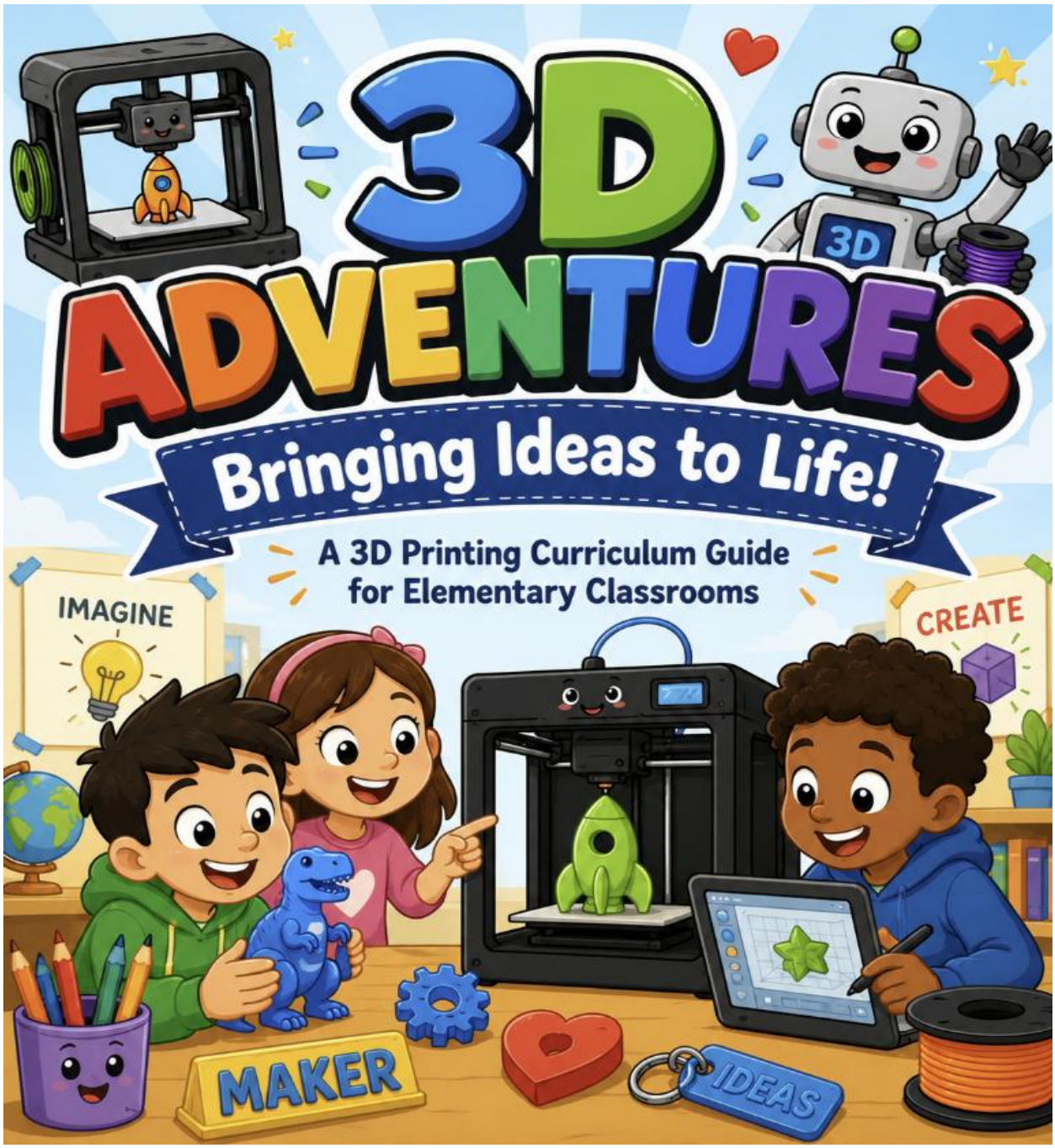


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Project Overview

"The best way to predict the future is to invent it."
— **Alan Kay**

3D Adventures: Bringing Ideas to Life is a hands-on STEM curriculum that introduces elementary students to the exciting world of 3D printing through creativity, engineering, and problem-solving. Students become designers and innovators as they research ideas, create digital models, observe the printing process, and reflect on their work.

