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IO2-A2: DUAL EDUCATIONAL PACK

CROSS CURRICULAR SCENARIO 2

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 SOCIAL ENTREPRENEURSHIP: AN INNOVATIVE PROGRAMME FOR A SUSTAINABLE FUTURE

PROJECT NUMBER:

2020-1-EL01-KA202-078957

WEBSITE:

https://3d2act.eu/

CONSORTIUM: PARTNER LIST

- **NATIONAL CENTER FOR SCIENTIFIC RESEARCH "DEMOKRITOS" (GREECE)**
- **EUROPEAN DIGITAL LEARNING NETWORK** (Italy)
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- **STICHTING INCUBATOR** (Netherlands)
- **REGIONAL DIRECTORATE EDUCATION OF CRETE** (Greece)
- **UNIVERSITY OF CRETE** (Greece)

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

Cross-curricular scenario 2

MANUFACTURING ASSISTING TOOLS FOR PEOPLE WITH WEAKENED HAND MUSCLES WITH 3D PRINTING

Introduction

As we get older our muscular functioning most of the time gets worse and simple activities like writing with a pen or opening a bottle can get very frustrating. This decreases the quality of lives of the elderly, but also the lives of younger people who suffer from muscular dysfunctionalities. They keep struggling with the not only the bigger issues, but also with activities, which are very simple for the rest of the people and thus, built in in a specific way, like typing on a keyboard.

In order to somehow make the lives of the people with worsened muscular functioning easier, there should be a solution created. This solution should be easy to use and should be convenient to carry when traveling for example. Also, it should be designed in a way that it can be reusable, considering the environmental footprint.

A can opener for someone with worsened muscular functioning (Halterman, T.E., 2015)

A tool to type on a key board without using (much) muscle strength (Halterman, T.E., 2015)

The need

Penny is over 80 years old, but that does not hold her motivation back to write letters to her long-time pen pal Mary. They have written each other for years, but recently **Penny is experiencing great difficulty writing, because her hand muscles are as strong as they have been**. She has tried several options to make writing easier, like writing slower or holding the pen in a different way, but nothing really worked.

The main question is here, how to help Penny to make sure she enjoys writing again to make her life easier, as she also has difficulties opening bottles, due to the same cause. There are probably more (elderly) people that struggle with the same situation as Penny, so how can she be helped by using 3D printing technologies? With the obtained knowledge from the Dual Educational Pack, you can work on this project where technical and human aspects are present.


Inspirational images to create a 3D printed pen tool (Shapeways, 2022).

Key terms

| 3D design/printing **|** Social entrepreneurship **|** Climate change problem **|** 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 physical challenges of the elderly people and the ones who experience discomfort, because of muscular dysfunctionalities overall.*
- *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 muscular dysfunctionalities in their hands.*
- *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 the main issue*
- *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. Taking 2-4 hours per week, it will probably take 4-6 weeks before the end product is created.

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 **Public Health and Vocational Medical Training** 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 social business model suitable for the social needs of the market. The **IT** sector can also be involved in the script, helping with the whole process regarding the software for a 3D printer, printing and having a final creation. This scenario could be also interesting for teachers or students with a high interest/expertise in **Mathematics** or **Geometrics**.

When having VET students from these different disciplines, it is best to split them into groups of 2-4, keeping in mind that in each group every discipline is represented. There should be at least 2 teachers present to guide the students and the teachers should be preferably from 2 different disciplines.

Guidelines - Milestones

Below, there are some steps presented that will guideline through the whole process of students working on the challenge. The main focus is on the **assisting pen tool** (see the 4th page), but there could be different other solutions created to ease the lives of the ones with weakened hand muscles, like a can opener on page 3.

Milestone 1 - (est. 2 hours)

Get familiar with the problem hand muscle weakness that often older people experience, but also young people who have to deal with arthritis of the hand for example.

> *Hint: Use Google to read about the problem, with the searching topics like **hand muscle weakness** or **arthritis of the hand**. How do these issues affect the ones suffering from it? What do their daily lives look like? How do they face the simple tasks, like putting on clothes?*

Milestone 2 - (est. 2 hours)

Look at the problem from the perspective of the medical sector. How would the solution contribute to the medical sector? Can we use 3D printing to provide some tools to create more comfort to those suffering from weakened hand muscles? Of course, the idea can be based on the assisting pen tool as presented on page 4, but there can be different ideas opted in order to make the quality of life better for those who have to deal with the issue.

> *Hint: Students brainstorm about the possible solutions to use for their 3D printing design and creation. All ideas are to be evaluated, also for different uses, like a solution to open a bottle or to open a can. There will be a democratic way to choose the best idea, based on the collected and listed arguments for each idea.*

Milestone 3 - (est. 8 hours)

After choosing the best solution, students should be divided in teams per preferably 4 students, with at least 2 teachers from different disciplines 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 chosen idea for a 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 social business model based on the idea of the prototype and how this process is involved in the production phase. For example:

- Design of the social business model
- Analysis of the production line
- Identification of prototype's involvement

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

Team-4: The fourth team can focus on the positive effects, which should be measured after the use of the tool. For example:

- Research on all the negative effects that the ones with weakened hand muscles have to face, before the existence of the tool
- Summarize the positive results that will arise from the use of the tool
- List of how the ones facing the issue will keep on living and the negative effects without the tool on the long term

Milestone 4 - (est. 4 hours)

Students under their teachers' guideline proceed in the optimization of all prepared material (the prototype, IT requirements, business model analysis, and quality of live improvement).

Team-1: Correction/Finalisation 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 finalisation of the social 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 physical discomfort.

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, students could be presented with a questionnaire, to learn how to improve on the scenario and its progress. 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 hand muscle weakness to perform daily tasks.

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.

Sources

Halterman, T.E. (2015). *Amplifying the Power of the Elderly with 3D Printed Assistive Technologies.* Retrieved on 28 February 2022 from https://3dprint.com/85424/3d-printed-assistive-devices/

Shapeways. (2022). *Writing Assist Tool (for the right hand).* Retrieved on 28 February 2022 from https://www.shapeways.com/product/2VT9VD92B/writing-assist-tool-for-the-right-hand?li=shareProduct

Shapeways. (2022). *Developing 3D Printed Assistive Tools for The Elderly.* Retrieved on 28 February 2022 from https://www.shapeways.com/product/2VT9VD92B/writing-assist-tool-for-the-right-hand?li=shareProduct