~ Maker Kit ~
Explore, Imagine, Create, Share

An *Applied Design, Skills and Technologies* Kit
for grades 4-5

compiled by Doug David, Debbie Nelson, Joan Pearce and Carol Walters, SD71

BIG IDEAS

Designs can be improved with prototyping and testing.	Skills are developed through practice, effort, and action.	The choice of technology and tools depends on the task.

Learning Standards

Curricular Competencies	Content
Students are expected to be able to do the following: **Applied Design** *Understanding context* • Gather information about or from potential **users** ***Defining*** • Choose a design opportunity • Identify key features or user requirements • Identify the main objective for the design and any **constraints** ***Ideating*** • Generate potential ideas and add to others' ideas • Screen ideas against the objective and constraints • Choose an idea to pursue ***Prototyping*** • Outline a general plan, identifying tools and materials • Construct a first version of the **product**, making changes to tools, materials, and procedures as needed • Record **iterations** of prototyping ***Testing*** • Test the product • Gather peer feedback and inspiration • Make changes and test again, repeating until satisfied with the product	*Students are expected to use the learning standards for Curricular Competencies from Applied Design, Skills, and Technologies 4–5 in combination with grade-level content from other areas of learning in cross-curricular activities to develop foundational mindsets and skills in design thinking and making.*

Learning Standards (continued)

Curricular Competencies	Content
Making • Construct the final product, incorporating planned changes ***Sharing*** • Decide on how and with whom to **share** their product • Demonstrate their product and describe their process • Determine whether their product meets the objective and contributes to the individual, family, community, and/or environment • Reflect on their design thinking and processes, and their ability to work effectively both as individuals and collaboratively in a group, including their ability to share and maintain a co-operative work space • Identify new design issues **Applied Skills** • Use materials, tools, and technologies in a safe manner, and with an awareness of the safety of others, in both physical and digital environments • Identify the skills required for a task and develop those skills as needed **Applied Technologies** • Use familiar tools and **technologies** to extend their capabilities when completing a task • Choose appropriate technologies to use for specific tasks • Demonstrate a willingness to learn new technologies as needed	

COMMUNICATION
CORE COMPETENCY

The Communication competency encompasses the set of abilities that students use to impart and exchange information, experiences, and ideas, to explore the world around them, and to understand and effectively engage in the use of digital media. Communication competency provides a bridge between students' learning, their personal and social identity and relationships, and the world in which they interact.

1. Connect and engage with others (to share and develop ideas)

Sample "I" Statements

- I ask and respond to simple, direct questions.
- I am an active listener; I support and encourage the person speaking.
- I recognize that there are different points-of-view and I can disagree respectfully.

2. Acquire, interpret, and present information (includes inquiries)

Sample "I" Statements

- I can understand and share information about a topic that is important to me.
- I present information clearly and in an organized way.
- I can present information and ideas to an audience I may not know.

3. Collaborate to plan, carry out, and review constructions and activities

Sample "I" Statements

- I ask and respond to simple, direct questions.
- I am an active listener; I support and encourage the person speaking.
- I recognize that there are different points-of-view and I can disagree respectfully.

4. Explain/recount and reflect on experiences and accomplishments

Sample "I" Statements

- I give, receive, and act on feedback.
- I can recount simple experiences and activities and tell something I learned.
- I can represent my learning, and tell how it connects to my experiences and efforts.

**The profiles emphasize the concept of growing and expanding.
They are progressive and additive.**

CRITICAL THINKING
CORE COMPETENCY

Critical thinking involves making judgements based on reasoning: students consider options; analyze these using specific criteria; and draw conclusions and make judgements. Critical thinking competency encompasses a set of abilities that students use to examine their own thinking, and that of others, about information that they receive through observation, experience, and various forms of communication.

1. Analyze and critique

Sample "I" Statements

- I can show if I like something or not.
- I can identify criteria that I can use to analyze evidence.
- I can analyze evidence from different perspectives.
- I can reflect on and evaluate my thinking, products, and actions.
- I can analyze my own assumptions and beliefs and consider views that do not fit with them.