At the heart of this curriculum is a **3D Printing Center**, where students rotate through engaging stations focused on research, design, engineering, printing, and reflection. These activities promote creativity, collaboration, critical thinking, and perseverance while introducing real-world STEM concepts.

This guide provides teachers with practical strategies, affordable classroom recommendations, free online resources, ready-to-use lesson ideas, and student activities that make integrating 3D printing into the elementary classroom both simple and engaging.

What You'll Find in This Packet

- A complete guide to creating a classroom **3D Printing Center**
- Recommendations for affordable 3D printers and classroom materials
- Information about kid-friendly design software
- Free websites for downloading and researching 3D models
- Ready-to-use lesson plans and classroom activities
- Engineering Notebook and assessment ideas, implementation tips, and helpful resources

Goals & Objectives

Project Goal

The goal of this project is to introduce elementary students to the exciting world of 3D printing through engaging, hands-on STEM experiences. By designing, researching, and creating three-dimensional models, students will strengthen their creativity, critical thinking, collaboration, and problem-solving skills while exploring the engineering design process.

Student Learning Objectives

By participating in this project, students will be able to:

- Explain how a 3D printer creates physical objects.
- Identify the steps of the Engineering Design Process.
- Research and evaluate 3D models using free online repositories.
- Create or modify simple digital models using Tinkercad.
- Demonstrate creativity and problem-solving while designing original objects.
- Practice safe and responsible use of classroom technology.
- Reflect on their learning and communicate how their ideas developed from concept to final product.

Teacher Learning Objectives

After completing this workshop, teachers will be able to:

- Identify the features of an affordable classroom 3D printer.
- Set up and manage a classroom 3D Printing Center.
- Introduce students to Tinkercad and other free 3D design resources.
- Utilize free online repositories such as MakerWorld and Thingiverse to locate classroom-ready models.
- Implement engaging STEM lessons that integrate creativity, engineering, and technology.

Florida Standards

The following Florida B.E.S.T. and Computer Science Standards are addressed throughout this project as students research, design, create, and reflect during the 3D printing process.

Mathematics

MA.1.GR.1.1

Identify, compare, and sort two- and three-dimensional figures based on their defining attributes. Students identify and use geometric shapes while creating and analyzing 3D models.

MA.2.M.1.1

Measure the length of an object using customary or metric units. Students measure and compare the dimensions of printed objects while evaluating and improving their designs.

Science

SC.1.N.1.2

Using the five senses as tools, make careful observations and describe objects in terms of shape, size, texture, color, and other observable properties. Students observe, analyze, and describe 3D printed objects throughout the design and printing process.

Computer Science

SC.K2.CS-CC.1.2

Use computing technology appropriately to create and communicate ideas. Students use Tinkercad and other digital tools to design original 3D models.

SC.K2.CS-DA.1.3

Recognize that digital tools can be used to solve problems and create new products. Students use technology to design, modify, and print three-dimensional objects while applying the Engineering Design Process.

Why 3D Printing in the Elementary Classroom?

3D printing transforms students from consumers of technology into creators. Through hands-on design, research, and engineering, students develop creativity, problem-solving, collaboration, and critical thinking skills while bringing their ideas to life. It also provides meaningful opportunities to integrate STEM concepts across multiple subject areas in an engaging and memorable way.

Benefits for Students

- Encourages creativity and innovation
- Develops problem-solving skills
- Promotes collaboration and teamwork
- Strengthens STEM and engineering concepts
- Builds confidence through hands-on learning
-

Benefits for Teachers

- Easy to integrate into existing lessons
- Supports project-based and STEM learning
- Uses free software and online resources
- Increases student engagement and participation

