, this is a difficult exercise. It is crucial for the teacher to keep time, and remind students of its passage: When it is up, it is up. The exercise will be as complex as the minds of those performing it: Students with greater knowledge of business, finance, and economics are likely take longer than those who know less. The former will be getting deeper down into the business plan details (management), which inevitable takes longer than just sketching it out.

<b>Feedback</b>	<p><u>Questions for discussion:</u></p> <p>Which business plan took your fancy?</p> <p>Which business plan would have the biggest chance of succeeding in real life?</p> <p>Which was the most detailed plan?</p> <p>What would you recommend to the presenters?</p> <p>Which part of planning gave you grief?</p> <p>Did you easily find your place in the company?</p> <p>Did anyone disagree with your position in the company?</p> <p>How did you come to think your business plan is the real McCoy?</p> <p>Was it difficult for you to choose a field of business?</p> <p>Why did you make your exact choice?</p> <p>What sort of advertising would you use?</p> <p>What kind of information would you need to be more successful next time round?</p> <p>How important is the presentation – what would you say?</p>
<b>Inspired by</b>	<p>Belz, H., Siegrist, M.: <i>Key Competencies and their Development</i>, Praha 2001</p>
<b>Notes</b>	

## WORKSHEET 1: Business Plan

*The government has decided to support start-up companies by offering would-be entrepreneurs (school-leavers) a grant of 1 million. It is subject to the presentation of a detailed, tangible business plan.*



### Task

Your group has to create a business plan, to be presented to a committee. While at it, make sure your business plan is **convincing and detailed**; **your personal position in the company should correspond to your capabilities and skills**. The plan might address the following points:



- Field of business
- What will you make and/or provide, what is your intention?
- What form will your business take on?
- Purpose of your company
- What do you offer – products or services?
- What is your target group?
- Where will the company be located?
- Does the location have impact on your plan?
- What do you need to start?
- Financial projections, budget
- Personnel
- Tasks assigned to members of your team
- Risks and threats

### Notes:

### 1.7.5 Alphabet Box

<b>Soft Skills</b>	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Flexibility</li> </ul>
<b>Aim</b>	<ul style="list-style-type: none"> <li>• to actively pursue a common goal</li> <li>• to work according to instructions</li> <li>• to provide rationale for one's views</li> <li>• to consider without prejudice other people's views, and take them into account</li> <li>• to provide stimulus to group work</li> </ul>
<b>Timing</b>	45 minutes
<b>Location</b>	indoors
<b>Resources and materials</b>	Alphabet Box Worksheet, inspirational suggestions for teachers, stopwatch, flipchart with Alphabet Box table, set of colour paper cards, highlighter, paper glue
<b>Description</b>	
<p>1. Teacher lets his students know the topic of the class, for instance Successful Start-Up, and gives initial instructions:</p> <ul style="list-style-type: none"> <li>○ "You will work in groups."</li> <li>○ "Each group will receive a worksheet with an alphabet table." (The alphabet will have been slightly abridged, according to particular language considerations.) "The table has 24 fields, leaving all but one to individual letters; the last field belongs to the joker." (As long as the students are unfamiliar with the Alphabet Box tool, teacher needs to demonstrate it.)</li> <li>○ "Your task is to write in the relevant fields all the words that spring to mind in connection with the notion of <i>successful start-up</i>. In your teams, you will propose the words that you think relate to the notion of start-ups. One of your group will record all those words in the table. Make sure that each word is assigned to its rightful field, i. e., as per the initial letter. Try to stay with nouns if at all possible."</li> <li>○ "There is no need to go from one letter to the next. Feel free to skip and/or return back as needed. The joker field offers you the opportunity to write in there any relevant word, regardless of its initial letter."</li> <li>○ "The time for this task is limited – you will have 10 minutes for it."</li> </ul> <p>2. Teacher casts lots to assign his students into groups, 4- to 6-strong. It would be best if there were four groups (i.e., just as many as columns in the table; or perhaps six, i.e. as per the</p>	

number of rows). Teacher distributes the Alphabet Box worksheets, one to each group, double-checking that everyone is clear on the task before starting the stopwatch.

3. While the class works, teacher prepares the flipchart with the table, and observes how his students are doing.
4. Once the time is up, teacher tells the class to stop working on the task and move onto the next stage. Each group is told to use colour paper cards to record in them only select words, in a particular order. Teacher sets the order as he sees fit, i.e., alphabetically; per column; per row, or even per chance. (In the sample provided, the choice is per column.)

