

LESSON 2: PROBLEM IDENTIFICATION & PROBLEM SOLVING

Invention Process Steps: Identifying and Ideating

Grade Level: 3-5

Base Time: 45 minutes



ESSENTIAL QUESTION

How can creative brainstorming lead to more and better ideas to solve a problem?

LESSON OVERVIEW

This lesson will introduce students to the concept of “ideating” and generating ideas through creative and critical thinking to identify problems and to address these problems and their possible solutions. First students will think more about the problems they wish to solve and then work to narrow down their choices. Next, they will focus on a technique used to brainstorm which can be applied to the development of their own original invention. Practicing ideation will encourage students to imagine new ideas quickly and work together to improve those ideas.

OBJECTIVE

Students will be able to:

- Engage in brainstorming techniques independently and with peers.
- Narrow down ideas based on practicality and feasibility using critical thinking
- Determine which solutions best address a specific problem or need
- Understand the value of collaboration during ideation.

LESSON STANDARDS

Next Generation Science Standards:

- 3-5-ETS1-1
- 3-5-ETS1-2

Common Core ELA Standards:

- CCSS.ELA-LITERACY.SL 3.1, 4.1, 5.1
- CCSS.ELA-LITERACY.SL 3.3, 4.3, 5.3
- CCSS.ELA-LITERACY.W 3.2, 4.2, 5.2
- CCSS.ELA-LITERACY.W 3.10, 4.10, 5.10

MATERIALS

Resources for the Educator

Materials

- YIP Inventor’s Journals
- [Worksheet: Problems All Around](#) (included in Inventor’s Journal)
- [Worksheet: Brainstorming Problems](#) (included in Inventor’s Journal)

- [Worksheet: Will My Idea Work?](#) (included in the Inventor’s Journal)
- Chart paper or poster to post “Ground Rules for Brainstorming” (optional)
- Paperclips (5 for each student/group)
- Paper for notetaking

NOTES FOR THE EDUCATOR

Educator may lead the following lesson plan with flexibility to adapt as needed to fit technology and class format.

This is a continuation of Lesson 1 and students will be narrowing down the ideas for their invention project. Students may work in groups and/or individually on these projects as you prefer.

Students should begin using an invention journal or logbook (provided by YIP or an alternative) if they did not do so in Lesson 1. You should also decide if students can take these journals home or if they will be kept in the classroom. The Inventor’s Journals should be used in each YIP lesson. YIP provides hard copies of the YIP Inventor’s Journals to all students, or you can download and copy or use the digital version found on the Young Inventor’s Program website:

<https://www.unh.edu/leitzel-center/young-inventors-program/teach/curriculum>.

In this lesson, when introducing the concept of ideating/brainstorming, it is recommended that you establish guidelines and a safe space for class brainstorming session. Suggested ground rules to create a positive and open sharing space include:

- Defer Judgment- accept all ideas without comment in first stage of brainstorming.
- Work for Quantity- all ideas should be recorded and allow ample time for everyone to contribute.
- Piggy-Back- encourage students to combine or improve ideas that may already be on the list.
- Freewheel- encourage crazy ideas. The most creative are often dismissed but should be considered.
- Everyone Participates- all students should be involved in the brainstorming process.

Depending on the format of class, you may choose to post a list of “Ground Rules for Brainstorming” where everyone can see them and review them throughout the invention unit.

INSTRUCTION & ACTIVITIES

Educator Instruction:

NOTE: If not done in Lesson 1 and or at home discuss problem identification and allow students time to complete/finish the Problems All Around Worksheet in the YIP Inventor’s Journal. (If students are ready, skip to the next part of the lesson after the Problems All Around activity.)

Discuss how identifying the problem is the first step of the Invention Process and starting to invent. Ask students to begin to think about the problems around them or the things that they wish could be made easier (school, home, activities) and the people who have those problems (themselves, family, friends, pets). You might give some prompts to help them get started:

- Chores that they have that they wish were easier- what could make them easier?
- Things that are hard for them or others to do

- Things to help their pets or animals in nature
- And improvement for a hobby (sport, music, craft, etc.) to make it more fun or easier to do

Students are also encouraged to talk to others to ask them what things in their lives bother them or are problems to help generate ideas.

Activity: Problems All Around (10 minutes + time additional time before next class)

Have students complete the Problems All Around Worksheet in the YIP Inventor's Journal. You may ask students to complete this worksheet in class or at home.

Educator Instruction:

Discuss the concept of "ideating", more commonly known as "brainstorming". Ask students if they know what it means to "brainstorm". Allow them to share ideas. Brainstorming requires quick thinking and creativity. Many ideas are produced, but value judgements are avoided in a brainstorming process.

Ideating/Brainstorming is an important step in the Invention Process- it is used both when exploring a problem and also when thinking about and designing a solution.

Ideating is thinking out of the box and exercising their creative brains. There are no right or wrong ideas when ideating and there is no limit to the ideas that can be generated. In a brainstorming session, the more ideas, the better and there are no silly ideas. All ideas are to be considered.