2. Question and investigate

Sample "I" Statements

- I can explore materials and actions.
- I can ask open-ended questions and gather information.
- I can consider more than one way to proceed in an investigation.
- I can evaluate the credibility of sources of information.
- I can tell the difference between facts and interpretations, opinions, or judgements.

3. Developing ideas

Sample "I" Statements

- I can experiment with different ways of doing things.
- I can develop criteria for evaluating design options.
- I can monitor my progress and adjust my actions to make sure I achieve what I want.
- I can make choices that will help me create my intended impact on an audience or situation.

The profiles emphasize the concept of growing and expanding.
They are progressive and additive.

CREATIVE THINKING
CORE COMPETENCY

Creative thinking involves the generation of new ideas and concepts that have value to the individual or others, and the development of these ideas and concepts from thought to reality.

1. Novelty and value

Sample "I" Statements

- I get ideas when I play. My ideas are fun for me and make me happy.
- I can get new ideas or build on other people's ideas, to create new things within the constraints of a form, a problem, or materials.
- I generate new ideas as I pursue my interests.
- I can develop a body of creative work over time in an area I'm interested in or passionate about.

2. Generating ideas

Sample "I" Statements

- I get ideas when I use my senses to explore.
- I build on others' ideas and add new ideas of my own, or combine other people's ideas in new ways to create new things or solve straightforward problems.
- I deliberately learn a lot about something (e.g. by doing research, talking to others or practising) so that I am able to generate new ideas or ideas just pop into my head.
- I have deliberate strategies for quieting my conscious mind (e.g. walking away for a while, doing something relaxing, being deliberately playful) so that I can be more creative.
- I have interests and passions that I pursue over time.

3. Developing ideas

Sample "I" Statements

- I make my ideas work or I change what I am doing.
- I can usually make my ideas work within the constraints of a given form, problem, and materials if I keep playing with them.
- I build the skills I need to make my ideas work, and usually succeed, even if it takes a few tries.
- I use my experiences with various steps and attempts to direct my future work.
- I can persevere over years if necessary to develop my ideas. I expect ambiguity, failure, and setbacks, and use them to advance my thinking.

The profiles emphasize the concept of growing and expanding.
They are progressive and additive.

A framework for Wonder

Significant Content: A focus on the Applied Design, Skills and Technologies Curriculum. Students should find the content to be significant and engaging in terms of their own lives, their interests and wonders.

A Need to Know: Activate learner curiosity and wonder! Engage student interest and initiate questioning with an entry event: this could occur through sharing a curious object, a story, a video clip, or a photograph that inspires wonder.

A Driving Question: A question that captures the heart of the wonder in clear, compelling language, giving students a sense of purpose and challenge.

Authentic Purpose: Learners share their stories of curiosity and design and explain how their design contributes positively in some way to the individual, family, community and/or environment.

Voice and Choice: Guided by the teacher, learners have voice and choice in terms of investigating their wonders; the tools, materials and technologies they will explore and use, how they will represent their learning and how they will structure their time.

Revision and Reflection: Learners go through a process of trial and error to make changes, solve problems and incorporate new ideas. Learners reflect on their ability to work effectively both as individuals and collaboratively in a group.

In-depth Inquiry: Learners follow a trail that begins with their own curiosity and wonder; identifying needs and opportunities for design through exploration, generating ideas from experiences and interests, and choosing an idea to pursue.

Core Competencies: questioning and investigating, connecting and engaging with others to share and develop ideas, collaborating to plan, carry out and review constructions; contributing to community and caring for the environment.