Instructions:

“I am about to provide each group with colour paper cards and a highlighter.” (He does as he says.) “You are going to transfer the words you have come up with from the table to the cards. However, not everything from the table will be used. You will work like this:

- YELLOW group should transfer only the words from the first column of their table.
- ORANGE group should transfer only the words from the second column of their table
- GREEN group should transfer only the words from the third column of their table
- BLUE group should transfer only the words from the fourth column of their table.

Once you are done, you will need to explain why a particular word sprang to your mind when you thought about *start-ups*. You will have to present your justification verbally to the rest of the class. It is up to you whether your group will be represented by a single speaker or whether all the team members will have their say. You will also affix the card with the chosen word to the flipchart, and in the correct field.” (Teacher points out the displayed flipchart.) “There is glue at your disposal. Again, only limited time is on hand for this task, and it is 7 minutes only.”


5. Teacher bids everyone to start working, and runs his stopwatch, observing how groups are progressing.
6. Once the time is up, teacher motions one group after another to come forth and make comments on their choices of words in front of the flipchart with cards. In case not all the fields in their flipchart have been covered (it may be difficult to find suitable words with certain initial letters), he challenges the other groups to help out, or even contributes himself.
7. Having gone through commenting on and justifying their choices, students and their teacher define what successful start-up means, pointing out both the positive and negative features.

### **Risks and recommendations**

Teacher must not be taken aback by some groups coming up with mostly negative features.



## WORKSHEET 1: Alphabet Table

A	B	C	D
E	F	G	H
CH	I	J	K
L	M	N	O
P	R	S	T
U	V	Z	

### 1.7.6 Challenges and Bets

<b>Soft Skills</b>	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Customer orientation</li> <li>• Stress resiliency</li> </ul>
<b>Aim</b>	<ul style="list-style-type: none"> <li>• to revise, possibly to learn something new</li> <li>• to enliven the class</li> <li>• to learn to handle information</li> <li>• to motivate towards self-improvement, boosting self-esteem</li> <li>• to seek suitable methods of learning</li> </ul>
<b>Timing</b>	ca 45 minutes
<b>Location</b>	indoors or outdoors
<b>Resources and materials</b>	poster with bets; chart with student names; paper and pens for competitors; tools and materials as specified
<b>Description</b>	
<ol style="list-style-type: none"> <li>1) Teacher should choose the required output – topic of learning.</li> <li>2) Teacher splits students into groups, or leaves them to act on their own.</li> <li>3) Teacher makes sure the list of challenges is prominently displayed; the items are of varying difficulty.</li> <li>4) Each group and/or individual assess the challenge by placing a bet to it, based on how much he believes he will succeed. The minimum bet is 10 points; maximum, 100. Every challenge must be assessed and betted on.</li> <li>5) If the challenge is met, the group and/or individual get the number of points they have wagered. In case of failure, the same amount is deducted. Everyone starts with from scratch.</li> <li>6) Once all the challenges are disposed of, points are counted and winners announced. Teacher lets the winner speak out first – what they did and how, what paid off, what helped them to succeed.</li> <li>7) Teacher arranges for a short feedback.</li> </ol>	
<b>Risks and recommendations</b>	<p>It is suggested to group the students congenially, while preventing a superior group to form. This ensures the competition remains interesting throughout.</p> <p>The risk lies in the necessity to tackle certain tasks in turns. Those watching only may copy the right ways and/or learn from the mistakes of others. That is why the order of groups should alternate.</p>

<p><b>Feedback</b></p>	<p>Both groups and individuals often underestimate their abilities. Feedback ought to point this out and spur the students onto greater self-confidence.</p> <p><u>Questions for discussion:</u></p> <p>How did you assign your points? Did you fly close to the ground, or did you overestimate your abilities? Do you know about this issue based on previous experience?</p> <p>What strategy paid off?</p> <p>Present your strategy for handling each challenge.</p> <p>Can we draw any conclusions from this exercise?</p>
<p><b>Notes</b></p>	

## 2 TECHNICAL SKILLS

Within the MAKE YOUR WAY project we support the development of technical skills through experiential (work-based) learning.

We recommend development of three main categories:

### 1) CAD DESIGN

- 3D SCANNING
- 3D PRINTING

### 2) BASIC ELECTRONICS

### 3) ART&CRAFTS

Some of the exercises in this toolkit can be used in all of those areas – simply by changing the product, while keeping the same principle of gamification.

There are many more exercises created in other EU programmes – the links can be found in the appendices section.

## 2.1 CAD Design

Computer-aided design (CAD) refers to computers being used to assist the design process in all sorts of industries. With CAD software, it's possible to build an entire model in an imaginary space, letting you visualize properties like height, width, distance, material, or color before the model is used for a particular application.