NOTE (as stated in Notes for the Educator above): It is recommended that you establish guidelines and a safe space for class brainstorming session. Depending on the format of class, you may post a list of "Ground Rules for Brainstorming" where everyone can see them and review them throughout the invention unit.

Activity: Paper Clip Challenge (10 minutes)

Distribute a paperclip to each student. Students should work independently.

Challenge students to brainstorm new ways to use the paperclip other than holding paper. They can manipulate the paper clip in any way they see fit. Encourage crazy ideas. Have them write down as many different ideas as they can on a piece of paper.

After 2 minutes, students should find a partner to work with and complete the same task. Can they come up with more ideas by working together?

After another 2 minutes, ask for volunteers to share their ideas. Remind students that this is a brainstorming session, so all ideas are valued. No one laughs at anyone's idea. The students might only have a few ideas to share. That's OK.

Still working with a partner, give each duo 5 paper clips. Like last time, they should brainstorm as many ways to use some or all of the paper clips for a purpose other than holding paper. They can be combined in any way.

After 2-3 minutes, encourage students to share their ideas. It is likely they have more ideas now.

Finally lead a reflection and ask them to evaluate their process and share observations of what they have learned. Discuss teamwork, collaboration and brainstorming. When did they struggle and how did they get unstuck? Did they get better at thinking outside the box? Explain that thinking creatively (Take Risks and Stay Curious) takes practice and working with others inspires the best ideas.

Educator Instruction:

Now that students have had time to play with “ideation”, it is time to apply that same creative thinking to the problems they identified earlier on their Problems All Around Worksheet.

Activity: Brainstorming Problems (10 minutes)

Even if working in a team, students should do this activity to brainstorm ideas individually. Then allow time for team members to get together to share ideas and begin to narrow down their project.

Have students choose 2-4 problems from their Problems All Around Worksheet. Next, ask them to write or draw solutions for the problems they choose on the Brainstorming Problems Worksheet in their journals. They should use the boxes on the worksheet for each of their solution ideas.

Educator Instruction:

Now students should have several solution ideas to a few problems narrowed down based on their ideation session. The next step is to select one problem and its solution to become their invention project. How do they do this? When narrowing ideas to a final choice, it is important to think about the following points:

- What problem is most critical?
- What problem might affect the most people?
- What solution idea is most realistic and could exist in real life?
- What solution is most realistic for them to do as a school project?
- What solution can be made from available materials (recycled materials and school/craft supplies)?
- Is the solution something that already exists (you can buy it in stores)? If the solution does exist, is there a way to improve it that could be done as a project instead?
- What problem means the most to them? What do they care about? What idea most excites them when they think about creating an invention?

Activity: Will My Idea Work? (10 minutes + optional additional time before next class)

If working in a team, students should be together as a team to complete this next step of the process so that all group members are involved in selecting the final project idea. However, they should still record their ideas and drawings in their own journals so that each student has their own record of the project.

Ask students to complete the Will My Idea Work? Worksheet included in YIP Inventor’s Journal. They will choose 2-3 ideas from their Brainstorming Problems Worksheet and for each idea, they will go through the list of questions on the worksheet to determine which invention idea will become their project.

If time is available, after students complete the Will My Idea Work? Worksheet, have students/teams, pair with another student/team to share their ideas and ask for any other feedback about which idea is most

realistic and practical. Students may also ask others at home for their feedback before selecting their final invention idea. (Or this may be done as a Take Home Assignment, see below).

IDEAS FOR VIRTUAL INSTRUCTION

Activity: Paper Clip Challenge

Ask students to find some paper clips at home (if they do not have paper clips, they can brainstorm with other common objects they may have such as rubber bands, drinking straws, or chip clips). Students should brainstorm new ways to use the paperclip other than holding paper (or if using another item, the items intended use). They can manipulate the paperclip in any way they see fit. Encourage crazy ideas. Have them write down as many different ideas as they can on a piece of paper. You may ask students to submit or share their work using the virtual platform of choice.

Activity: Will My Idea Work?

Ask students to complete the Will My Idea Work? Worksheet. They will choose 2-3 ideas from their Brainstorming Problems Worksheet and for each idea, they will go through the list of questions on the worksheet to determine which invention idea will become their project. If possible, they should share their ideas with someone at home and ask for any other feedback about which idea is most realistic and practical before selecting their final invention project idea.

CHECK FOR UNDERSTANDING

Educator may wish to do one of the following to check for understanding:

1. In a whip share (students go around the room as they give their response- a short one/two word response is ideal for a “whip share”), ask students to say one word that describes their invention idea.
2. Ask students to share why they selected the problem they will solve and their invention idea.

TAKE HOME ASSIGNMENT (OPTIONAL IF GIVING HOMEWORK)

Ask students to share their invention ideas and ask for any other feedback about which idea is most realistic and practical before selecting their final invention project idea.