Adapted from: *Larmer, J. & Mergendoller, J. (2012). 8 essentials for project-based learning. Originally published in 2010 in Educational Leadership, 68(1), 34.*

Inspiring Wonder in the Maker Space

Creating Spaces that inspire Wonder

Consider sharing:
Objects that inspire Wonder
Books that inspire Wonder
Photos that inspire Wonder: (i.e. National Geographic photos)
Websites that inspire Wonder:
http://thekidshouldseethis.com/
http://wonderopolis.org/wonders

Offering Different Kinds of Wonders

Wonders you Can Test
How-to Wonders (i.e. How to make origami? How to make something with Lego? How to do magic tricks?)
Wonders from the Heart (i.e. How do I be a kind friend?)
Research Wonders: *Kid Rex* search engine; *World Book* on our Destiny site

Inquiry-Based Learning

Inquiry-based learning is a dynamic and emergent process that builds on students' natural curiosity about the world in which they live. Inquiry places ideas at the center of the learning experience. Teachers using an inquiry-based approach encourage students to ask and genuinely investigate their own questions about the world. Teachers further facilitate students' learning by providing a variety of tools, resources, and experiences that enable learners to investigate, analyze, reflect, and rigorously discuss potential solutions to their own questions about a topic the class is studying. (An excerpt from www.naturalcuriosity.ca)

Types of Inquiry

Structured inquiry

- the teacher determines the big idea, and what the students will come to understand by the end of the inquiry
- the teacher provides the guiding questions
- the students will help create the plan and guide the inquiry with their questions, interests, ideas, analysis, reflections and understandings

Guided inquiry

- the teacher determines the big idea or topic and the students and/or the teacher come up with the questions
- the students are responsible for designing and following their own procedures to test the question and then communicate their results and findings

Open inquiry

- the students determine the purpose and formulate the questions
- the students design the procedures, gather the materials and communicate their findings
- the teacher facilitates, supports, asks questions and redirects the investigation

Adapted from Michelle Hikida, mhikida@sd38.bc.ca ~ *BCPTA Fall Conference, 2016*

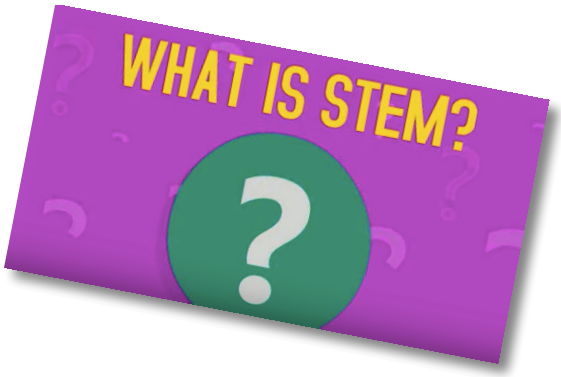
Quick video clips inspire Wonder

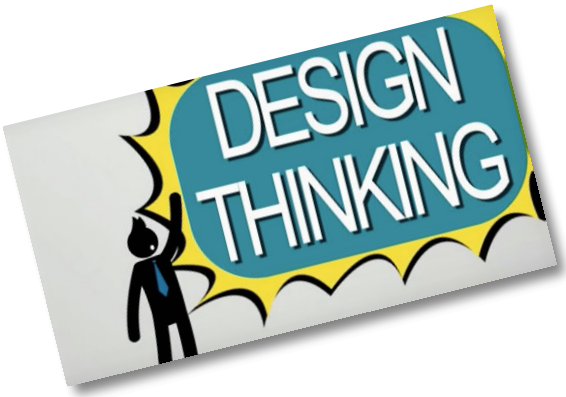
What is a MakerSpace? (1:02)

https://www.youtube.com/watch?v=NLEJLOB6fDw

What is STEM? (1:06, **stop at :34**)
https://www.youtube.com/watch?v=8yog11u8HTc