It was 1962 when the computer scientist Ivan Sutherland created the first computer graphic program, known as “SketchPad”, which allowed people to write or draw simple figures directly on a screen with the help of a special pencil. This marked the start of all future CAD software.

At first, CAD was used only for research purposes, but in the 1970s, big automotive and aerospace companies started developing their own software, expanding its applications to other industries in the 1980s. It wasn't until the 1990s that tools like CATIA and AutoCAD were born, making it possible to be used in many professional sectors.

There are several benefits of using CAD as a design and analysis tool:

**Visualization:** It allows you to create and visualize 2D or 3D objects and make as many changes as you need with less effort than drawing it on paper with a pencil.

**Detail:** Digital representation in CAD is very close to real life, making it accurate up to a certain level. You can also add as much detail as you need.

**Optimization:** Finding fails during the design process is very difficult but CAD software can help in a very reliable way, even though they are not perfect. The more sophisticated CAD programs even allow you to run simulations to test for imperfections.

**Specialization:** There's CAD software for almost every professional sector with specialized features and tools for each one, making it widely applicable.

**Realization:** You have the possibility of bringing your digital design to the real world in the form of a physical object with the help of fabrication technologies and CAM software, which would be more difficult and expensive with traditional fabrication methods.

**Here are a few of the biggest professional sectors that rely on CAD:**

**Architecture:** Architecture is one of the most demanding disciplines when talking about CAD; there are so many elements involved during the design of a project that one almost needs software support.

*Example: Large design companies usually use BIM modeling software like Revit or ArchiCAD to improve productivity, but small design firms more typically combine different tools in their workflow. This is the case for architect Eric Reinholdt, for example, who runs a YouTube channel and his own studio, called 30x40 Design Workshop. He claims to use AutoCAD, SketchUp Pro, Adobe Photoshop, and Lightroom for his daily work.*

**Product design:** Industrial designers use CAD software not only to visualize an object but also to understand and confirm how it will function. Tools like Fusion 360, Inventor, or SolidWorks are the most commonly used.

*Example: Grovemade is a company focused on developing high-quality wood products. They use Fusion 360 in their workflow of CAD and CAM tools, making work more efficient.*

**Graphic design:** Professional graphic design also makes use of 2D or 3D CAD software to create visualizations. This kind of software lets designers add effects, typography, shapes, and backgrounds to improve their visuals.

*Example: Matthew Encina is a designer and content creator who uses Adobe Photoshop, Illustrator, and After Effects as his main tools to develop branding and interactive experiences for his clients.*

**Engineering:** Given the many and diverse engineering fields, the types of CAD programs used by engineers is also many and diverse. Some of the most common targets include infrastructure, buildings, circuits, telecommunications networks, thermodynamics, mechanical parts, medical devices, and manufacturing.

*Example: In a complex project made possible thanks to BIM, the Engineering Research Center of Brown University in 2017, the architecture firm Kieran Timberlake, and the company BuroHappold Engineering coordinated design and the construction through Revit models.*

*What is CAD Design [online]. [2020-02-15]. <https://all3dp.com/2/what-is-cad-design-simply-explained/>*

## 2.2 Basic Electronics

Electrons, a component of atoms, and their use—known as electronics—play an important role in many pieces of household equipment. Basic electronics comprises the minimal “electronics components” that make up a part of everyday electronics equipment. These electronic components

include resistors, transistors, capacitors, diodes, inductors and transformers. Powered by a battery, they are designed to work under certain physics laws and principles. Basic electronics also concerns the measurement of voltage, current (electron flow) and resistance in the assembled working "circuit."

## **Principles of Electronics**

All electronics equipment works on a fundamental physics principle known as Ohm's law, which states that a circuit contains a voltage directly proportional to the current and resistance encountered by the current in that circuit. The circuit comprises the electronic components also known as circuit elements, linked with wires to a battery and designed to obey Ohm's law.

## **Power Supply**

The battery produces the voltage and current that drives or powers the electronic components. The electrons flow through wires and are modulated by the arrangement of the electronics components to produce specific results. The voltage is measured in units called volts and the current in units called amperes, or amps.

## **Resistors**

The resistor is a circuit element designed to offer resistance to the flow of electrons called current. In so doing, it produces heat and, in turn, dissipates power—a resistance multiplied by the square of the current. A heating coil is an example of an application of a resistor. Arranged in series, resistors have an additive value (that is, the circuit's total resistance equals the sum of all of the resistors' value). Arranged in parallel, their combined value diminishes. The unit of resistance is the ohm. In practice, we have kilohm and megaohm units.

