SDG12 Future of Innovation and Enterprise
MM5: Introduction to Engineering for Good

Micro-Module 5: Introduction to Engineering for Good

Exploration and Experimentation

Lesson 8: 3D Printing 1

Subjects: Applied Technology, Climate Action and Sustainable Development, Digital Literacy, Technology

Lesson Title and Summary: 3D Printing 1

3D printing is a process of creating three-dimensional objects by layering materials on top of each other. Unlike traditional manufacturing processes, where material is removed to create a final product, 3D printing builds up an object layer by layer from digital models. Learners will discover the scope that 3D Printing can offer to helping with everyday life and more complex global challenges.

Vocabulary: 3D Printing, Manufacturing, Application

In this lesson, the learner will...

- develop their understanding of 3D printing
- develop their understanding of how 3D printing relates to traditional manufacturing processes
- examine potential applications for 3D printing to tackle SDG-related problems

Materials:

- Video: What Is 3D Printing and How Does It Work? | Mashable Explains
- Teachers' Guide
- Access to the Internet
- Notebooks
- Pen/Pencil

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Activity Instructions

Activity 1: What is 3D Printing? (10min)

1. Elicit ideas of what 3D printing is.
2. Watch Video: What Is 3D Printing and How Does It Work? | Mashable Explains [2:21min]. See Media box.

Activity 2: What can you use 3D printing for in your everyday life? (15min)

1. Learners break into groups or 2 or 3 to discuss potential uses for 3D printing in their everyday life. Prompts include:

- What could you use it for in the kitchen, shed, etc.?
- What small problems do you face every day at home?
- What would you make for yourself?
- What would you make for your parents, family, friends etc.?

2. Share ideas as a whole class and create a collaborative list on the board. See Teachers' Guide.

Activity 3: How can 3D printing help solve global challenges? (25min)

1. Come up with a class list of global challenges. Aim for a minimum of five and maximum of ten ideas.
2. In pairs, ask learners to find out how 3D printing is or can help solve one of the global challenges on the list. Give 10 minutes.
3. As a whole class, or in small groups share potential 3D printing-solutions to the list of global challenges.

Reflective Exercise: 3-2-1 (10 mins)

- Three things they feel they have learnt from the tasks
- Two things they found most interesting and would like to explore more
- One opinion they have about the tasks

Use Post-its or a mentimeter survey - www.mentimeter.com - to gather reflections

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Extension / Reduction Activities

Reduction: For a shorter class, reduce timings of Activities 1 & 2.

Extension: For a longer class, extend the timing of Activity 3 and ask learners to consider how these solutions could impact Ireland.

Media (materials, online video links, extra resources, case studies etc)

What Is 3D Printing and How Does It Work? [2:21min] https://youtu.be/Vx0Z6LplaMU

BCN3D Explains: Sustainable 3D Printing [2:30 min] https://www.youtube.com/watch?v=8OWwK2CgOeA&ab_channel=BCN3D

Eco-sustainable 3D Printed House [1:56 min] https://www.youtube.com/watch?v=w9sXqxccRPM&ab_channel=3DWASP

How Does 3D Printing Support Sustainability and the Circular Economy? [1:09 min] https://www.youtube.com/watch?v=JURMYWitYVY&ab_channel=AdditiveManufacturingMedia

Sustainable 3D Printed Fashion - How and When 3D Printing Could Help Prevent Climate Change [2:25min] https://www.youtube.com/watch?v=r5GbLsRGxKE&ab_channel=JuliaDaviy

Local Tips / Expertise / Additional Work and Assessments

Contact and visit businesses who use 3D printing. Prepare interview questions around the use and impact of using 3D printing in their work.

Learners can explore Tinkercad, a free web-based software that you can utilise to set up classrooms and continue toexplore the world of 3D printing, Robotics coding and more.

MM5 L8 TO L9: TEACHERS' GUIDE

What is 3D Printing?

3D printing is a process of creating three-dimensional objects by layering materials based on a digital model. Instead of traditional subtractive manufacturing methods, where material is cut or shaped from a larger block, 3D printing builds up objects layer by layer. This technology has gained popularity for its versatility and the ability to create complex shapes and structures.