Why STEM? (1:00) *funny*
https://www.youtube.com/watch?v=8V8EjEzIpkg





What is Design Thinking? (1:50)

https://www.youtube.com/watch?v=a7sEoEvT8l8

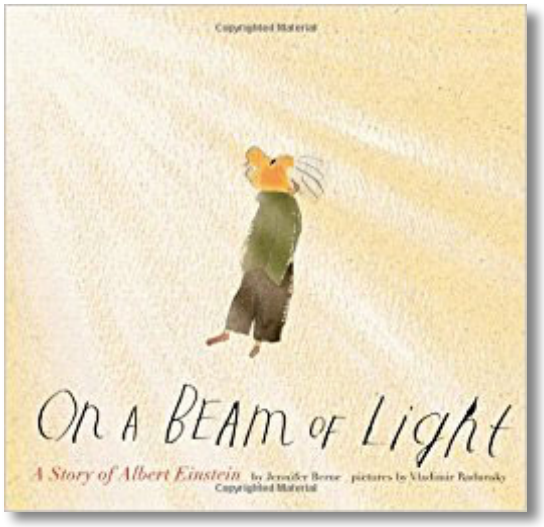
7 Things That Happen When Students Own Their Learning (1:40)

https://www.youtube.com/watch?v=N7S9kyk-odA

What is Genius Hour? (1:42)

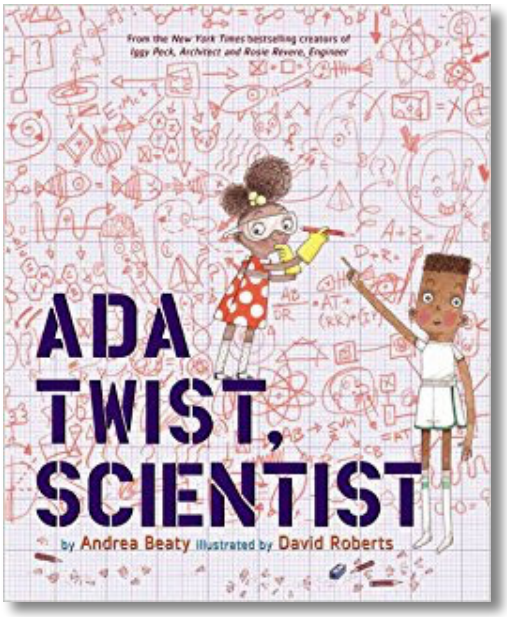
https://www.youtube.com/watch?v=2n7EelMbzG0

Books inspire a Maker Mindset

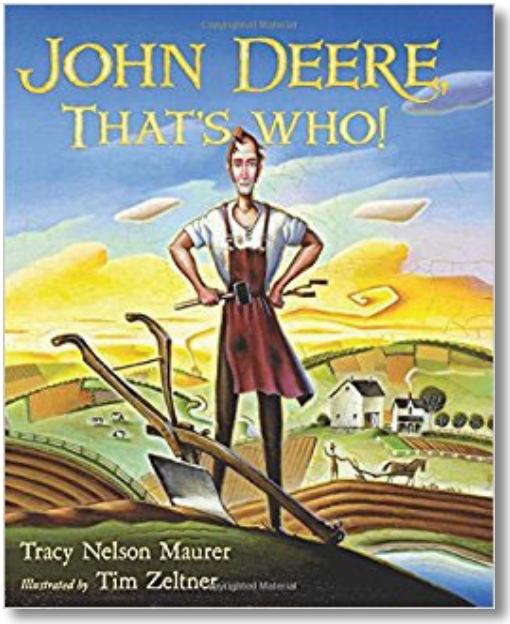


Travel along with Einstein on a journey full of curiosity, laughter, and scientific discovery. Adults and children alike will appreciate this moving story of the powerful difference imagination can make in any life.

Ada Twist has a boundless imagination and has always been hopelessly curious. Why are there pointy things stuck to a rose? Why are there hairs growing inside your nose? When her house fills with a horrific, toe-curling smell, Ada knows it's up to her to find the source. What would you do with a problem like this? Not afraid of failure, Ada embarks on a fact-finding mission and conducts scientific experiments, all in the name of discovery. But, this time, her experiments lead to even more stink and get her into trouble!