## **Capacitors**

Capacitors are circuit elements that represent the opposite of resistors: They store electrical power. Their capacity is measured in farads and practical subunits of a farad such as microfarad and picofarad. When arranged in parallel, their combined value increases. When in series, their combined value diminishes. Basic electronics circuits always include some capacitors.

## **Diodes and Transistors**

The diode, a circuit element, encourages current to flow in only one direction. It has two terminals, unlike the transistor—which has three. In the transistor, current can flow in more than one direction. Both diodes and transistors modulate current direction and voltage.

## Inductors, Transformers and RLC Circuit

Basic electronics circuits often include inductors and transformers as circuit elements. An inductor is a coil of wire that produces a desired magnetic field, unlike a capacitor, which produces a desired electric field. When coupled with a resistor and capacitor, an inductor contributes to a special “tuning” circuit, called an RLC circuit, which can be tuned to various frequencies as electric current flows through it. Transformers, another type of circuit element, can step up a voltage or step it down to desired values. All these circuit components make up what is generally called "basic electronics."

## Measuring Instruments

Basic electronics is not complete without mention of the basic instruments used in electronics measurements. These include analog and digital meters that measure voltages, current, resistance and capacitance; power supplies, which provide stable regulated voltage and current; oscilloscopes, which measure circuit waveforms from circuits; and function generators, which provide standard desired waveforms.

*What is Basic Electronics?* [online]. [2020-02-15]. <https://sciencing.com/what-is-basic-electronics-13580662.html>

## 2.3 Arts&Crafts

While CAD designing or electronics are disciplines in which we follow or should follow strict scientific and technological principles the rules are not so strict in the field of arts and craft.

The real art is about stretching or even crossing the existing borders, says Jan Mukařovský, Czech art critic. The only mandatory rule is the safety rule, while lecturing students on creativity. Apart from that, it is always beneficial to use various creativity technics, or just allow students to use their intuition in trying to do things in a different way.

Amongst other methods the SCAMPER technique can be used to inspire innovation. The SCAMPER method was created by Michael Michalko. It is a list of suggestions how to think about a problem, situation, object or a product from different point of view

<b>S</b>	substitute	parts, material, people
<b>C</b>	combine	connect, join, integrate
<b>A</b>	adapt	substitute, change the function, use other parts
<b>M</b>	modify	make smaller, bigger, change the shape or attributes
<b>P</b>	put to another use	other usage, different interpretation
<b>E</b>	eliminate	remove, simplify, reduce
<b>R</b>	reverse	change the order or the production linef

## 2.4 Exercises

### 2.4.1 Collage

<b>Technical skills</b>	<ul style="list-style-type: none"> <li>• Can be used in all three areas (especially 3D printing and crafts) by simply changing the product (while keeping the customers demand)</li> </ul>
<b>Aim</b>	<p>On finishing the activity, the participants will have</p> <ul style="list-style-type: none"> <li>• tested their ability to focus on a customer;</li> <li>• experienced the challenge of completing a group task;</li> <li>• used their creativity.</li> </ul>
<b>Timing</b>	30-60 minutes
<b>Location</b>	FabLab
<b>Resources and materials</b>	<p>Flipchart Markers Workbook Stopwatch</p> <p>For each group: ½ of flipchart sheet Scissors and glue Magazines, advertising leaflets, catalogues (on the trainer's desk) Clippings of fabric, of crepe paper, and of ribbons, paints, brush (on the trainer's desk)</p>
<b>Description</b>	
<p>1) The trainer introduces the exercise along these lines:</p> <p>“You are probably familiar with an art technique called “collage”. What you may or may not know is that this technique is fairly young. It first emerged in the 20<sup>th</sup> century and is connected with the name of Max Ernst, a German artist. Collage has since its inception been used in numerous areas of art, such as music, literature, and film. Photo collage, sometimes called <i>montage</i>, has its own history by now, albeit a short one, as well as a number of applications in video art, advertising, book graphics and other forms of applied arts. The basis of a collage is a cut and assemblage; in our case, gluing various parts of something into a new whole.”</p>	

- 2) The trainer divides the participants into three groups. Each group receives half a flipchart sheet, a pair of scissors and glue. The groups spread around 3 work tables, which are sufficiently far away so that the participants cannot see or hear what the other groups are working on.

- 3) The trainer continues:

Your goal is to create a collage from the materials available (see the table) or from any other materials that you find. **You are preparing the collage for me.** It is up to me to choose the collage that I like best. It will remind me of the time that we spent together in this training. You have 10 minutes to work on your project, but keep in mind that, after that, each group will have 3 minutes to present and offer its collage to me -- your customer. So during the



10 minutes you should also work on a short presentation the aim of which is to impress me so that I select specifically YOUR work. And do not forget that in this time you also must clean up your tables and return all materials to my desk. You can now start working."

