Grade 8 Unit 2: 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)

Standards

Connecticut Goals and Standards
Computer Aided Drafting and Design: 9
Analyze the use of current CADD design technology. *(CADD.02)*
Express a design of an object as a 3D model.*(A5) *(CADD.02.07)*
Identify basic geometric elements (e.g., line, circle, rectangle, sphere, and cube).*(A9) *(CADD.02.11)*
Utilize measurement and annotation systems as they apply to CADD technology design. *(CADD.03)*
Describe the measurement standards used in the manufacturing industry. *(CADD.03.02)*
Utilize Proper projection techniques to develop orthographic and pictorial drawings. *(CADD.05)*
Generate a pictorial drawing.*(E28) *(CADD.05.15)*
Analyze the use of current CADD design technology. *(CADD.02)*
Describe objects as geometric entities.*(A1) *(CADD.02.12)*

NGSS/NSTA Science & Engineering Practices
NGSS Science & Engineering Practices: 6-8

Transfer

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).

Meaning

Understanding(s)	Essential Question(s)
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.	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?

Stage 1: Desired Results - Key Understandings

Constructing Explanations and Designing Solutions: The end-products of science are explanations and the end-products of engineering are solutions. The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power of phenomena than previous theories. The goal of engineering design is to find a systematic solution to problems that is based on scientific knowledge and models of the material world. Each proposed solution results from a process of balancing competing criteria of desired functions, technical feasibility, cost, safety, aesthetics, and compliance with legal requirements. The optimal choice depends on how well the proposed solutions meet criteria and constraints. *(SE.6-8.6)*
Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. *(SE.6-8.6.7)*

ITEEA - Standards for Technological Literacy
Technological Literacy: K-12
Technology and Society
Students will develop an understanding of the cultural, social, economic, and political effects of technology. *(4)*
Design
Students will develop an understanding of the attributes of design. *(8)*
Abilities for a Technological World
Students will develop the abilities to apply the design process.

Other Goals

Profile of a Graduate
Design: Engaging in a process to refine a product for an intended audience and purpose. *(POG.2.2)*

Acquisition of Knowledge and Skill

Knowledge

K1 3D modeling vocabulary: Extrusion, work plane, group, smooth, align, organic extrusion, and handles.
K2 3D printing vocabulary: supports, raft, brim, filament.
K3 Subtractive vs. additive prototyping.
K4 Millimeters vs. centimeters vs. inches.

Skill(s)

S1 Create an object with a variety of features, using 3D modeling software.
S2 Insert shapes on a new geometric plane while creating an object, using 3D modeling software.
S3 Group several shapes together while creating your object.
S4 Smooth edges and curved surfaces, using 3D modeling software.
S5 Precisely align objects for aesthetic and/or functional purposes.
S6 Manipulate the orientation options of any given object, as needed.
S7 Utilize a 3D printer in creating prototypes in solving problems.
S8 Manipulate the criteria within a slicing software to yield to best print results when 3D printing.