# 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 independant 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 snapps together with the other students piece. Each student is graded on creativity, intracacy, scale, and connectability.

#### **Enduring Understandings**

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

#### **Essential Questions**

How do you percicely design the proper dimensions?

#### New Jersey Student Learning Standards (No CCS)

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.

	All students will use digital tools to access, manage, evaluate, and			
0xTECH.8.1.12	synthesize information in order to solve problems individually			
	and collaborate and to create and communicate knowledge.			
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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 <sup>1</sup>[kindergarten] <u>six</u><sup>1</sup> through eight financial literacy instruction to pupils enrolled in those grades. The purpose of the instruction shall be to provide <sup>1</sup>[elementary and]<sup>1</sup>middle 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 independant 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 snapps together with the other students piece. Each student is graded on creativity, intracacy, 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 sholder 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	Original design	Original design	Completely
	with very few	with a few features.	with attention to	original design
	features.		detail and intricate	with a lot of
			details.	attention to detail
				and intricate
				details.
Scale	Does not fit in the	Scaled to a size	Scaled in inches to	Scaled in mm to a
	3D printer.	that fits in the 3D	a size appropriate	size appropriate for
		printer but needs to	for the 3D printer	the 3D printer so it
		be scaled down so	so it can be printed	can be printed in a
		it can be printed in	in a reasonable	reasonable period
		a reasonable period	period of time.	of time.
		of time.		
Coordination	Design does not	Demonstrates	Demonstrates	Demonstrates a
	connect with	coordination with	coordination with	high level of
	another students	another student	another student	coordination with
	design.	where both designs	where both designs	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	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.

#### **504**

- 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