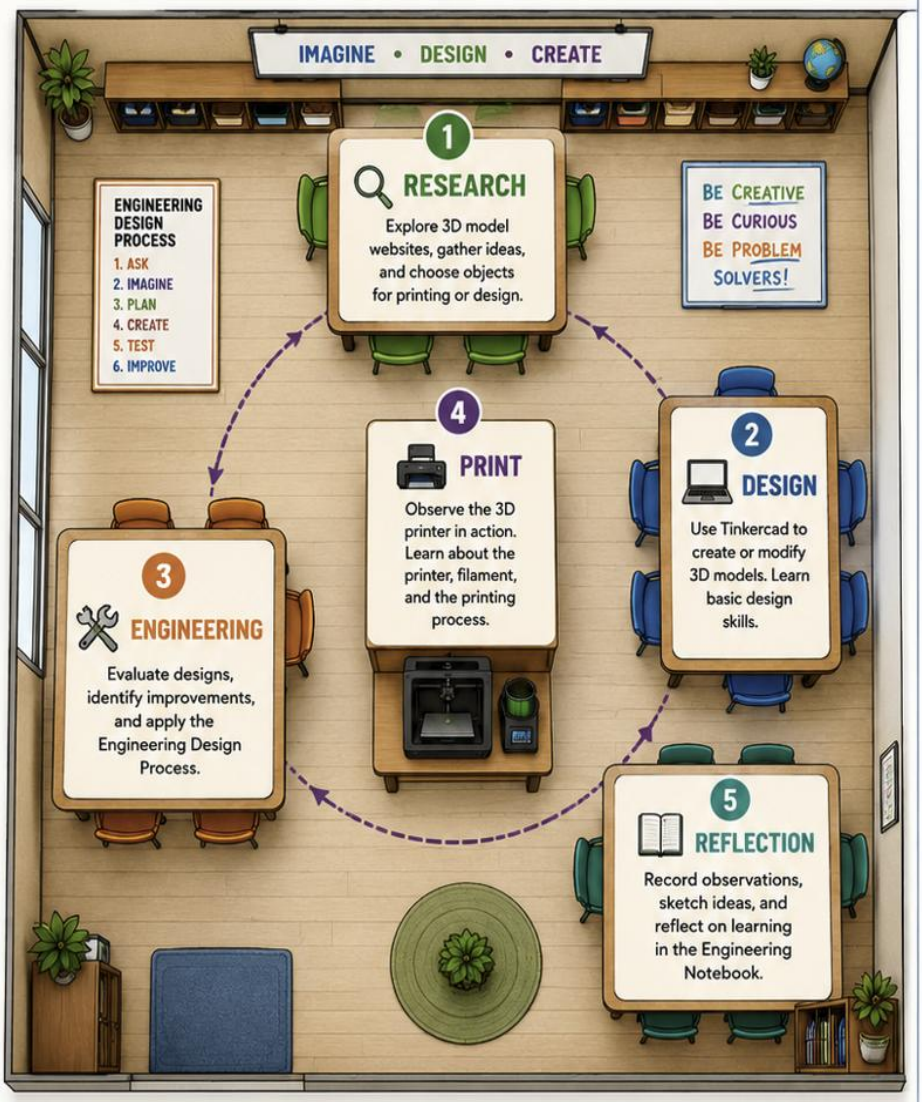
💡 **Teacher Tip**

Start small. You don't need every student to create an original design on the first day. Begin by allowing students to explore and print existing models before introducing Tinkercad and original design challenges.

CREATING A 3D PRINTING CENTER

An Engaging, Hands-On Learning Environment

A 3D Printing Center allows students to explore the engineering design process through hands-on learning and collaboration. Students rotate through stations to research, design, engineer, print, and reflect.



THE 3D PRINTING CENTER STATIONS

1 RESEARCH

- Explore websites like MakerWorld, Thingiverse, Printables, and more.
- Find and evaluate models.
- Gather inspiration for original ideas.

2 DESIGN

- Use Tinkercad to create or modify 3D models.
- Learn to resize, rotate, combine, and group shapes.
- Save and prepare models for printing.

3 ENGINEERING

- Apply the Engineering Design Process.
- Plan, test, and refine designs.
- Identify problems and improvements.

4 PRINT

- Observe the 3D printer in action.
- Learn about printer parts and how it works.
- Discuss filament types and print settings.

5 REFLECTION

- Record what was learned.
- Sketch and write ideas for improvement.
- Reflect on the process and final product.

ROTATION ROUTE

Students rotate clockwise from one station to the next. Each group spends 15–20 minutes at each station (or as time allows).

