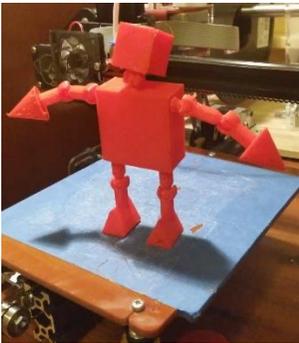


EQUIPMENT INTRODUCTION PROJECT

3D DESIGN AND 3D PRINTING



PROJECT DESCRIPTION

Participants create a 3D printed figurine as a group with individuals each designing a part of the figurine (such as head, torso, arms, and legs). A ball and socket joint is used to attach the body parts of the figurine and allow for movement.

This project was specifically designed to have a relatively short 3D print time by having a group create one figurine that must fit within a 3D printer's bed.

LEARNING OBJECTIVES

Design for manufacture and assembly: participants learn how to break their design into parts for 3D printing. It also introduces a method of attaching objects to allow for movement.

Systems engineering: this approach teaches participants how to work together to design parts of a figurine which must function as a whole.

Teamwork and communication: participants practice teamwork and communication skills by working together to create a figurine.

Biology: participants learn about the anatomical structure of the ball and socket joint and how to apply this structure to a design.

3D design: participants are introduced to 3D design and modeling.

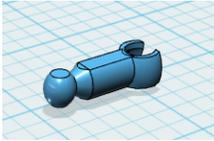
3D printing: participants learn how a 3D printer operates and how to print 3D objects.

SOFTWARE

[123D DESIGN](#) | [123D DESIGN TUTORIALS](#)

An easy to use, free software program for 3D design and modeling.

[Ball and Socket Joint](#)

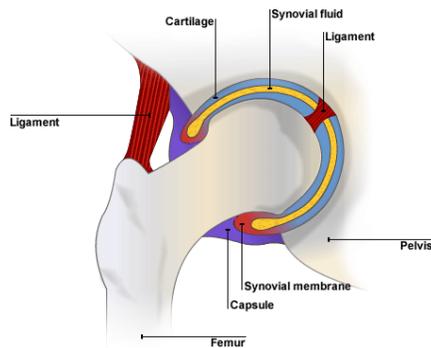


A 123D Design file of a ball and socket joint for participants to incorporate in their design.

EXAMPLE SESSION: 70 MINUTES

Introduction: 20 minutes

Discuss the concept of ball and socket joints



http://www.bbc.co.uk/bitesize/standard/pe/the_body/structure_and_function/revision/2/

Skeletal system: <https://www.youtube.com/watch?v=c5kMactCaus>

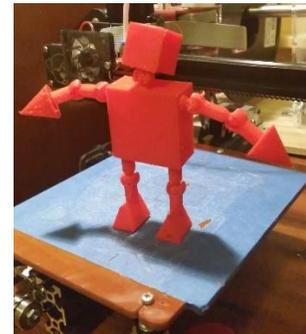
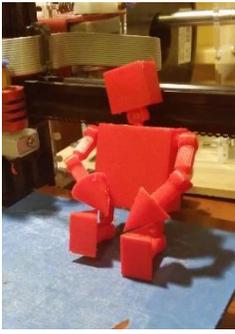
Ball and socket: <https://www.youtube.com/watch?v=wMOoXB6OwXQ>

Explain that the goal of the project is to use the concept of the ball and socket joint to create a 3D printed figurine.

Introduce 3D Printing

For information see the webpage: [About 3D Printing](#)

Show examples of 3D printed joints and figurines



It is recommended to have physical examples for participants to examine the size, shape and feel of 3D printed parts. This will also help when explaining the process and the properties of the plastic.

Divide the class into groups and explain how individuals will create part of the figurine and the group must work together to create an entire figurine.

Have a class discussion about this process:

Ask: How can you work as a team to build this figurine? What information needs to be shared? How will you coordinate sharing this information?

Introduce the design software

Show students how to import the ball and socket object.

Give students a quick overview of 123D Design: <http://www.123dapp.com/howto/design>

Such as how to:

Create, move, and rotate shapes

Pan and orbit the view

Copy and paste objects

Merge and subtract objects

Notes

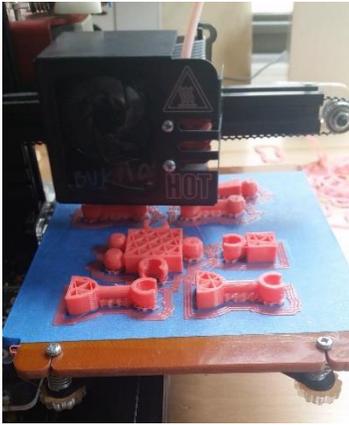
It is recommended to constrain participants to fit all of their body parts for one figurine onto the 3D printer bed to limit the amount of time it takes to print one figurine. Use the 'Edit Grid' button in the lower right hand corner of 123D Design to adjust the size of workspace to match the 3D printer bed size.

Create: 30 minutes

Have participants 3D design the body parts for their figurine.

3D Print Setup: 10 minutes

Have participants 3D print their figurine parts.



3D Printing: varies

Participants might want to watch the 3D printing to ensure there are no issues with the print and to better understand the process.

The next stage of the project (testing & reflection) should happen during the next class or after students have moved onto other projects since 3D printing can take a long time.

Test & Reflection: 10 minutes

Have students assemble the figurine.

Ask: Did all the parts fit together? What were some issues? How could the participants improve their design and build process if they were to do it again?

POSSIBLE MODIFICATIONS

A modification to this activity could be to have one class create a figurine and groups of students create the different body parts to further limit the 3D printing required. This might be helpful if only one 3D printer is available.

POSSIBLE EXTENSIONS

This project can be combined with introducing other equipment by having participants create a stop motion animation about their figurine using other equipment to design scenery and props.