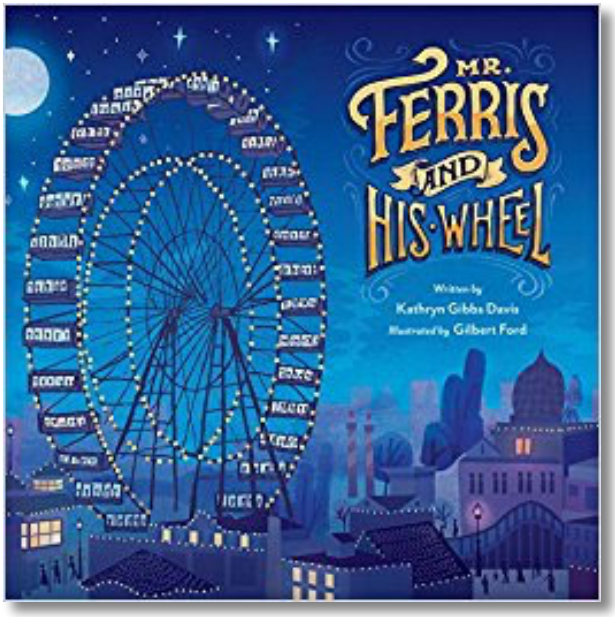


Books inspire a Maker Mindset

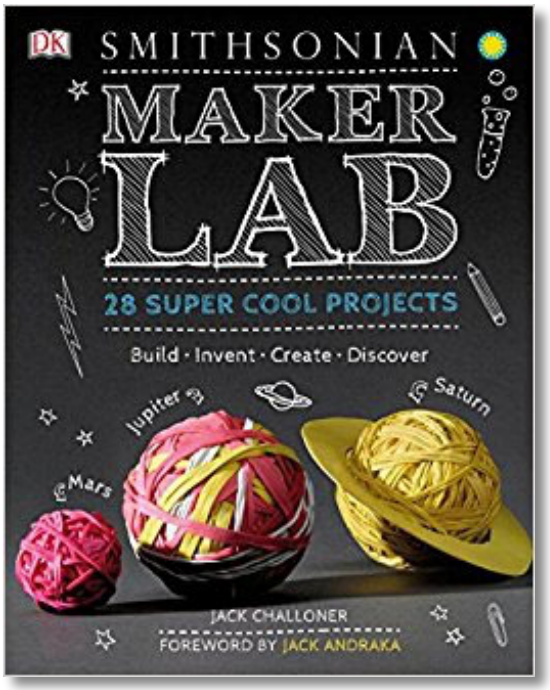


Back in the 1830s, who was a young blacksmith from Vermont, about to make his mark on American history? John Deere, that's who! Who moved to Illinois, where farmers were struggling to plow through the thick, rich soil they called gumbo? Who tinkered and tweaked and tested until he invented a steel plow that sliced into the prairie easy as you please? Long before the first tractor, who changed farming forever? John Deere, that's who!

Capturing an engineer's creative vision and mind for detail, this fully illustrated picture book biography sheds light on how the American inventor George Ferris defied gravity and seemingly impossible odds to invent the world's most iconic amusement park attraction, the Ferris wheel. A fun, fact-filled text by Kathryn Gibbs Davis combines with Gilbert Ford's dazzling full-colour illustrations to transport readers to the 1893 World's Fair, where George Ferris and his big, wonderful wheel lifted passengers to the skies for the first time.