SAMPLE ROTATION SCHEDULE

Time	Group 1	Group 2	Group 3	Group 4	Group 5
0:00 – 0:20	1	2	3	4	5
0:20 – 0:40	2	3	4	5	1
0:40 – 1:00	3	4	5	1	2
1:00 – 1:20	4	5	1	2	3
1:20 – 1:40	5	1	2	3	4

CENTER SUCCESS TIPS

- Keep printed models, tools, and supplies organized in labeled bins.
- Establish clear expectations for each station.
- Use job cards to assign student roles.
- Encourage teamwork, respect, and responsible use of equipment.
- One group prints while others continue learning at their stations.

TEACHER TIP: Only one group needs to use the printer at a time. While one group is printing, the other groups continue learning at the other stations, maximizing instructional time and engagement.

Choosing a Classroom 3D Printer

Recommended Classroom 3D Printers

The following printers are recommended based on ease of use, reliability, print quality, and classroom implementation. Both are excellent choices for elementary STEM programs.

🖨️ Flashforge Adventurer 5M Pro (300)



Best for: Single-color classroom printing

The Flashforge Adventurer 5M Pro is an enclosed printer that is easy to operate and delivers fast, reliable, high-quality prints. Its automatic bed leveling and quiet operation make it an excellent choice for everyday classroom use.

🌈 Bambu Lab P1S Combo ($550)



Best for: Multi-color printing

The Bambu Lab P1S Combo includes the Automatic Material System (AMS), allowing students to create vibrant multi-color prints. It offers excellent print quality, automatic calibration, and fast printing, making it ideal for advanced STEM projects and classroom showcases.

👱 Bambu Lab A1 Mini ($220)



Best for: Budget-friendly classrooms and home Learning. The **Bambu Lab A1 Mini** is an affordable, beginner-friendly 3D printer with automatic bed leveling, fast print speeds, and excellent print quality. Its compact design and optional **AMS Lite** for multi-color printing make it a great choice for teachers and families just getting started.

Understanding 3D Printing Filament

Filament is the material used by a 3D printer to create objects. It comes in many colors and specialty finishes, allowing students to design unique and creative projects.



Recommended Filament

PLA
The best choice for elementary classrooms. PLA is easy to print, affordable, and available in a wide variety of colors.

Silk PLA
Produces a smooth, shiny finish that is great for awards, ornaments, and display pieces.

Rainbow PLA
Gradually changes colors during printing, creating eye-catching models that students love.

Glow-in-the-Dark PLA *(Optional)*
A fun choice for special STEM projects and classroom demonstrations.

💡 Teacher Tip
Keep several colors of **PLA** on hand for everyday classroom projects, and use specialty filaments like **Silk** or **Rainbow PLA** to make showcase projects extra exciting.

Free Software for Students

Creating a 3D model is the first step in the design process. The following free programs are beginner-friendly and provide students with opportunities to develop creativity, spatial reasoning, and problem-solving skills.

Tinkercad ⭐ ***Recommended***
A free, web-based design program that allows students to create 3D models by dragging, dropping, resizing, and combining simple shapes. Its visual interface makes it an excellent choice for beginners.

3D Slash
Offers a free version that uses a block-building system similar to Minecraft. Students build models by adding and removing cubes, making it an engaging introduction to 3D design.

BlocksCAD
A free, block-based coding platform that allows students to create 3D models while introducing basic computational thinking and logical sequencing.

💡 **Teacher Tip:** For younger students (Grades K–2), begin with **Tinkercad** or **3D Slash**, as both are highly visual and intuitive. **BlocksCAD** is better suited for older elementary students who are ready to explore simple coding concepts.

Free 3D Model Websites

Students do not always need to design from scratch. These free websites provide thousands of ready-to-print models that students can explore, download, and use for inspiration before creating their own designs.

⭐ **MakerWorld**
(Recommended)
A free library of high-quality 3D models with a user-friendly interface. It offers educational models, toys, tools, decorations, and STEM-related projects suitable for classroom use.

Printables
A free collection of printable models organized into easy-to-browse categories. Many designs include detailed instructions and are ideal for classroom activities.

Thingiverse
One of the largest online collections of free 3D printable models. Teachers and students can browse a wide variety of educational resources, games, and creative projects.

Thangs
A searchable platform that allows users to discover models from multiple 3D printing communities in one place, making it a great resource for finding unique designs.

