

Grade 8 – Unit 1 – 3D Modeling & Printing

Unit Focus

While still in its early stages, 3D printing, or additive manufacturing, is already having an impact on society, allowing entrepreneurs and startup businesses to take advantage of its versatility and prototyping capabilities. As the technology advances, becoming cheaper and more accessible, it only promises to transform and disrupt key aspects of familiar economic models, such as the retail, supply chain and manufacturing sectors. Even the way we “buy” certain products will change as additive manufacturing technology continues to improve. Therefore, it is important for our students to learn how 3D printed objects are created, through an iterative process, from conception, to design, to the final print. Students will learn and apply discrete skills within a 3D modeling software (Tinkercad) while creating solutions (models) to different problems.

Additionally, they should consider the potential impacts additive manufacturing has on society.

Design and perseverance are both necessary skills when creating 3D models. Students will be expected to persevere as they learn unfamiliar 3D modeling software and engage in the iterative design process to create tangible products while adhering to specific parameters. Students will have opportunities to develop key 21st century capacities through class activities as well as larger projects.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
<p>Connecticut Goals and Standards <i>Computer Aided Drafting and Design: 9</i></p> <ul style="list-style-type: none"> Express a design of an object as a 3D model.*(A5) <i>CADD.02.07</i> Identify basic geometric elements (e.g., line, circle, rectangle, sphere, and cube).*(A9) <i>CADD.02.11</i> Describe objects as geometric entities.*(A1) <i>CADD.02.12</i> Describe the measurement standards used in the manufacturing industry. <i>CADD.03.02</i> Generate a pictorial drawing.*(E28) <i>CADD.05.15</i> <p>ITEEA - Standards for Technological Literacy <i>Technological Literacy: K-12</i></p> <ul style="list-style-type: none"> Students will develop an understanding of the cultural, social, economic, and political effects of technology. 4 Students will develop an understanding of the attributes of design. 8 Students will develop the abilities to apply the 	<p>T1 Explore and hone techniques, skills, methods, and processes to create and innovate T2 Develop a product/solution that adheres to key parameters (e.g., cost, timeline, restrictions, available resources and audience).</p>	
	Meaning	
	Understanding(s)	Essential Question(s)
<p>U1 Design is a revolving reiterative process whereby the designer creates multiple prototypes, improving each one along the way. U2 Design requires a great deal of precision and accuracy in creating a prototype, which means being able to fluently manipulate 3d modeling software and work in virtual 3D spaces. U3 Creating new ideas involves relying on previous ideas, designs, or models in sparking some type of innovation. U4 3D printing has the potential to transform different aspects of our society, such as current jobs, the way people "buy" things, and how businesses develop new products.</p>	<p>Q1 When is 3D printing useful? What needs does it serve? Q2 How can I design something so that it is the most accurate representation of a physical product I have in mind? Q3 How can I get the best possible 3D print in the shortest period of time? Q4 How can I alter my design to improve performance?</p>	

Stage 1: Desired Results - Key Understandings

<p>design process. <i>11</i></p> <p>NGSS/NSTA Science & Engineering Practices <i>NGSS Science & Engineering Practices: 6-8</i></p> <ul style="list-style-type: none"> Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. <i>SE.6-8.6.7</i> <p>Student Growth and Development 21st Century Capacities Matrix <i>Creative Thinking</i></p> <ul style="list-style-type: none"> Design: Students will be able to engage in an appropriate process to refine their product. <i>MM.2.3</i> <p><i>Collaboration/Communication</i></p> <ul style="list-style-type: none"> Product Creation: Students will be able to effectively use a medium to communicate important information (findings, ideas, feelings, issues, etc.) for a given purpose. <i>MM.3.2</i> 	Acquisition of Knowledge and Skill	
	Knowledge	Skill(s)
	<p>K1 3D modeling vocabulary: Extrusion, work plane, group, smooth, align, organic extrusion, and handles.</p> <p>K2 3D printing vocabulary: supports, raft, brim, filament.</p> <p>K3 Subtractive vs. additive prototyping.</p> <p>K4 Millimeters vs. centimeters vs. inches.</p>	<p>S1 Create an object with a variety of features, using 3D modeling software.</p> <p>S2 Insert shapes on a new geometric plane while creating an object, using 3D modeling software.</p> <p>S3 Group several shapes together while creating your object.</p> <p>S4 Create an organic extrusion from scratch, using 3D modeling software.</p> <p>S5 Smooth edges and curved surfaces, using 3D modeling software.</p> <p>S6 Precisely align objects for aesthetic and/or functional purposes.</p> <p>S7 Manipulate the orientation options of any given object, as needed.</p> <p>S8 Utilize a 3D printer in creating prototypes in solving problems.</p> <p>S9 Manipulate the criteria within a slicing software to yield to best print results when 3D printing.</p>