- 4) During the time the groups are working on the collage, the trainer walks around, keeps an eye on the time, and gives the groups an opportunity to ask her or him as a customer what her or his preferences are, what an ideal collage would look like in the opinion of the trainer, etc. The idea is to demonstrate orientation towards a customer. The trainer observes which group tends to orient itself towards her or him as a customer – asking about favourite colours, themes, etc. The trainer answers any questions discretely so that the other groups cannot hear the dialogue. The trainer takes notes to be able to later justify the selection of the best piece of work. When the time is up, the trainer prompts the groups to take turns and present their collage. Each group has 3 minutes to make the presentation. The trainer keeps an eye on the time and stops the presentation when the time limit is reached.
- 5) When the presentations are over, the trainer announces the group with the best customer orientation, but does not specify why she or he chose this particular group as the winner. The trainer then asks the participants why they think this group was chosen. He or she then asks a variety of questions leading the participants towards the correct answer – the group was selected based on the best orientation towards the customer, i.e. the trainer.
- 6) The trainer prompts the participants to note in their Workbooks what they gained from this exercise. She or he may then ask a few of the participants to share their ideas with the others. The trainer thanks all for their participation.

<b>Risks and recommendations</b>	Trainees may argue that this was just a game and in the reality, they would behave in a different way. Stress this in the beginning – that we play games to act better in the real life.
<b>Feedback</b>	<p><u>Questions for discussion:</u></p> <ul style="list-style-type: none"> <li>• Did you do anything before you started working on the collage?</li> <li>• Did you take into consideration the needs of the person for whom you were creating the collage?</li> <li>• Did you ask me what I would like, what my idea was?</li> <li>• Did you try to guess what I was like and tailor the collage to my needs?</li> <li>• Did you give me anything extra beyond what I asked for (e.g. that you would frame the collage and come to hang it for me, etc.)?</li> <li>• Did you anticipate my future needs related to the collage?</li> </ul>
<b>Notes</b>	

## 2.4.2 Shopping Trolley Opener

<b>Technical skills</b>	<ul style="list-style-type: none"> <li>Can be used in all three areas (especially 3D printing and crafts) by simply changing the product (while keeping the gamification principle)</li> </ul>
<b>Aim</b>	<p>On finishing the activity, the participants will have</p> <ul style="list-style-type: none"> <li>developed their creativity skills and team work;</li> <li>experience the process from the idea to the first viable product..</li> </ul>
<b>Timing</b>	60 minutes
<b>Location</b>	FabLab
<b>Resources and materials</b>	<p>Flipchart</p> <p>Markers</p> <p>Internet acces</p> <p>Computers</p> <p>3D printers</p>
<b>Description</b>	
<ol style="list-style-type: none"> <li>1) The teacher introduces the exercise along these lines: “Did you notice there are more and more open trolleys in front of supermarkets? Do you know why? Yes, people invented special device how to open the shopping cart without using a coin.”</li> <li>2) If anyone knows such devices, teacher asks him to step aside and be an observer only. The rest of the participants is divided into groups (3-5) and asked to draw their own device that could be able to open the trolley, while not staying inside. No internet is allowed for this stage. (10 minutes)</li> <li>3) Groups present their plans and drawings and discuss about them. Teacher informs them that they are all members of one fictional company, so they are not competing with each other.</li> <li>4) The best solutions are chosen and students are asked to create their own 3D model for 3D printing (depends on the equipment – can be individual or team work.</li> <li>5) One final file is chosen from each team and is sent to printer. The printing is expected to last up to 1 hour, so another activity can take place in the meantime.</li> </ol>	

6) In the end participants go together to test their product to any nearby supermarket.



### Risks and recommendations

If there is not enough time, participants can search the internet, after the original discussion and download some prefabricated files for printing. This should happen after their initial discussion anyway.

### Feedback

#### Questions for discussion:

- How did you work in the group, did you all have a chance to present your idea?
- Was your initial idea different from your final product?
- How could you use the product commercialy?
- What was the most difficult and easiest thing in this excercise?

### Notes

### 2.4.3 Recreating Koala

<b>Technical skills</b>	<ul style="list-style-type: none"> <li>Vector Design - Introduction</li> </ul>
<b>Aim</b>	<p>On finishing the activity, the participants will have</p> <ul style="list-style-type: none"> <li>known the basics of vector design: layers, vectors, shapes, fill and stroke, tracing and exporting;</li> </ul>
<b>Timing</b>	90 minutes
<b>Location</b>	FabLab
<b>Resources and materials</b>	<p>Computer with Vector Design Software – ex: Adobe Illustrator, Corel Draw, Inkscape...</p> <p>Koala Tutorial (seperate file)</p> <p>(in this example, we will be using Adobe Illustrator)</p>
<b>Description</b>	
<ol style="list-style-type: none"> <li>1) The teacher introduces the exercise showing the sample image.</li> <li>2) The teacher could solve the exercise as a tutorial style – following the attached pdf: <i>koala.pdf</i> - or let the students lead the way, depending on their experience with the software.</li> <li>3) The output dont need to be exactly the same – in terms of colors and shape sizes -, but it must be an aproximate match.</li> </ol>	
<b>Risks and recommendations</b>	<p>If it's a group work, some of the students will not use the software, so its recommended that they switch during the exercise.</p>
<b>Feedback</b>	<p><u>Questions for discussion:</u></p> <ul style="list-style-type: none"> <li>Did everyone understood the basic tools?</li> </ul>
<b>Notes</b>	<p><u>Exercise could be shared with a premade project folder.</u></p>

## 2.4.4 Preparing a Design to laser cut and engrave

<b>Technical skills</b>	<ul style="list-style-type: none"> <li>• Vector Design</li> <li>• Laser Cutting Specifications</li> </ul>
<b>Aim</b>	<p>On finishing the activity, the participants will have</p> <ul style="list-style-type: none"> <li>• Understood the basic principles of laser cutter;</li> <li>• Develop skills to adapt any design to laser cut.</li> </ul>
<b>Timing</b>	120 minutes
<b>Location</b>	FabLab
<b>Resources and materials</b>	<p>Computer with Vector Design Software – ex: Adobe Illustrator, Corel Draw, Inkscape... (in this example we will be using Adobe Illustrator)</p> <p>Laser Cutting Machine</p>
<b>Description</b>	
<ol style="list-style-type: none"> <li>1) The teacher introduces the exercise showing the sample design. It could be the output of the first exercise, if not, the design should be given to the students.</li> <li>2) The teacher should explain the choices of shapes, colours and line thickness, so it matches the machine used.</li> <li>3) The teacher could solve the exercise as a tutorial style – following the attached pdf: <i>koala_laser.pdf</i> - or let the students lead the way, depending on their experience with the software and knowledge on the machine specifications.</li> <li>4) The output should be a file that is prepared to lasercut. Choose one of the designs and “print” it on the laser cutter.</li> </ol>	
<b>Risks and recommendations</b>	<p>If it's a group work, some of the students will not use the software, so its recommended that they switch during the exercise.</p> <p>If the FabLab don't have the material to cut – wood, acrylic, etc. -, the teacher should get it beforehand.</p>
<b>Feedback</b>	<p><u>Questions for discussion:</u></p> <ul style="list-style-type: none"> <li>• Did everyone understood the basic tools?</li> <li>• What type of products can we develop in the technology?</li> <li>• How can this technology be usefull to improve learning, entrepreneurship and business?</li> </ul>

**Notes**

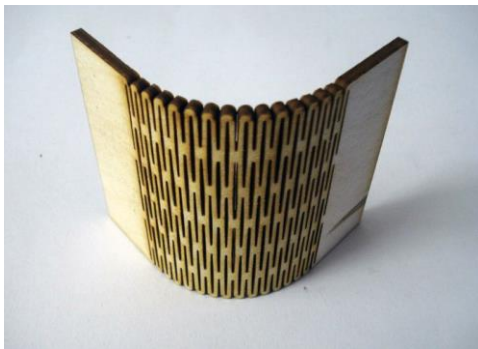
Exercise could be shared with a premade output project folder.