💡 **Teacher Tip:** Encourage students to analyze existing models before creating their own. Ask questions such as, *"What shapes do you recognize?"*, *"What problem does this object solve?"*, and *"How could you improve this design?"*

Lesson Plan 1: Introduction to 3D Printing

Grade Level: K–5 (adaptable)

Time: 45–60 minutes

Objective
Students will learn how a 3D printer works, identify the purpose of filament, explore printable models on MakerWorld, and collaborate to identify a useful object they would like to print for their classroom.

Materials
- 3D printer
- PLA filament
- Computer with internet access
- Projector or interactive display
- Student Engineering Notebook
- Pencils

Lesson Procedure
1. Introduction (10–15 minutes)

Introduce students to the classroom 3D printer.
Discuss:
- What is a 3D printer? How does it work? What is filament? How does a digital design become a real object? Show examples of several 3D printed classroom items.

---

2. Explore Together (10 minutes)

As a class, visit MakerWorld.
Explore different printable models and discuss:

- What does this object do? Why would someone print it? Could this be useful in our classroom? What other classroom items could we create?

---

3. Engineering Challenge (15–20 minutes)

Place students into small groups.
Each group discusses:
"What is something our classroom needs that could be 3D printed?"
Students record their ideas in their Engineering Notebook, including:

- What they want to print? Why it would help the classroom? A simple sketch of their idea

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4. Research (10–15 minutes)

Groups search MakerWorld to see if their idea already exists.
If they find a model, they save or bookmark it.
If they cannot find one, they discuss how they might design it themselves in a future lesson using Tinkercad.

Assessment

Students will be assessed on:

- Participation in classroom discussions
- Collaboration with group members
- Completion of their Engineering Notebook
- Ability to explain why their chosen object would benefit the classroom

---

Extension Activity

As a class, vote on one student-selected design to print. Once completed, discuss how the printed object could improve the classroom and identify any changes that could make it even better.

💡 **Teacher Tip**

Encourage students to think like engineers by asking, "What problem are we trying to solve?" Designing objects with a real purpose helps students understand that engineering is about creating solutions, not just making interesting objects.

Lesson Plan 2: Creating Your First 3D Name Tag

Grade Level: K–5 (adaptable)
Time: 45–60 minutes

Objective
Students will use Tinkercad to create a personalized name tag while learning the basic tools used in 3D design.

Materials

- Computers or tablets
- Internet access
- Tinkercad
- Student Engineering Notebook
- Projector

Lesson Procedure

1. Introduction (5 minutes)
Review the previous lesson by asking:

- What is a 3D printer?
- What is filament?
- What website did we explore?

Explain that today students will create their first 3D model.

---

2. Teacher Demonstration (15 minutes)
Model the following steps in Tinkercad while students follow along:

1. Click **Create New Design**.
2. Drag a **Box** onto the workplane and resize it to create the base.
3. Add the **Text** shape and type your first name.
4. Resize and center the text using the **Align** tool.
5. Add one simple decorative shape (optional).
6. Select all objects and click **Group**.
7. Rename and save the project.

3. Independent Practice (20 minutes)

Students create their own name tag while the teacher circulates and provides assistance.

Encourage students to check:

- Is my name centered?
- Did I group all my shapes?
- Did I save my project?

---

4. Reflection (10 minutes)

Students complete a reflection in their Engineering Notebook:

- Draw your name tag.
- What was the easiest step?
- What was the most challenging?
- What would you improve before printing?

Assessment

Students will be assessed on their ability to:

- Use basic Tinkercad tools.
- Create a completed name tag.
- Save their design.
- Reflect on their learning.

💡 **Teacher Tip:** Print one or two sample name tags first so students can compare the digital design with the finished product before the class print.

Lesson Plan 3: Bringing Our Designs to Life

Grade Level: K–5 (adaptable)
Time: 45–60 minutes

Objective

Students will observe the 3D printing process, compare their digital design to the finished product, and reflect on possible improvements.

Materials

- 3D printer
- PLA filament
- Student name tag files
- Student Engineering Notebook

Lesson Procedure

1. Review (5 minutes)

Review the previous lesson and ask:

- What software did we use?
- What did we create?
- What do you think your finished name tag will look like?

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2. Print Demonstration (15 minutes)

Demonstrate how to prepare the name tags for printing.
Show students how to:

- Open the file.
- Arrange models on the build plate.
- Slice the design.
- Send the file to the printer.