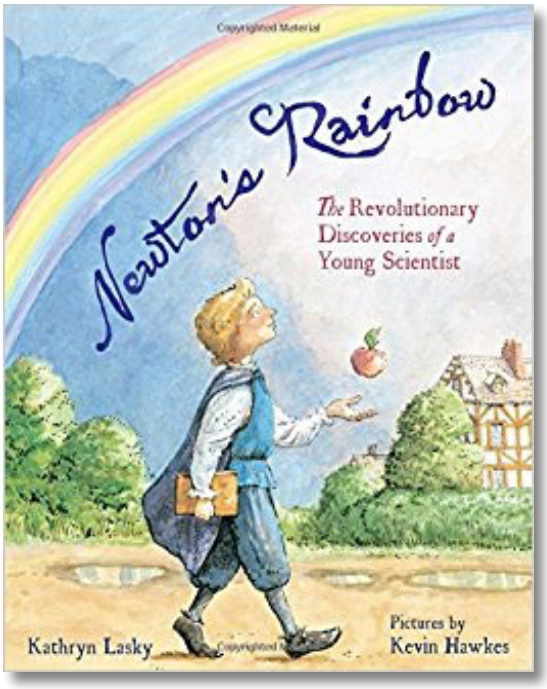


Books inspire a Maker Mindset

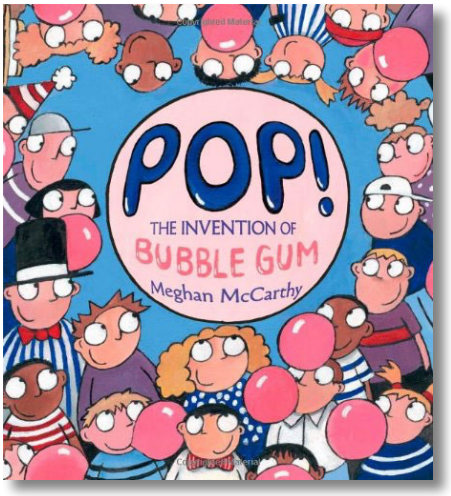


Each step-by-step activity is appropriate for kids ages 8–12, and ranked easy, medium, or hard, with an estimated time frame for completion. Requiring only household materials, young makers can build an exploding volcano, race balloon rocket cars, construct a solar system, make a lemon battery, and more. Photographs and facts carefully detail the "why" and "how" of each experiment using real-world examples to provide context so kids can gain a deeper understanding of the scientific principles applied.

Famed for his supposed encounter with a falling apple that inspired his theory of gravity, Isaac Newton (1642–1727) grew from a quiet and curious boy into one of the most influential scientists of all time. Newton's Rainbow tells the story of young Isaac—always reading, questioning, observing, and inventing—and how he eventually made his way to Cambridge University, where he studied the work of earlier scientists and began building on their accomplishments. This colourful picture book biography celebrates Newton's discoveries that illuminated the mysteries of gravity, motion, and even rainbows, discoveries that gave mankind a new understanding of the natural world, discoveries that changed science forever.

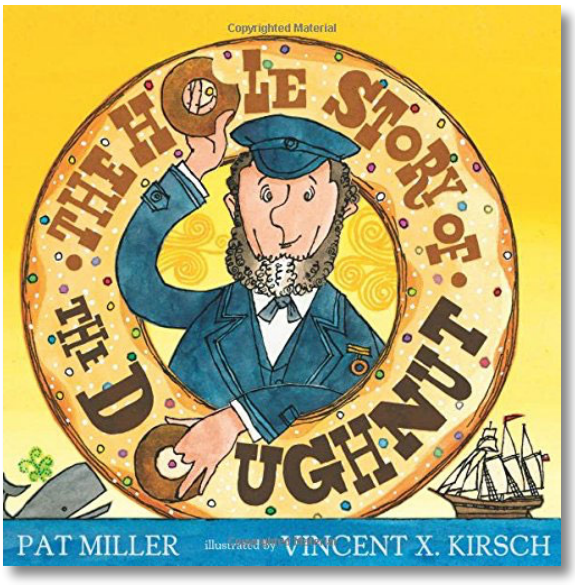


Books inspire a Maker Mindset



Gum. It's been around for centuries—from the ancient Greeks to the American Indians, everyone's chewed it. But the best kind of gum—bubble gum!—wasn't invented until 1928, when an enterprising young accountant at Fleer Gum and Candy used his spare time to experiment with different recipes. Bubble-blowing kids everywhere will be delighted with Megan McCarthy's entertaining pictures and engaging fun facts as they learn the history behind the pink perfection of Dubble Bubble.

