Rapid Prototyping & 3D Printing

KID SPARK EDUCATION

Unit Overview:

In this unit, students will learn the basics of how to create custom, 3D printed components using Tinkercad. Students will gain confidence as they design and print a custom airplane propeller that snaps onto a model airplane. Then, students will have an opportunity to apply what they have learned throughout the unit as they participate in a fun free build challenge.

> **Recommended Grade Level:**
> 6 - 8
>
> **Kid Spark STEM Lab:**
> Engineering Pathways **OR**
> Young Engineers **OR**
> SnapStack

Alignment to STEM Standards:

The table below highlights how this unit is aligned to the Next Generation Science Standards (NGSS) and the International Society for Technology in Education Standards (ISTE).

- ⚙ NGSS Disciplinary Core Ideas (DCI) are standards related to content knowledge.
- ⚙ NGSS Science and Engineering Practices (SEP) and Crosscutting Concepts (CCC) provide a foundation for all scientific and engineering disciplines and are particularly important to develop in young students.
- ⚙ ISTE standards are designed to prepare students to thrive in a constantly evolving technological landscape. **Click here** to view ISTE standards.

Lessons & Assessment	NGSS DCI	NGSS SEP	NGSS CCC	ISTE
Lesson 1: Taking Flight, Part 1 (30 - 40 Min.) In this lesson, students will start out using Kid Spark engineering materials to assemble an airplane model that is missing a propeller. Then, students will set up a Tinkercad account and explore the Tinkercad workspace.	Engineering design	Developing & using models	Systems & system models	Innovative designer
Lesson 2: Taking Flight, Part 2 (30 - 40 Min.) In this lesson, students will explore Kid Spark's 3D virtual parts library. Students will also learn how to import and manipulate objects in Tinkercad as they prepare to create a new propeller for the airplane they built in Part 1.	Engineering design	Asking questions & defining problems	Structure & function	Innovative designer
Lesson 3: Taking Flight, Part 3 (40 - 60 Min.) In this lesson, students will learn how to use some of the basic tools in Tinkercad as they create a custom propeller for their airplane. Students will create a 3D, virtual propeller and prepare it for 3D printing.	Engineering design	Using mathematics	Scale, proportion, & quantity	Innovative designer
Lesson 4: Taking Flight, Part 4 (120 Min.) In this lesson, students will learn how to 3D print the custom airplane propeller they designed throughout the previous lessons. After the propeller has successfully printed, students will clean it and snap it on the airplane.	Engineering design	Developing & using models	Systems & system models	Innovative designer
Lesson 5: Free Build Challenge (120 - 180 Min.) In this lesson, students will be challenged to design a custom, 3D printed component that can be integrated into a Kid Spark project or build.	Engineering design	Planning & carrying out investigations	Stability & change	Innovative designer
Unit Assessment: Rapid Prototyping & 3D Printing In this performance-based assessment, students will complete a series of tasks as they demonstrate their understanding of the core ideas and concepts that were covered throughout this unit.				

Target Vocabulary

The following key terms will be used throughout this unit. It may be helpful to explain these terms as they show up in lessons and challenges.

Align	Group	Paraboloid	Shell thickness
CAD	Layer height	Print speed	Support type
Duplicate	Navigate	Prototyping	Tinkercad
Filament	Nozzle size	Rotate	Workplane

Additional Unit Resources

The following videos and articles are a great resource when teaching the concepts that are covered throughout this unit.

Kid Spark 3D virtual parts library:
kidsparkeducation.org/3D-Print

Print quality troubleshooting guide:
simplify3d.com/support/print-quality-troubleshooting/

Using 3D printing to teach math and science (article):
weareteachers.com/3d-printing-math-science/

How to use 3D printers in the classroom (article):
resourced.prometheanworld.com/use-3d-printers-classroom/