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IO2-A2: DUAL EDUCATIONAL PACK

CROSS CURRICULAR SCENARIO 1

3D2ACT:

FOSTERING INDUSTRY 4.0 AND 3D TECHNOLOGIES THROUGH SOCIAL ENTREPRENEURSHIP: AN INNOVATIVE PROGRAMME FOR A SUSTAINABLE FUTURE

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PROJECT INFORMATION

PROJECT ACRONYM:

3D2ACT

PROJECT TITLE:

FOSTERING INDUSTRY 4.0 AND 3D TECHNOLOGIES THROUGH SOCIALENTREPRENEURSHIP: AN INNOVATIVE PROGRAMME FOR A SUSTAINABLE FUTURE

PROJECT NUMBER:

2020-1-EL01-KA202-078957

WEBSITE:

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Real Life Social Entrepreneurial Opportunities for Applying 3D-P Education

Cross-Curricular Scenario 1

MANUFACTURING CAR COMPONENTS WITH 3D PRINTING

Introduction

According to experts, social entrepreneurship is a type of entrepreneurship where entrepreneurs try to create a business dedicated to solving social, cultural, or environmental issues, possibly taking greater financial risks than usual. This practice aims to resolve issues that the traditional approach has failed in the social market and to create opportunities for systematic addition of social value, through innovative methods. In other words, it involves running a business to benefit society and not just to maximize individual profits.

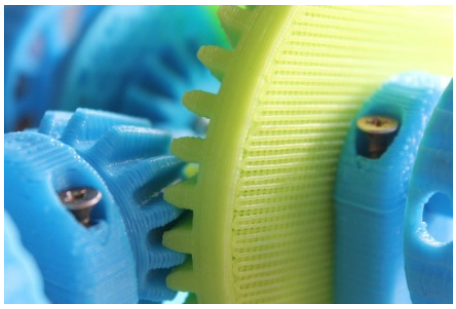
How can we create such an opportunity to systematically promote a social value, such as strengthening environmental protection or strengthening actions against climate change? Could this idea become profitable within a business, but always maintain the priority of positive social impact?

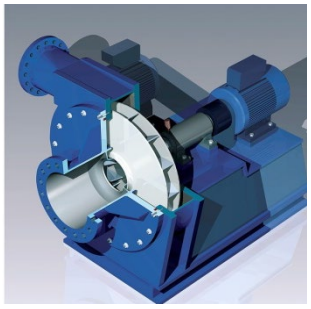
The need

Climate change as a problem is the change of the global climate and in particular of the meteorological conditions that extend over a large scale and that are due to human activities with an impact on the climate. In recent years, due to the over-consumption of primary sector products, the reckless over-consumption of natural resources, and the increase of the earth's population, the natural environment has deteriorated, resulting in an imbalance between the

countries of the developed and developing world. Most countries in the world, through international organizations, have already agreed and started working to de-escalate climate change and restore **climate justice** as much as possible.

Under this aspect, we are considering in the **automotive sector** alternative ways of creating components for vehicles, to reduce the negative emissions during their production. So, we are called to find out **how 3D printing could help in the manufacture of such components so that the whole process is more environmentally friendly**. Which or what car items/parts could be produced with 3D printing and thus contribute to the reduction of emissions and negative impacts on the planet?





Key terms

| 3D design/printing | Social entrepreneurship | Climate change problem | Social impact | Automotive sector |

Objectives and Expected Learning outcomes

- *To stimulate the interest of students from different areas of vocational education.*
- *Students to gain social empathy for climate change.*
- *Students to work up as a team and promote a collaborative approach in finding acceptable solutions.*
- *Students to learn to categorize and evaluate the above solutions.*
- *The collection of necessary data and the design of the solution (in 3D printing design) to meet the needs of automotive production.*
- *To identify business opportunities, by analyzing market needs.*

Prerequisites

- *Basic knowledge of pre-mentioned guided lesson plans in 3D printing*
- *Basic IT knowledge*
- *Basic knowledge of automotive mechanics*
- *Basic knowledge of economics and analyzing business models*

Time distribution - Estimated Delivery

The duration of this open-ended challenge-based scenario can vary depending on the depth of approach by students and teachers. For example, in the case of implementation of a simple prototype, it can be about 4-6 weeks from 2-4 hours per week, or for something more complex it can take an entire semester. In any case, this could be best estimated during the *Milestone-3* phase.

Modes of Interaction

This challenge-based scenario provides the opportunity for teachers and students from different areas of vocational education to get involved.

For example, areas such as **Car Engineers** have a direct connection, since the script negotiates issues related to their subject. Also, **Management/Economics** is an area that can play an important role in the scenario, since the whole process will eventually have to evolve into a business model suitable for the needs of the market. The **IT** sector can also be involved in the script, helping with the whole process with the part that involves collecting useful information, designing software for a 3D printer, and completing and presenting the final project. But also, this scenario can be a pole of attraction for teachers or students with an interest in **Mathematics** or **Physics** or simply in innovative ideas!

Students from different sectors of vocational education can work in groups of 2 - 4 persons. The way of interaction in this scenario is direct, promoting cooperation and exchange of information between the involved groups.

Guidelines - Milestones

To help you in this process, we provide you with some steps you can follow to carry out your project. The parentheses refer to the estimated time that may be required in each implementation phase, having in mind the implementation of a simple object of a vehicle, such as an **interior mirror**.

