

Design Your Own Dice

Subject: 3D Design and Printing	Topic or Unit of Study: 3D Design and Printing
Grade/Level: 6-8	Time Allotment: 2 hours
Objectives: <ul style="list-style-type: none"> • Create a 3D representation of an object within Tinkercad. • Use mathematical computation to solve real-world problems. • Introduce a 3D object to the class. 	Standards: <ul style="list-style-type: none"> • ISTE Standard 4 Innovative Designer: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful, or imaginative solutions. • MCSS 10.DA.IM.01: Design computational models that identify and represent the relationships among different elements of data collected from a phenomenon or process. • CCSS, Grade 4, Measurement & Data: Solve problems involving measurement and conversion of measurements. • CCSS, Grade 5, Number & Operations in Base Ten: Perform operations with multi-digit whole numbers and with decimals to hundredths.
Skills: <ul style="list-style-type: none"> • 2D design • 3D design • 3D printing • Mathematical computation • Visual communication 	Materials: <ul style="list-style-type: none"> • Teacher computer with Google Slides or PowerPoint • Make Your Own Avatar presentation • Student computers with access to the Internet • Engineering Notebooks • Rulers • Paper, markers, crayons, or colored pencils/pens • 3D printer and supplies (filament, glue) • Multiple copies of a 3D printed dice as models

Instructor Note:

Prior to implementing this session, you will need to create an educator account on TinkerCad.com, as well as create a class with login information for each student. We suggest creating login cards for each student, to be used throughout the 3D Design and Printing Sessions.

Create Your Own Avatar

By Dr. Ben Finio, Cornell University Sibley School of Mechanical and Aerospace Engineering

Subject: Design, Art, Math	Topic or Unit of Study: Design
Grade/Level: 6-8	Time Allotment: 6 hours
Objectives: <ul style="list-style-type: none"> • Develop a vocabulary that can help you express ideas. • Create a 2D representation of a character using papercraft materials. • Create a 3D representation of a character within Tinkercad. • Use mathematical computation to solve real-world problems. • Introduce a 3D avatar to the teacher or the class. 	Standards: <ul style="list-style-type: none"> • ISTE Standard 4 Innovative Designer: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful, or imaginative solutions. • ISTE Standard 6 Creative Communicator: Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats, and digital media appropriate to their goals. • CCSS, Grade 4, Measurement & Data: Solve problems involving measurement and conversion of measurements. • CCSS, Grade 5, Number & Operations in Base Ten: Perform operations with multi-digit whole numbers and with decimals to hundredths. • CCSS, Grade 5, Geometric Measurements: Understand concepts of volume. • CCSS, Grade 5, Number & Operations in Base Ten: Perform operations with multi-digit whole numbers and with decimals to hundredths. • CCSS, Grade 6, Geometry: Solve real-world and mathematical problems involving area, surface area, and volume.
Skills: <ul style="list-style-type: none"> • 2D design • 3D design • Mathematical computation • Visual communication 	Materials: <ul style="list-style-type: none"> • Teacher computer with Google Slides or PowerPoint • Make Your Own Avatar presentation • Student computers with access to the Internet • Engineering Notebooks • Rulers • Paper, markers, crayons, or colored pencils/pens • 3D printer and supplies • Physical Traits Inventory worksheet copies • Graph Paper worksheet copies • Measure Your 2D Design worksheet copies

Instructor Note: Ensure you have implemented the following sessions prior to implementing this lesson:

- Introduction to Tinkercad and 3D Printing
- Engineering Notebooks

Design Your Dream Room

Subject: Computer-Aided Design, 3D Printing, Math	Topic or Unit of Study: 3D Design and Printing
Grade/Level: 6-8	Time Allotment: 3 hours
Objectives: <ul style="list-style-type: none"> • Use technology and sketching to develop an organized system for drawing ideas and documenting progress. • Develop proportional models based on real measurements. • Convert feet/inches to millimeters. • Choose an appropriate scale to create a room on a Tinkercad workplane. • Create a 3D room and accessories that are easily identifiable. • Design a 3D room that can be 3D printed. 	Standards: <ul style="list-style-type: none"> • ISTE Standard 4 Innovative Designer: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful, or imaginative solutions. • ISTE Standard 5 Computational Thinker: Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions. • ISTE Standard 6 Creative Communicator: Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats, and digital media appropriate to their goals. • CCSS, Grade 7, Ratios & Proportional Relationships: Analyze proportional relationships and use them to solve real-world and mathematical problems. • CCSS, Grade 5, Measurement & Data: Convert like measurement units within a given measurement system. • CCSS, Grade 6, Geometry: Solve real-world and mathematical problems involving area, surface area, and volume.
Skills: <ul style="list-style-type: none"> • 2D design • 3D design • Brainstorming • Geometric design • Mathematical computation • Measurement conversion • Spatial reasoning 	Materials: <ul style="list-style-type: none"> • Student computers with audio and Tinkercad access • Student Engineering Notebooks • Teacher Computer with Google Slides or PowerPoint access • Pencils or pens • Rulers • Tips for Creating Room Objects worksheet copies • Graph Paper copies • Converting Measurements worksheet copies • 3D printer and filament

Instructor Note:

Prior to implementing this session, you will need to create an educator account on TinkerCad.com, as well as create a class with login information for each student. We suggest creating login cards for each student, to be used throughout the 3D Design and Printing Sessions.

Pencil Holder

Subject: 3D Design and Printing	Topic or Unit of Study: 3D Design and Printing
Grade/Level: 6-8	Time Allotment: 2 hours
Objectives: <ul style="list-style-type: none"> • Develop a vocabulary that can help you express ideas. • Create a 2D representation of an object using papercraft materials. • Create a 3D representation of an object within Tinkercad. • Use mathematical computation to solve real-world problems. • Introduce a 3D object to the class. 	Standards: <ul style="list-style-type: none"> • ISTE Standard 4 Innovative Designer: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful, or imaginative solutions. • ISTE Standard 6 Creative Communicator: Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats, and digital media appropriate to their goals. • MCSS 10.DA.IM.01: Design computational models that identify and represent the relationships among different elements of data collected from a phenomenon or process. • CCSS, Grade 4, Measurement & Data: Solve problems involving measurement and conversion of measurements. • CCSS, Grade 5, Number & Operations in Base Ten: Perform operations with multi-digit whole numbers and with decimals to hundredths.
Skills: <ul style="list-style-type: none"> • 2D design • 3D design • 3D printing • Mathematical computation • Visual communication 	Materials: <ul style="list-style-type: none"> • Teacher computer with Google Slides or PowerPoint • Make Your Own Avatar presentation • Student computers with access to the Internet • Engineering Notebooks • Rulers • Paper, markers, crayons, or colored pencils/pens • 3D printer and supplies • Multiple copies of a 3D printed pencil holder for students to measure • Graph Paper worksheet copies

Instructor Note:

Prior to implementing this session, you will need to create an educator account on TinkerCad.com, as well as create a class with login information for each student. We suggest creating login cards for each student, to be used throughout the 3D Design and Printing Sessions.

