LEARNING SCENARIO

Learning by Making

Educational level: Secondary | **Age:** >10

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LEARNING OBJECTIVES/ ASPIRATIONS

To learn about new tools and technologies, and foster important thinking skills—such as adaptability, collaborative thinking, and risk-taking.

NARRATIVE OVERVIEW

Makerspaces, which are designed for hands-on, collaborative, creative work, are a fairly recent addition to some schools in Europe and worldwide. Students in school makerspaces can work with materials such as paper, card, wood, metal, plastics, clay, fabrics, electronic components, microcontrollers, construction kits or programmable robots to create many different objects, and complete many different projects, using a variety of tools and machinery.

Activities in makerspaces can include analyzing objects, especially electronic, mechanical and IT devices, breaking these down and creating new objects from the pieces and knowledge acquired; as well as creating new objects by working in design cycles that lead to a solution by progressively correcting errors. Makerspaces allow students to progress from passively using objects created by others to better understanding how technologies work and creating innovative objects themselves.

Students typically start with introductory projects requiring basic knowledge of specific technologies or subjects. They progress to applied knowledge projects that may be collaborative and interdisciplinary, in which they enhance their knowledge and skills through problem solving activities. Students can also participate in more ambitious, long-term projects that may simulate a professional context. These can relate to competitions that require planning, teamwork and project management skills in addition to making skills.

Once teachers and students are able to use different machines and teachers increasingly collaborate with the makerspace coordinator/technician, new kinds of activities can be tried out by modifying activities they already have designed.

Making can be part of a science project or placed in extra curricular activities.

APPROACH TO TEACHING AND LEARNING

Constructivist learning and learning by doing is at the heart of maker-centred learning. Possible approaches can include inquiry and experiential learning and learning by doing; collaborative learning including working in teams; project-based methodology.

ASSESSMENT:

- Informal rather in the form of feedback.
- Assessment can be added, then students' products are evaluated on predetermined criteria.

ROLES

TEACHERS: Teachers' role is to guide and support students throughout their making

LEARNERS: Students decide what they want to build and with whom they collaborate. Different products are developed in parallel running.

OTHERS: External experts can be invited.

LEARNING ENVIRONMENT

Makerspaces are often centered in physical spaces as well as online communities. The key is that a makerspace provides with resources, technologies, materials, and importantly with human 'guides'. Students can take a role of 'experts' as well to support their peers.

Makerspaces can have tools like screwdrivers, sewing machines, as well as tools that incite our imagination as they contain new objects like a 3D printer, hobbyist electronics etc. Thus, they can be learning environments where you can create anything. Makerspaces can be described as true communities of practice, where peers learn from each other, and everyone's idea is important.

POSSIBLE CHALLENGES

There is a challenge to set up a maker-space in a school.

Before teachers can skillfully integrate maker-centered learning into their existing curriculum they must be educated on maker-centered learning strategies. Maker-centered learning requires the teacher to become a facilitator and understand their new role in the acquisition of knowledge through maker-centered learning activities. It asks for a motivated and competent teacher.

RESOURCES

- To create metal business cards : Laser cutter; 3D Printer; Materials for cards (anodized aluminium cards)
- Software: Inkscape; K40 Whisperer, TinkerCad, Prusa or Cura slicer
- Notebooks, Tablets or IPADs
  - Software for designing:
  - https://www.tinkercad.com
  - https://inkscape.org/
  - https://www.blender.org/

LEARNING ACTIVITIES

- The tasks in the maker projects usually include multiple **investigation** and **creation** activities. The work can be done individually or collaboratively while the students **develop** their projects . However, before they get started, they **exchange** their ideas. And this is a very important step. At the end, each team **presents** what they created and learned. Throughout the process, the teacher **interacts** with the students to instruct and guide.
- Once teachers and students can use different machines and teachers increasingly collaborate with the makerspace coordinator/technician, new kinds of activities can be tried out by modifying activities they already have designed.
- For example, a science activity based on observation of the effects of light on plants can be strengthened with light sensor tools created in middle schools to measure the value of light during time, or students can add 3d objects to supplement their drawings for their history homework.
  Once teachers see that students are confident using the tools and machinery safely and can organise their activities in the makerspaces in a given timeframe, new activities related to real life problems can be created based on different topics and in collaboration with the makerspace coordinator/technician.
- For example, students can create something to help birds in the school park (or another park where students can develop a school project). This activity can be part of a long-term project involving observations and studying plants and birds in and around the park, which affect birds' lives, and identifying problems and solutions using the makerspace.

LITERATURE TO SUPPORT

Cater Heroman, Making and Tinkering With STEM, ISBN 978-1-938113-28-4 Solving Design Challenges With Young Children.

EUN Schoolnet: https://fcl.eun.org/icwg-makerspaces

EUN Schoolnet: https://fcl.eun.org/guideline

LEARNING SCENARIO VIDEO

https://www.youtube.com/watch?v=tgkXX15UXRc

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