

3D CAD / 3D Printing

Content Area: **Science**
Course(s): **CP Introduction to Engineering**
Time Period: **Marking Period 1**
Length: **1 weeks**
Status: **Published**

Course Pacing Guide

Unit	MP/Trimester	Weeks
3D CAD / 3D Printing	1	1

Unit Overview

In this unit students learn to use a 3D CAD program, TinkerCad, by following their tutorials and independent practice. Students are then paired with another student that they need to coordinate with. Since engineers often need to work on one piece of a larger project they each need to create a piece that snaps together with the other student's piece. Each student is graded on creativity, intricacy, scale, and connectability.

Enduring Understandings

Students will leave knowing how to convert their CAD into a printable form.

Essential Questions

How do you precisely design the proper dimensions?

New Jersey Student Learning Standards (No CCS)

TECH.8.1.12

Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to

	create and communicate knowledge.
TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B	Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
TECH.8.1.12.B.CS2	Create original works as a means of personal or group expression.
TECH.8.2.12.C.CS1	The attributes of design.

Amistad Integration

The Amistad Bill (A1301), which became law in 2002, calls on New Jersey schools to incorporate African-American history into their social studies curriculum.

This course does not fall in this category.

Holocaust/Genocide Education

a. Every board of education shall include instruction on the Holocaust and genocides in **an appropriate place in the curriculum** of all elementary and secondary school pupils.

This lesson does not fall within this category.

Interdisciplinary Connections

9-12.HS-ETS1	Engineering Design
9-12.HS-ETS1-1.1.1	Analyze complex real-world problems by specifying criteria and constraints for successful solutions.
CAEP.9.2.12.C	Career Preparation
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

Technology Standards

0xTECH.8.1.12 All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

0xTECH.8.1.12.A.CS1 Understand and use technology systems.

0xTECH.8.1.12.A.CS2 Select and use applications effectively and productively.

0xTECH.8.1.12.B Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.

0xTECH.8.1.12.B.CS2 Create original works as a means of personal or group expression.

0xTECH.8.2.12.C.CS1 The attributes of design.

21st Century Themes/Careers

CAEP.9.2.12.C	Career Preparation
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.

Financial Literacy Integration

1. The State Board of Education shall require that a school district incorporate in each of the grades ¹[kindergarten] six¹ through eight financial literacy instruction to pupils enrolled in those grades. The purpose of the instruction shall be to provide ¹[elementary and]¹middle school students with the basic financial literacy necessary for sound financial decision-making.

This course does not fall in this category.

Instructional Strategies & Learning Activities

In this unit students learn to use a 3D CAD program, TinkerCad, by following their tutorials and independent practice. Students are then paired with another student that they need to coordinate with. Since engineers often need to work on one piece of a larger project they each need to create a piece that snaps together with the other students piece. Each student is graded on creativity, intricacy, scale, and connectability.

Differentiated Instruction

- Curriculum Map
- Inquiry/Problem-Based Learning
- Learning preferences integration (visual, auditory, kinesthetic)
- Tiered Learning Targets
- Learning through play
- Relationship-Building & Team-Building
- Self-Directed Learning

- Debate
- Student Data Inventories
- Mastery Learning (feedback toward goal)
- Goal-Setting & Learning Contracts
- Grouping
- Rubrics
- Flipped Classroom
- Mentoring
- Assessment Design & Backwards Planning

Formative Assessments

An over the shoulder assessment of students progress as they work on their designs. This is usually followed up with several questions about how they plan to make their design to connect with their partners design.

Summative Assessment

The printed project is assessed based on the rubric developed for this project.

Benchmark Assessments

Rubric for 3D CAD Assignment

Category	1	2	3	4
Creativity	A simple design with very few features.	Original design with a few features.	Original design with attention to detail and intricate details.	Completely original design with a lot of attention to detail and intricate details.
Scale	Does not fit in the 3D printer.	Scaled to a size that fits in the 3D printer but needs to be scaled down so it can be printed in a reasonable period of time.	Scaled in inches to a size appropriate for the 3D printer so it can be printed in a reasonable period of time.	Scaled in mm to a size appropriate for the 3D printer so it can be printed in a reasonable period of time.
Coordination	Design does not connect with another students design.	Demonstrates coordination with another student where both designs	Demonstrates coordination with another student where both designs	Demonstrates a high level of coordination with another student

		almost connect.	connect.	where both designs connect seamlessly.
Printability	Is not printable.	3D model needs major adjustments to be printed.	3D model needs minor adjustments on the build plate in order for it to be printed.	3D model is ready to print.

Alternate Assessments

Rubric for 3D CAD Assignment

Category	1	2	3	4
Creativity	A simple design with very few features.	Original design with a few features.	Original design with attention to detail and intricate details.	Completely original design with a lot of attention to detail and intricate details.
Scale	Does not fit in the 3D printer.	Scaled to a size that fits in the 3D printer but needs to be scaled down so it can be printed in a reasonable period of time.	Scaled in inches to a size appropriate for the 3D printer so it can be printed in a reasonable period of time.	Scaled in mm to a size appropriate for the 3D printer so it can be printed in a reasonable period of time.
Coordination	Design does not connect with another students design.	Demonstrates coordination with another student where both designs almost connect.	Demonstrates coordination with another student where both designs connect.	Demonstrates a high level of coordination with another student where both designs connect seamlessly.
Printability	Is not printable.	3D model needs major adjustments to be printed.	3D model needs minor adjustments on the build plate in order for it to be printed.	3D model is ready to print.

Resources & Technology

Students use either the classroom computers or a laptop/cromebook to access the TinkerCad program online to create their design. Students then use one of two Makerbot 3D printers to print their design.

BOE Approved Texts

There is no text for this assignment.

Closure

Students are assessed based on their performance and the closure to this assignment is attaching the two pieces together that were created.

ELL

- Teacher Modeling
- Group work
- Simplified Written and Verbal Instructions
- Google Translate

Special Education

- Specify and list exactly what the student will need to learn to pass.
- Evaluate the classroom structure against the student's needs (flexible structure, firm limits, etc.).
- Keep workspaces clear of unrelated materials.
- Reduce visual distractions in the classroom (mobiles, etc.).
- Provide a computer for written work.
- Seat the student close to the teacher or a positive role model.
- Provide an unobstructed view of the chalkboard, teacher, movie screen, etc.
- Keep extra supplies of classroom materials (pencils, books) on hand.
- Maintain adequate space between desks.
- Give directions in small steps and in as few words as possible.
- Number and sequence the steps in a task.
- Have student repeat the directions for a task.
- Provide visual aids.
- Go over directions orally.
- Allow the student to complete an independent project as an alternative test.
- Grade spelling separately from content.
- Show a model of the end product of directions (e.g., a completed math problem or finished quiz).
- Stand near the student when giving directions or presenting a lesson.

- preferential seating
- extended time on tests and assignments
- modified textbooks or audio-video materials
- behavior management support
- excused lateness, absence, or missed classwork

At Risk

- Have student restate information
- Provision of notes or outlines
- Concrete examples
- Assistance in maintaining uncluttered space
- No penalty for spelling errors or sloppy handwriting
- Follow a routine/schedule
- Teach time management skills
- Verbal and visual cues regarding directions and staying on task
- Visual daily schedule
- Immediate feedback
- Work-in-progress check
- Pace long-term projects
- Cue/model expected behavior
- Use de-escalating strategies
- Use peer supports and mentoring
- Chart progress and maintain data

Gifted and Talented

Focus on effort and practice

Offer the Most Difficult First

Offer choice

Speak to Student Interests

Allow G/T students to work together

Encourage risk taking