Biomimicry and Using Nature as a Design Partner

By Kellyanne Mahoney, Tinkercad Learning

Subject: Design	Topic or Unit of Study: Engineering, Design, Math, Technology, Science, Social Studies, Computer Science, Art
Grade/Level: 5-8	Time Allotment: 8 hours
Objectives: <ul style="list-style-type: none"> • Identify Fibonacci numbers and their origin, and generate the next numbers in the Fibonacci sequence. • Practice computational thinking in analyzing a code-generated pattern inspired by nature. • Identify ways that analyzing and imitating nature can help solve problems. • Research the issue of climate change and apply that knowledge to an authentic design challenge. • Define a problem using design thinking. • Apply an engineering mindset by defining the criteria and constraints of a design problem. • Create a 3D model within Tinkercad. • Use a digital prototype to creatively communicate your ideas. 	Standards: <ul style="list-style-type: none"> • ISTE Standard 4 Innovative Designer: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful, or imaginative solutions. • ISTE Standard 5 Computational Thinker: Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions. • ISTE Standard 6 Creative Communicator: Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats, and digital media appropriate to their goals. • MS-ETS1-2 Engineering Design: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. • MS-ETS1-4 Engineering Design: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. • MS-ESS3-3 Earth and Human Activity: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. • CCSS, Grade 6, Ratios & Proportional Relationships: Understand ratio concepts and use ratio reasoning to solve problems. • CCSS, Grade 7, Ratios & Proportional Relationships: Analyze proportional relationships and use them to solve real-world and mathematical problems. • CCSS, Grades 6-8, ELA Writing: Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

Invent a Device That Can Move Through a Pipe

By Spark!Lab Smithsonian, Tinkercad Learning

Subject: Design, Robotics, 3D Printing	Topic or Unit of Study: 3D Design and Modeling
Grade/Level: 6-12	Time Allotment: 4-6 hours
Objectives: <ul style="list-style-type: none"> Identify steps in the engineering design process. Develop initial ideas on how you could solve a defined problem. Create a 2D representation of a device that can move through a pipe using art materials or digital resources. Create a 3D representation of a device that can move through a pipe within Tinkercad. Use the provided mathematical computation and object-sizing tools to solve real-world problems. Review your ideas using the provided facilitative questions and direct feedback from others. Revise your invention based on input you feel is useful or valid. Present your finished invention to share your idea with others. 	Standards: <ul style="list-style-type: none"> ISTE Standard 4 - Innovative Designer: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful, or imaginative solutions. ISTE Standard 5 - Computational Thinker: Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions. ISTE Standard 6 - Creative Communicator: Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats, and digital media appropriate to their goals. CCSS Grade 5 Geometric Measurements: Understand concepts of volume. CCSS Grade 6 Geometry: Solve real-world and mathematical problems involving area, surface area, and volume.
Skills: <ul style="list-style-type: none"> 2D design 3D design Computational design Problem solving Researching Verbal communication Providing feedback Visual communication 	Materials: <ul style="list-style-type: none"> Student computers with audio and Tinkercad access Student Engineering Notebooks Teacher computer with Google Slides or PowerPoint access Invent a Device That Can Move Through a Pipe teacher presentation Generate Possible Solutions worksheet copies Sketch It worksheet copies Evaluate Possible Solutions worksheet copies Share It worksheet copies Rulers Markers, crayons, or colored pencils/pens 3D printer and supplies Pipe

Program an LED Light Show

By Dr. Ben Finio, Cornell University Sibley School of Mechanical and Aerospace Engineering

Subjects: Computer Science, Electronics, and Technology	Topic or Unit of Study: Computer Science
Grade/Level: 6-12	Time Allotment: 4 hours
Objectives: <ul style="list-style-type: none">● Build a basic LED circuit.● Connect and program an Arduino to control the circuit.● Expand the circuit to add more LEDs.● Build neat, organized circuits.● Troubleshoot when things don't work as expected.	Standards: <ul style="list-style-type: none">● ISTE Standard 4 Innovative Designer: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful, or imaginative solutions.● ISTE Standard 5 Computational Thinker: Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.● NGSS MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet criteria and constraints of the problem.
Skills: <ul style="list-style-type: none">● Circuit design● Programming● Debugging	Materials: <ul style="list-style-type: none">● Teacher computer with access to internet, Tinkercad, and Google Slides or PowerPoint● Teacher presentation● Teacher lesson plan open on teacher computer (contains links to videos and ppts used throughout the lesson)● Student computers with Tinkercad access● Student Engineering Notebooks● Arduino Breadboards and Circuit Kits (one per student)

Teacher/Instructor Notes:

There are three options for each section of this lesson, allowing you to customize it to your classroom format: