Industry 4.0 awareness session for 14-20 years old
Instructions for teachers

What is Industry 4.0?

Industry 4.0 is the name given to the fourth industrial revolution. See below the evolution of the sector over the past three centuries:

- The first industrial revolution (1765) began with the invention of steam engines and enabled **mechanical production** (whereas before the energy was coming directly from men and animal effort).
  Examples:
  - Steam boats
  - Steam trains
- The second industrial revolution (1870) spurred by electric and petrol energy along with the division of labour brought mechanical production to a new level in term of quantities allowing the rise of **mass production**.
  Examples:
  - Ford T
  - Charlie Chaplin in *Modern Times*
- The third industrial revolution (1969) was supported by the development of electronics and computing and gave birth to **automated production** meaning that workers need less and less to be directly involved in operational tasks.

- Example:
  - Robots
- The fourth industrial revolution (happening now) is emerging thanks to new technologies such as big data, artificial intelligence, the internet of things and the cloud. Such technologies contribute to the development of **autonomous production**. Workers need less and less to deal with supervision tasks as machines are more and more able to adjust their parameters themselves if required (demand changes, etc.). This is why we talk now of **smart factories**.

Why promote the manufacturing sector and Industry 4.0 in front of young minds?

Manufacturing is an essential industry for our quality of life

First of all, it's worth pointing out that manufacturing is *everywhere* in our daily lives as it produces everything around us, from tables, clothes, books to ping-pong rackets, robots and cars.

Despite the current trend of reusing/repairing, buying second hand and turn to more local and handcrafted goods, this will not make manufacturing disappear but rather push the sector to adapt as we can see now with the willingness to use more recycled materials and build more personalised products.

The manufacturing industry needs to be more sustainable

The industry is the number one emitter of greenhouse gases (more than one third or all greenhouse gases) and is thus a major polluter. There is no question that manufacturing has to find ways to reduce its carbon footprint.

The current status would mean an acceleration of climate change, the deterioration of our environment and therefore of our quality of life.

The manufacturing industry needs to be more diverse

Only 21% of scientists and engineers in manufacturing in the European Union are female. Overall, the proportion of women employees in the field does not exceed 30%.

This is an issue. As the American Association of University Women points out: increasing the representation of women will "enhance women's economic security and ensure a diverse and talented STEM workforce and prevent biases in these fields and the products and services they produce".

The manufacturing industry needs people!

There are currently many advantages in working in the manufacturing industry: the pay is good and comes with benefits, you can work with new technologies, you have job stability and you can take pride in making something real, helpful for people and organisations.

However, a study from 2018 predicted that more than 8 million manufacturing jobs worldwide could be unfilled in 2030 and only a tiny 5% of manufacturing executives are confident in their ability to acquire the talent needed.

The current labour shortage can slow down the necessary transition that manufacturing has to operate as well as cause delays in deliveries and potentially more workplace injuries and also affect product liability.

Escape Room about Industry 4.0. How does it work?

FEATURES

- Target audience: Students between 14 and 18 years old.
- Location: Designed to be played in the educational centre with a video call option.
- Type: Virtual Cooperative Escape Room.
- Duration: 40 minutes.
- Languages: English.
- Team size: 3 participants.
- Platform: Large screen devices: PC and Tablet.
- Technology: Web App (played through the web browser)
- Theme: Fantasy
- Hint system: Integrated (on player request).
- 100% autonomous game

OBJECTIVES

Acquisition of Knowledge

In addition to the fun that should characterise all gamified activities, this game seeks to be a first point of contact with the characteristics that define industry 4.0 as well as the processes and technologies involved. Specifically, the following objectives will be pursued:

Understand what industry 4.0 is and its most notable features:

- Discover the offerings of industry 4.0
- Understand the challenges faced by industry 4.0
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- Know the most relevant technologies in industry 4.0
- To fully understand the contents, the participants must complete a set of complementary activities that are outside the scope of this document.
- Development of skills
- It is necessary for participants to work and develop the following Soft Skills during the game.
- Time management
- Teamwork.
- Leadership
- Critical thinking and Problem solving
- Negotiation

As far as possible, the following skills will also be worked on:

- Initiative
- Analytical ability
- Familiarisation with new technologies
- Interest in learning new technologies

PREPARATION

Players must organise themselves into teams of exactly 3 members and connect to the website where the game will be hosted, each with a different device.

On this screen, they will see the game instructions and 3 buttons to start playing. Each player must access using a different button, as the information displayed in the game will be different depending on the button used to access, and information from the 3 options will be necessary to progress in the game.

GAME

Players must communicate what they see on their screen to their teammates (physically or through a video call) to gather all the information and solve the different puzzles that will be posed before time runs out.

When a teammate discovers the key to moving on to the next challenge, they must communicate it to the rest of the team so that they can also enter it on their screens.

If during the activity the teams get stuck on a challenge, the game will have a hint system that they can consult to continue.

If time runs out, the game will display an alert indicating that time has run out, but will allow you to continue playing normally.

CLOSING AND REFLECTION

When the team meets the goal, a congratulations video will be displayed with a message that allows reflection on the game experience and the learning achieved.

How to lead the session?

Basic information

Number of pupils: Up to 25
Duration of the session: 1:30
Structure:
1- Presentation of Industry 4.0 and the related stakes (45 minutes)
2- Virtual escape room (45 minutes)

Presentation of Industry 4.0 and the related stakes

Outline of the presentation:

1. Manufacturing is an essential aspect of our lives (**Factories & us**)
2. …That has evolved a lot in the past three centuries (**A brief history of manufacturing**)
3. …But manufacturing is also facing huge challenges
4. …That can be solved with the use of new technologies

Virtual escape room

HOW TO PLAY THE GAME AND CLUES

INTRO VIDEO	CLUES
(1) *Agent, the Time Guardians need you!* *Our secret organisation has been protecting humanity from the threats that have come from parallel universes for millions of years.* *Today, a time portal opened.* *Someone is trying to send us a message from the future.* *Your mission is to crack the message in less than 40 minutes. Otherwise, the energy of the portal will run out and it will close forever.* *Hurry up! The information could be vital to save our planet once again!*	1: Looks like the portal is trying to send us a message. 2: Only player 3 can see how the portal shines. Maybe the key is the way it shines. Solution: Player 3 must inform the other players on the way the portal shines. Short flashes correspond to dots. Long flashes correspond to lines. You must associate the way it shines with the letters of players 1 and 2 to find the keyword "SOS".
(2) *Great work agents!!* *We have been able to decode the first part of the message. But, the mission is not yet completed. Hurry up because the Time Guardians are running out of time. To crack the rest of the message, we need to build a quantum decoder in record time.* *The first thing we need to do is to prepare the production line using all the technology available today thanks to the progress of Industry 4.0 and working as a team.* *No time to waste!*	1: Mark only the 9 most efficient, productive and sustainable technologies. You can see the efficiency, productivity and sustainability of each technology by placing the cursor over it. If you can't see them, maybe any other teammate can! 2: Start by marking only the 3 technologies whose indexes of efficiency, productivity and sustainability sum up exactly the value indicated at the top of your screens. From there, you must discover the other 6… Which ones could they be? Solution: Each one of you must mark the 3 technologies that enable you to obtain the exact value of efficiency,

	productivity and sustainability that you can see at the top of your screen. Player 1: Digital Twin, AI & Machine learning, Additive manufacturing Player 2: IoT, Cloud, Collaborative robotics Player 3: Big data, Cybersecurity, Augmented Reality. Then, the colour of the indexes will change to green. Once all the indexes are green, indicate the 3 technologies that you have marked until all of you have 9 technologies marked and the keyword "Industry 4.0" is displayed.
(3) *Impressive!* *Now that we have the production line ready, we need to use the "Digital Twin" technology to discover which decoder is compatible with the portal emitting the signal. This way, we will avoid wasting time building decoders that we don't know whether they will be of any use.* *Speed up agents, find the compatible decoder right now!*	1: You can rotate the components by dragging the mouse to explore all their details. 2: Each one of you must select the appropriate component. Solution: Make sure the component you have selected is exactly the same as the objective decoder. Once you have selected them all, match the texts displayed above the component to obtain the keyword "Digital Twin".
(4) *Good job agents!* *You have discovered the design of the decoder, but before building it, we need you to develop the software capable of reading the signal of our hadron nanochip. There is no time to do it manually, so you need to use "Machine Learning" technology to help the system learn, indicating the correct*	1: It looks like the entry signal is coded. We need to find a way to decode it. 2: Decipher the entry code using the different equivalences on your screens. Each one of you has a fragment of the equivalences so… you must communicate!

answer to each input signal. This way, our artificial intelligence will learn how to crack signals and will be able to find the way to decode the signal of the portal. *Time is running out! The portal is closing!*	Solution: Use the equivalences on the left-hand side of your screens to decode the message and find the keyword "Innovation" V = I A = N A = N B = O I = V N = A G = T V = I B = O A = N Solution bis: Use the equivalences on the left-hand side of your screens to decode the message and find the keyword "Technology" ** Equivalences in freemason**
(5) *Amazing work agents!!* *Our artificial intelligence has learned how to decode encrypted signals and has used its knowledge to develop the software we need for our portal.* *Time to start manufacturing!* *Thanks to the additive manufacturing technology of our 3D printers, we will have it ready in no time. We should analyse the data we are monitoring in real-time to make sure everything works to be able to solve the issues. Otherwise we will have to start the process all over again.*	1: Solve the errors that our 3D printer is experiencing. 2: Only one of you can see how to solve each error 3: Press the buttons in the order of the error arrows that the printer is showing to obtain the keyword "Real time" Error 241 = < > v ^ Error xxx = < > v ^ Error xxx = < > v ^

This is the last step! One last effort and we will complete our mission!	

(6)

Mission Accomplished!

Thanks to the industry 4.0 technologies, you have been able to manufacture the decoder in record time.

Just a few years ago, it would have been unthinkable to design and build a totally custom device in such a short time, but today we have the tools needed to take our species to a new stage of unprecedented industrialisation.

By optimising waste management, we are able to produce for the greatest number of people while ensuring we have a cleaner planet.

We are taking the efficiency and the sustainability of our production capacities to levels we would have never imagined.

Ensuring a fairer society with better opportunities for all.

Agents, it is time to decode the signal of the portal.

I am Ariel Wallace, and I'm sending this message from the future for you to avoid a catastrophe.

At the moment I'm speaking, machines have taken control of all of our vital spaces and they now dominate the world. We have regressed to a state of pseudo species that are not allowed to have feelings or express their emotions, condemned to work tirelessly in order to maintain the machines.

The fever for more productivity that was characteristic to your era has reached a limit , devastating our planet and destroying our species and rights.

You still have time to change our destiny. You need to establish solid ethical criteria and keep developing the technology that enables our species to evolve, but always respecting the code of values that makes us human.

Paying special attention to vulnerable groups. Respecting our fundamental rights.

But above all… Guaranteeing our freedom.

Now, the future of humankind is in your hands