## 2.4.5 Preparing a Design to CNC

<b>Technical skills</b>	<ul style="list-style-type: none"> <li>• Vector Design</li> <li>• CNC Specifications</li> </ul>
<b>Aim</b>	<p>On finishing the activity, the participants will have</p> <ul style="list-style-type: none"> <li>• Understood the basic principles of laser cutter;</li> <li>• Develop skills to adapt any design to CNC Milling.</li> </ul>
<b>Timing</b>	120 minutes
<b>Location</b>	FabLab
<b>Resources and materials</b>	<p>Computer with Vector Design Software – ex: Adobe Illustrator, Corel Draw, Inkscape... (in this example we will be using Adobe Illustrator)</p> <p>CNC Router;</p>
<b>Description</b>	
<ol style="list-style-type: none"> <li>1) The teacher introduces the exercise showing the sample design. It could be the output of the first exercise, if not, the design should be given to the students.</li> <li>2) The teacher should explain the choices of shapes, colours, so it matches the machine used and also the cares to have when doing this: space between shapes considering the tool diameter, how to properly fix the material to the machine table, measuring the material and the tool, etc.</li> <li>3) The teacher could solve the exercise as a tutorial style – following the attached pdf: <i>koala_cnc.pdf</i> - or let the students lead the way, depending on their experience with the software and knowledge on the machine specifications.</li> <li>4) The output should be a file that is prepared to be milled in the CNC router. Choose one of the designs and send it to the machine.</li> </ol>	
<b>Risks and recommendations</b>	<p>If it's a group work, some of the students will not use the software, so its recommended that they switch during the exercise.</p> <p>If the FabLab don't have the material to cut – wood, acrylic, etc. -, the teacher should get it beforehand.</p>
<b>Feedback</b>	<p><u>Questions for discussion:</u></p> <ul style="list-style-type: none"> <li>• Did everyone understood the basic tools?</li> <li>• What type of products can we develop in the technology?</li> <li>• How can this technology be usefull to improve learning, entrepreneurship and business?</li> </ul>


Notes	<u>Exercise could be shared with a premade output project folder.</u>

## 2.4.6 Wood Living Hinge

<b>Technical skills</b>	<ul style="list-style-type: none"> <li>• Vector Design</li> <li>• Laser Cutting</li> </ul>
<b>Aim</b>	<p>On finishing the activity, the participants will have</p> <ul style="list-style-type: none"> <li>• Used advanced laser cutting techniques;</li> <li>• Used advanced vector designing techniques applied to laser cut.</li> </ul>
<b>Timing</b>	120 minutes
<b>Location</b>	FabLab
<b>Resources and materials</b>	<p>Computer with Vector Design Software – ex: Adobe Illustrator, Corel Draw, Inkscape... (in this example we will be using Adobe Illustrator)</p> <p>Laser Cutting Machine;</p>
<b>Description</b>	
<ol style="list-style-type: none"> <li>1) The teacher introduces the exercise showing asking if anyone is familiar with the term “Living Hinge” (see Notes). If not, explain or have the students search the internet.</li> <li>2) The teacher could solve the exercise as a tutorial style, following the attached pdf: <i>living_hinge.pdf</i>, or let the students lead the way, depending on their experience with the software and knowledge on the machine specifications.</li> <li>3) The main focus should be on Pattern Design (vector design software) and Inside Out Cutting (Laser Cutting Machine).</li> <li>4) The output should be a file that is prepared to lasercut. Choose one of the designs and “print” it on the laser cutter.</li> </ol>	
	
<b>Risks and recommendations</b>	<p>If it's a group work, some of the students will not use the software, so its recommended that they switch during the exercise.</p> <p>If the FabLab don't have the material to cut – wood, acrylic, etc. -, the teacher should get it beforehand.</p>
<b>Feedback</b>	<p><u>Questions for discussion:</u></p> <ul style="list-style-type: none"> <li>• Did everyone understood the tools and cutting techniques?</li> </ul>

	<ul style="list-style-type: none"> <li>• What type of products can we develop in the technology?</li> <li>• How can this technology be usefull to improve learning, entrepreneurship and business?</li> </ul>
Notes	<p><u>Living Hinge - laser-cut pattern that allows hardwoods and other non-flexible materials to bend with ease.</u></p> <p><u>Exercise could be shared with a premade output project folder.</u></p>

## 2.4.7 CNC CHAIR

<b>Technical skills</b>	<ul style="list-style-type: none"> <li>• Vector Design</li> <li>• CNC Milling</li> </ul>
<b>Aim</b>	<p>On finishing the activity, the participants will have</p> <ul style="list-style-type: none"> <li>• Known how to better prepare a design no CNC Milling;</li> <li>• Understood a variety of CNC milling techniques.</li> </ul>
<b>Timing</b>	120 minutes
<b>Location</b>	FabLab
<b>Resources and materials</b>	<p>Computer with Vector Design Software – ex: Adobe Illustrator, Corel Draw, Inkscape... (in this example we will be using Adobe Illustrator)</p> <p>CNC Router;</p>
<b>Description</b>	
<ol style="list-style-type: none"> <li>1) The teacher introduces the exercise showing a sample design.</li> <li>2) The teacher should explain the techniques that will be used: Profiling, Milling and Drilling, and also how to change tools, in case the machine doesn't do that automatically.</li> <li>3) The teacher could solve the exercise as a tutorial style – following the attached pdf: <i>cnc_chair.pdf</i> - or let the students lead the way, depending on their experience with the software and knowledge on the machine specifications.</li> <li>4) The output should be a file that is prepared to be milled in the CNC router. Choose one of the designs and send it to the machine.</li> </ol>	
	