Discuss how the printer builds objects one layer at a time using filament.

3. Observation (15 minutes)
Students observe the printing process and identify the printer's main parts, including the nozzle, build plate, and filament spool. Students record one or two observations in their Engineering Notebook.

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4. Reflection (10 minutes)
After receiving their printed name tags, students compare the finished product to their digital design.
Discuss:

- What turned out well?
- What would you change?
- What did you learn about 3D printing?

Assessment
Students will be assessed on their participation, observations, and reflection on the printing process.

💡 **Teacher Tip:** If time does not allow every student's project to print during class, continue printing throughout the week and celebrate each completed print as students receive their finished name tag.

Student Activities & Engineering Notebook

The Engineering Notebook encourages students to think like engineers by documenting their ideas, observations, and reflections throughout the 3D printing process. Rather than simply completing worksheets, students plan, sketch, evaluate, and improve their designs while recording their learning.

The following activities can be used individually or combined into a student engineering notebook.

Included Activities

- **My Classroom Idea** – Brainstorm an object that would improve the classroom.
- **3D Model Research** – Explore MakerWorld and record interesting designs.
- **My Name Tag Design** – Sketch and label a personalized name tag before creating it in Tinkercad.
- **Print Observation Log** – Record observations while watching the 3D printer in action.
- **Design Reflection** – Compare the digital model to the printed object and identify possible improvements.

Assessment & Rubrics

Student learning may be assessed through participation, collaboration, completed activities, and the rubric below.

3D Printing Project Rubric

Criteria	4 - Exceeds Expectations	3 - Meets Expectations	2 - Developing	1 - Beginning
Participation	Actively participated and contributed ideas throughout all activities.	Participated appropriately in most activities.	Participated with occasional reminders.	Rarely participated or needed frequent support.
Design & Creativity	Created an original, thoughtful design with excellent attention to detail.	Created a complete design that met the project expectations.	Design was partially complete or needed revisions.	Design was incomplete or required significant assistance.
Technology Skills	Used Tinkercad and other digital tools independently and confidently.	Used digital tools with minimal assistance.	Needed frequent assistance using digital tools.	Required constant teacher support.
Engineering Reflection	Thoughtfully reflected on the design process and suggested meaningful improvements.	Completed the reflection and identified at least one improvement.	Reflection was partially complete.	Reflection was incomplete or missing.

Overall Performance

☐ 16–14 points – Outstanding Engineer

☐ 13–10 points – Skilled Designer

☐ 9–6 points – Developing Engineer

☐ 5–4 points – Keep Creating!

Materials & Resources

Classroom Materials

- 3D printer (Flashforge Adventurer 5M Pro or Bambu Lab P1S Combo)
- PLA filament (variety of colors)
- Computers or tablets with internet access
- Projector or interactive display
- Student Engineering Notebooks
- Pencils and colored pencils
- Optional: calipers, rulers, key rings, or magnets for extension projects

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Free Software

- Tinkercad – Beginner-friendly 3D design software

Free 3D Model Websites

- MakerWorld
- Thingiverse
- Printables
- Thangs

Additional Resources

- Beginner 3D printing tutorials
- Tinkercad classroom lessons
- Engineering Design Process posters
- Classroom STEM extension activities

References

Autodesk. *Tinkercad*. https://www.tinkercad.com
MakerBot. *Thingiverse*. https://www.thingiverse.com
Prusa Research. *Printables*. https://www.printables.com
Physna Inc. *Thangs*. https://thangs.com



MY 3D PRINTING PLAN!

My Name: _____

1. My Idea:

Draw your design!

Sketch your 3D design here.

2. What will you make?

I will create a _____

3. Materials Needed:

What materials will you use?

- Filament color: _____
- Other materials: _____
- Other materials: _____

4. Steps to Create It:

Write the steps to make your project:

1. _____
2. _____
3. _____

Why will your project be awesome? _____



3D PRINTING REFLECTION

My Name: _____

1. My 3D Creation:

I made a. _____

2. What I Learned:

- One thing I learned is: _____
- Another thing I learned is: _____

3. Challenges I Faced:

- One challenge I had was: _____

  I solved it by: _____

4. My Favorite Part:

The best part of my project was: _____

_____

_____

_____



What would I make next?

_____