



Title

German gingerbread and 3D printing

Author

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Table of activities

School subject	<i>Technology</i>
Topic	<i>3D modeling</i>
Age	<i>18 years</i>
Required time fo the acitivity	<i>90 minutes</i>
Required materials	<i>3D printer, computer, flour, sugar, butter, gingerbread spices, baking powder, salt, eggs, coconut oil, nuts, almonds.</i>
Cultural concept	<i>Exploring German tradition of baking gingerbread cookies that are popular worldwide</i>



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Teaching concept

In this activity, students will learn how to model 3D objects and print them using 3D printers. Using 3D printing in the classroom students develop different knowledge and skills, such as mathematical, technological, but also collaboration and cultural exploration.

Cultural concept

Gingerbread is a symbol of Christmas in the western world which is celebrated through food and other holiday activities. Its German origins became widespread when 15th century children promoted Emperor Friedrich III cookies bearing the image of his portrait. Today, the cookies are usually in the shape of heart, but as the technology advanced many other shapes are available. There are many different receipts, usually include honey, aniseed, cardamom, cloves, nuts and ginger.

Technology concept

3D printing creates objects from virtual and digital design into modeled shape. Today, 3D printing has become affordable and available to use in school activities. During our activities students can use [GeoGebra](#), [Thingiverse](#) or [Tinkercad.com](#) to model objects, in our case cookie cutter. During 3D printing objects are created from digital designs by overlapping thin layers of a particular substance in a modeled shape.

Aim of activity

The goal of the activity is for students to learn how to model 3D objects by using software and prepare files for 3D printing. Students use 3D printer to produce products that could be used in everyday life such as a cookie cutter.

Activities

This activity is consisted of three phases:

The first stage is to model a cookie cutter using mentioned softwares. They also could use prepared files and adapt the to their requirements. The final result in modeling should be saved as STL file to make suitable for 3D printing. Beside creating cookie cutters, students can explore mathematical problem in order to create the most suitable product, such as what dimension and shape would be the most effective for the cookies, how to minimize leftovers, what is the area of leftover or how much ingredients are needed to multiply the receipt.

The second stage is to prepare 3D printer and print final product. The main processing software is called a slicer. It converts those STL files into files that a 3D printer can understand. It breaks down models into commands that make 3D printer move, heat up the nozzle/bed, or regulate speed. The created files are called G-Code files which 3D printer uses to move the printing head to specific locations on the surface to extrude material through. There are different slicer that could be used, but the most common is [Cura](#).

The final third part is to prepare gingerbread cookies following the receipt and to use 3D printed cookie cutter.

Additional materials

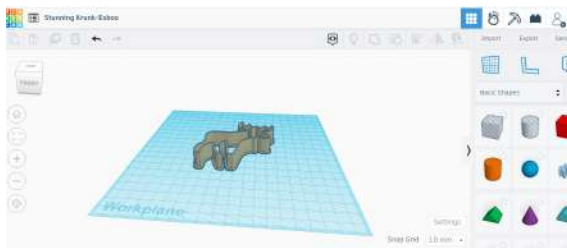


Figure 1 Modeling cookie cutter using Tinkercad

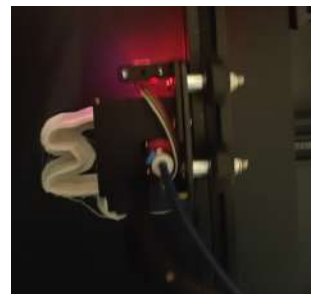


Figure 2 3D printing process



Figure 3 Students made different cookies using cookie cutters



Figure 4 Students made different cookies using cookie cutters