<b>Risks and recommendations</b>	<p>If it's a group work, some of the students will not use the software, so its recommended that they switch during the exercise.</p> <p>If the FabLab don't have the material to cut – wood, acrylic, etc. -, the teacher should get it beforehand.</p>
<b>Feedback</b>	<p><u>Questions for discussion:</u></p> <ul style="list-style-type: none"> <li>• Did everyone understood the basic tools?</li> <li>• What type of products can we develop in the technology?</li> </ul>

	<ul style="list-style-type: none"><li>• How can this technology be usefull to improve learning, entrepreneurship and business?</li></ul>
Notes	<u>Exercise could be shared with a premade output project folder.</u>

## 3 HOW TO IMPLEMENT THE EXERCISES WITH VET STUDENTS

With every activity, all the necessary data is provided: aim, timing, resources and material, activity description, and also risks and recommendations. In the feedback section you will find solutions, tips, questions for discussion. All the information is based in practical experience. If the activity has been inspired by external sources, they are quoted.

It is recommended to start and finish the training with the competency test, in which students self-assess themselves in 6 key competencies and 3 key technical skills that are important for their success in the labour market.

The training day for your students must be adjusted according to number of hours available, as well as the technical background (e.g. do you have 3D printer or other necessary equipment).

To help teachers to organize the training, we include the time table of all exercises included, so you can only delete the exercises which you will not deliver or change the order and you have the basic structure of your training ready.

No	Lenght	Mind Skills Activity	Skills	Resources&Preparation
1	30m	Competency Test	14 key competencies	Paper test / PC
2	45-60m	Target Audience	Communication Customer orientation Flexibility Stress resiliency	topics to be used (cards)
3	30m	Can I fill one minute	Communication Stress resiliency	Cards with topics
4	30-45m	Pacific Railroad	Communication Problem solving Stress resiliency	Pacific Railroad Worksheet – Group Instructions; Pacific Railroad Worksheet – Information Set; pens, paper, scissors
5	45-90m	One's Own Boss at Last	Communication Planning and organising Customer orientation	Flipchart sheet (one per group), worksheet: Business plan (each group; if advisable, for every individual), sticky tape and highlighters for each group, chronometer (mandatory; e.g., kitchen timer)
6	45m	Alphabet Box	Communication Flexibility	Alphabet Box Worksheet, inspirational suggestions for teachers, stopwatch,

				flipchart with Alphabet Box table, set of colour paper cards, highlighter, paper glue
7	45m+	Challenges and Bets	Communication Customer orientation Stress resiliency	Poster with bets; chart with student names; paper and pens for competitors; tools and materials as specified
	270m+	Total for MIND SKILLS		

No	Lenght	Hand Skills Activity	Skills	Resources&Preparation
1	30-60m	Collage	Arts&Crafts (in the default version), 3D printing or any other technical skill – if adjusted	For each group: ½ of flipchart sheet Scissors and glue Magazines, advertising leaflets, catalogues (on the trainer's desk) Clippings of fabric, of crepe paper, and of ribbons, paints, brush (on the trainer's desk)
2	60+ m	Shopping Trolley Opener	3D printing	Flipchart Markers Internet acces Computers 3D printers
3	90m	Recreating Koala	Vector Design - Introduction	Computer with Vector Design Software – ex: Adobe Illustrator, Corel Draw, Inkscape... Koala Tutorial (seperate file) Adobe Illustrator
4	120m	Preparing a Design to laser cut and engrave	Vector Design Laser Cutting Specifications	Computer with Vector Design Software – ex: Adobe Illustrator, Corel Draw, Inkscape... (in this example we will be using Adobe Illustrator) Laser Cutting Machine

5	120m	Preparing a Design to CNC	Vector Design CNC Specifications	Computer with Vector Design Software – ex: Adobe Illustrator, Corel Draw, Inkscape...  Adobe Illustrator  CNC Router
6	120m	Wood Living Hinge	Vector Design Laser Cutting	Computer with Vector Design Software – ex: Adobe Illustrator, Corel Draw, Inkscape...  Adobe Illustrator  Laser Cutting Machine;
7	120m	CNC Chair	Vector Design CNC Milling	Computer with Vector Design Software – ex: Adobe Illustrator, Corel Draw, Inkscape...  Adobe Illustrator  CNC Router



**Make  
your  
way**