The basic steps of 3D printing typically include:

1. Designing a 3D Model: The process begins with creating a digital 3D model of the object you want to print. This can be done using computer-aided design (CAD) software or by downloading pre-made models from online repositories.
2. Slicing the Model: The 3D model is sliced into thin horizontal layers using slicing software. This software generates a set of instructions that guide the 3D printer on how to build each layer.
3. Printing: The 3D printer reads these instructions and builds the object layer by layer. Various materials can be used for 3D printing, including plastics, metals, ceramics, and even certain types of food.
4. Post-Processing: Depending on the printing technology and materials used, post-processing steps may be required. This can include removing support structures, smoothing surfaces, or applying additional finishes.

What can you use 3D printing for in your everyday life?

1. Prototyping and DIY Projects: If you enjoy tinkering or working on DIY projects, 3D printing allows you to prototype and create custom parts and components for various purposes, from household repairs to hobbyist creations.
2. Customized Accessories: You can design and print personalized accessories such as phone cases, jewelry, and wearables, tailoring them to your style and preferences.
3. Household Items: 3D printing can be used to create replacement parts for household items that may break or wear out. This can include things like drawer handles, hooks, or brackets.
4. Educational Models: Students and educators can use 3D printing to create educational models and visual aids for subjects like geography, biology, architecture, and more.
5. Home Décor: Design and print unique home décor items, such as vases, lampshades, or sculptures, to add a personal touch to your living space.
6. Culinary Creations: Some 3D printers can use food-grade materials, allowing you to experiment with creating customized shapes for chocolates, cookies, or other edible items

7. Personalised Gifts: 3D printing enables you to design and create personalised gifts for friends and family, ranging from customised keychains to unique pieces of art.
8. Organisational Tools: Print organizers, storage solutions, or custom containers to help keep your living and working spaces tidy and well-organised.
9. Fashion and Wearables: Design and print unique fashion accessories or even clothing items. Some designers use 3D printing to create avant-garde fashion pieces
10. Learning and Skill Development: Using 3D printing can be a fun way to learn about design, engineering, and technology. It's a hands-on approach to developing skills in these areas

How can 3D printing help solve global challenges?

3D printing has the potential to contribute significantly to several of the United Nations' Sustainable Development Goals (SDGs) due to its ability to promote innovation, efficiency, and sustainability in various sectors. Here are some ways in which 3D printing can support specific SDGs:

- SDG 9: Industry, Innovation, and Infrastructure:
  - Rapid Prototyping: 3D printing facilitates quick and cost-effective prototyping, accelerating the innovation process in product development.
  - Localized Production: By enabling localized manufacturing, 3D printing can reduce the need for extensive transportation of goods, contributing to sustainable and efficient infrastructure.
- SDG 11: Sustainable Cities and Communities:
  - Construction Materials: 3D printing can be used to create sustainable building materials, offering alternatives to traditional construction methods and reducing the environmental impact of urban development.
- SDG 12: Responsible Consumption and Production:
  - Reduced Waste: Traditional manufacturing often produces more waste due to subtractive processes. 3D printing, an additive process, can minimize material waste by building objects layer by layer.
  - On-Demand Production: 3D printing enables more efficient production with on-demand manufacturing, reducing overproduction and the need for large inventories.
- SDG 13: Climate Action:
  - Lighter Components: 3D printing allows for the creation of lightweight and optimized structures, which can contribute to fuel efficiency in transportation and reduce overall carbon emissions.
- SDG 14: Life Below Water:
  - Marine Conservation: Some 3D printing applications involve creating artificial reefs and marine structures to promote biodiversity and protect underwater ecosystems.

- SDG 15: Life on Land:
  - Eco-friendly Products: 3D printing allows for the production of environmentally friendly products using sustainable materials, contributing to the protection of terrestrial ecosystems.
- SDG 3: Good Health and Well-being:
  - Medical Applications: 3D printing is used in the medical field to create custom implants, prosthetics, and even organs, improving patient outcomes and quality of life.
- SDG 8: Decent Work and Economic Growth:
  - Job Creation: The 3D printing industry can contribute to job creation, especially in areas related to design, software development, and maintenance of 3D printing technologies.
- SDG 1: No Poverty:
  - Affordable Products: 3D printing can enable the production of low-cost, customizable solutions for various needs, contributing to poverty reduction by making products more accessible.
- SDG 2: Zero Hunger:
  - Food Printing: While in early stages, 3D printing of food may offer innovative solutions for personalized nutrition and reducing food waste.