Milestone 1 - (est. 2 hours)

Get familiar with the problem of climate change and the actions that countries around the world have agreed to take.

> *Hint: Use Wikipedia or any other official source to help students understand the climate change problem and the actions that countries around the world have agreed to take. How these actions will affect our lives and our future?*

Milestone 2 - (est. 4 hours)

Consider of the challenge in the automotive sector. How a typical car industry is involved in the climate change problem? Are negative emissions produced? Can we use 3D printing to gain a more positive impact on environmental protection? Bring up ideas or proposed solutions in which certain car parts can be 3d printed.

> *Hint: Students use brainstorming method to identify possible solutions. All ideas are listed and categorized. (e.g. internal car parts such as internal mirror, external car parts such as door handles, engine's parts such as the exhauster system, a compressor, etc.). Each solution is evaluated and clear arguments are produced to conclude to the one that it is more efficient to implement.*

Milestone 3 - (est. 8 hours)

Having concluded on an efficient solution, students are divided in 4 teams with at least 2 teachers to support them.

Team-1: The first team will focus on the preparation of a prototype under these aspects:

- Sketching/drawing of the prototype on paper
- Description of the operation of the specific car part
- Identification of parts of which the prototype consists
- General dimensions

Hint: Students must verify each of the above steps taking into account the final produced item.

Team-2: The second team will deal with the computing requirements and equipment that will be used in this scenario. For example:

- List of hardware requirements
- List of software requirements
- Description and study of the operation of a 3D printer

Hint: Students can search the Internet to find out what software they will use for 3D design (TinkerCAD, OnShape, etc.) and justify their preference.

Team-3: The third team will focus on the analysis of the business model based on the idea of the prototype and how this process is involved in the production phase. For example:

- Design of the business model
- Analyze the production line
- Identify prototype's involvement

Hint: Students can use real or non-real (hypothetical) data to implement the above guidelines.

Team-4: The fourth team can focus on the study and recording of climatic effects from the traditional production method. For example:

- Calculate the negative emissions at the production phase
- Summarize the results in charts
- List of negative consequences on the global climate

Milestone 4 - (est. 4 hours)

Students under their teacher's guideline proceed in the optimization of all prepared material (the prototype, IT requirements, business model analysis, and Climate effects).

Team-1: Correction/Finalization of the prototype.

Team-2: Reviewing of the computing requirements and equipment that will be used in this scenario. Identify resources and which 3D design software will be used.

Team-3: Correction and finalization of the business model based on the idea of the prototype.

Team-4: Report on findings.

Milestone 5 - (est. 8-10 hours for Team-1 & Team-2 and 4 hours for Team-3 & Team-4)

Implementation of Prototype's 3D design for 3D printer.

Team-1 & Team-2: Implementation of Prototype's 3D design in the chosen 3D software.

Team-3: Investigation of alternative production methods in the business model, including the new prototype-based approach for 3D printer.

Team-4: Study to capture the data that will highlight the usefulness of the production of the prototype concerning the problem of climate change.

Milestone 6 - (est. 2-4 hours)

Team-1 & Team-2: Correction and printing of the final design.

Milestone 7 - (est. 4 hours)

Team-1 & Team-2 will focus on the preparation of the technical documentation. For example:

- List of materials
- List of parts / commercial items
- Assembly plans and exploded view
- Assembly Manual
- Manufacturing processes + process sheets + instruction phases

Milestone 8 - (est. 4 hours - All teams)

Presentation of the final product. Each team will make a presentation mentioning the steps they followed until the completion of the project, providing as well photos from each stage and relevant data-tables.

Reflection & Feedback

To get valuable feedback on this scenario, we can implement a brief questionnaire, the answers to which will be a topic of discussion with students. The final evaluation must be correlated to the degree of students' satisfaction with the results of the project, in combination with their initial assessments.

Indicative Questionnaire

1. *In which team did you participate?*

   ○ *Team-1* ○ *Team-2* ○ *Team-3* ○ *Team-4*

2. *Do you think that this scenario enhanced your knowledge and skills?*

   ○ *Definitely* ○ *In most cases* ○ *Not sure* ○ *Not at all*

3. *Do you think that this scenario met your personal motivations/criteria?*

   ○ *Definitely* ○ *In most cases* ○ *Not sure* ○ *Not at all*

4. *Was there enough time to fulfill your goals?*

   ○ *Yes* ○ *No, I needed more time*

5. *What problems did you face and how did you overcome them?*

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6. *What did you like most?*

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7. *What did you like least?*

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8. *What would you suggest for the optimization of the scenario and the process of its implementation?*

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9. *What would you like to be your next goal?*

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Expansion

This educational scenario can easily be the basis for expanding the educational process, as it is oriented towards principles and techniques that promote the dynamic development of the student. In particular these techniques:

Allow choice: Students gain the flexibility to choose both the main topic to be dealt with and the approach they will seek to achieve this goal.

Promote research: Students rely on the know-understand-research model to build the knowledge base on which they will work.

Promote collaboration: Through the teams that are created, collaboration is promoted and bilateral channels of communication are created.

Use of technology: Through IT tools and 3D printers, students learn or even deepen their skills on new technologies.

Teach creativity: Students are asked to tackle key issues such as environmental protection and finding alternative forms of production.

Encourage self-assessment: Through feedback and assessment practices, students have the opportunity to assess what they have learned and what they have gained from the script implementation process.