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IO2-A2: DUAL EDUCATIONAL PACK

CROSS CURRICULAR SCENARIO 3

3D2ACT:

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

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PROJECT INFORMATION

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3D2ACT

PROJECT TITLE:

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

PROJECT NUMBER:

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WEBSITE:

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

Cross-curricular scenario 3

MANUFACTURING CUSTOMISED GLOVES FOR PEOPLE WITH MOBILITY RESTRICTIONS IN THE WORLD OF SPORTS

Introduction

Almost 20% of the world population suffers from some type of disability. These can be physical, psychosocial, cognitive or sensory. Unfortunately, no one is exempt from suffering from any of them during their life. For example, physical disabilities can be caused by genetic reasons (during pregnancy) or caused by problems during childbirth, accidents and/or diseases that arise throughout life.

Taking into account this social reality, are we prepared to suffer from some type of functional diversity? In the same way, are cities, homes, public spaces and companies accessible to all people, promoting equality, autonomy and social inclusion for all of us? If we want to continue living our life, is the world of sports prepared for it? Is the material prepared for it? Is it customized?

The need

Higinio suffered an accident while climbing, which led to serious spinal injuries, having to be bedridden in the hospital for three months and undergoing rehabilitation for a year. Yet he has no mobility from the waist down. This injury has not stopped him from continuing to enjoy nature. He currently practices canoeing and was proclaimed world champion in 2016 and 2017. Currently, due to the situation in which we live because of Covid-19, and also to mobility restrictions and to not being able to train, he decided to do triathlons. **However, the equipment he has is not adapted to his needs.**

In order to practice the adapted triathlon, special gloves are used that serve to propel the chair. They are very standard and very expensive gloves, which do not adapt to the hands and needs of the users. Higinio is one of them.

Aware of this situation, we want to provide Higinio with a solution for the costumised gloves and taking into account that the protagonist is the user, solidarity and you.

We intend you to open our eyes to a reality unknown to many and much suffered by others. In the same way, realizing that our effort, awareness and capabilities can help improve the lives of many people.

Thanks to the abilities acquired with the Dual Educational Pack to design solutions to industrial problems, it is desired to carry out a collaborative project where technical and human aspects will be worked on, in order to learn by helping.

Key Terms

| 3D design/printing | Social entrepreneurship | Social impact | Assisting physical functions |

Objectives and expected learning outcomes

- *To stimulate the interest of students from different areas of vocational education.*
- *Students to gain social empathy for people suffering from serious injuries.*
- *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 the ones suffering from spinal injuries and still wanting to practice sports.*
- *To identify business opportunities, by analysing market needs.*

Prerequisites

- *Basic knowledge of pre-mentioned guided lesson plans in 3D printing*
- *Basic IT knowledge*
- *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.

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 Manufacturing Design have a direct connection, since students should be able to design the prototype starting from scratch. Also, **Management/Economics/Marketing** 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 **Medical or Health Training** 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 focus is the design and creation of **customized gloves**.

Milestone 1 - (est. 2 hours)

Get familiar with the problem of those suffering from spinal injuries and the different needs they might have. Focus on those who are still competing in sports and their adapted materials.

> *Hint: Ask the students to research on real life cases of people with no mobility from the waist down and how they are still practicing sports. How has this affected their lives and their future?*

Milestone 2 - (est. 4 hours)

Consider the challenge in the production section. How are mechanical designers involved in the manufacturing of these special tools? Can we use 3D printing to gain a more positive impact on the production of the tools to meet their needs? Bring up ideas or proposed solutions in which certain objects can be produced for people suffering from spinal injuries.

> *Hint: Students use brainstorming method to identify possible solutions. All ideas are listed and categorized. (e.g. customized gloves, especial parts for wheel chairs, 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 tool

- 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 of the different tools/objects produced from people with the special need identified. For example:

- Research on already produced object for the development of sports in people with no mobility from the waist down
- Summarize the results in charts in terms of their utility
- List of products that haven't proved to be useful

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).

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 need of those continuing practicing sports despite having spinal injuries.

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 optimisation 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 issues, which might help the ones who suffer from spinal injuries but are still willing to practice sports and compete.

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.