At long last, here's the hole truth about the invention of the doughnut! In 1843, fourteen-year-old Hanson Gregory left his family home in Rockport, Maine, and set sail as a cabin boy on the schooner Achorn, looking for high-stakes adventure on the high seas. Little did he know that a boatload of hungry sailors, coupled with his knack for creative problem-solving, would yield one of the world's most prized and beloved pastries. Lively and inventive cut-paper illustrations add a taste of whimsy to this sweet, fact-filled story that includes an extensive bibliography, author's note, and timeline.



Young Canadian Inventors inspire a Maker Mindset

Meet Ann (Andini) Makosinski, an 18-year-old inventor and entrepreneur from BC who is dazzling people with her ideas. Ann is especially known for her invention of the *Hollow Flashlight* and the *E-drink*. (6:29)

https://www.youtube.com/watch?v=ErqyIm2CGp8&index=4&list=PLvntPLkd9IMcdr1kzNK60P-tnIg-XYKzz

Vancouver teen Austin Wang's brilliant idea won him the prestigious Intel Science Fair, discovering a method to turn waste water into electricity. (6:53)

https://www.youtube.com/watch?v=Wt4R-QrmfJY&index=1&list=PLvntPLkd9IMcdr1kzNK60P-tnIg-XYKzz

Meet Rachel Brouwer, a 14-year-old Nova Scotia inventor who's out to change the world with her water-cleaning system. (6:49)

https://www.youtube.com/watch?v=32ndO22BorM&index=2&list=PLvntPLkd9IMcdr1kzNK60P-tnIg-XYKzz

Young Canadian Inventors inspire a Maker Mindset

Meet Frank Bouchard, co-founder of the *Wipebook*, a dry-erase notebook! (3:18)

https://www.youtube.com/watch?v=EBia0UesYAc

Montreal inventor Catalin Alexandru Duru has invented a hoverboard! (7:47)

https://www.youtube.com/watch?v=AUq3mBuENiw&index=3&list=PLvntPLkd9IMcdr1kzNK60P-tnIg-XYKzz

Alex Deans is working to improve the lives of the visually impaired with his invention, the *iAid*. (2:12)

https://www.youtube.com/watch?v=EGPo7gnvlhE

The Marshmallow Challenge

Learning Target: I can collaborate with others to build the tallest free-standing structure using spaghetti sticks, tape, string and one marshmallow.

Establishing a 'Need to Know': Read the story The Most Magnificent Thing by Ashley Spires. Next, share glimpses of the Youtube video MVMS Marshmallow Challenge #1 https://www.youtube.com/watch?v=xy54jxC_Z6A

Co-constructing ideas: Building from clues - Use the Picture Symbols we've sketched and invite students to come up with the shared expectations (the rules) for the marshmallow challenge. (see attached notes)…

1. Build the tallest free-standing structure.
2. The entire marshmallow must be on top.
3. Use as much or as little of the kit.
4. Break up the spaghetti, string, or tape.
5. The challenge last 18 minutes.

Launch the challenge with pre-arranged kits and groups; follow instructions in attached notes.

Post-Challenge conversation regarding the two 'layers' of learning: *Collaboration* and *Building a Structure*…

1. What worked? (What were the successes in your group?)

2. What was difficult for your group?

3. What would you do differently next time?

Closure: Share parts or all of the Youtube video: Tom Wujec, Build a tower, build a team

https://www.youtube.com/watch?feature=player_detailpage&v=H0_yKBitO8M

The Marshmallow Challenge

The Marshmallow Challenge is a remarkably fun and instructive design exercise that encourages teams to experience simple but profound lessons in collaboration, innovation and creativity.

The task: in eighteen minutes, teams must build the tallest free-standing structure out of 20 sticks of spaghetti, one arms length of tape, one arms length of string, and one marshmallow. The marshmallow needs to be on top.

The goals and rules of the Marshmallow Challenge:

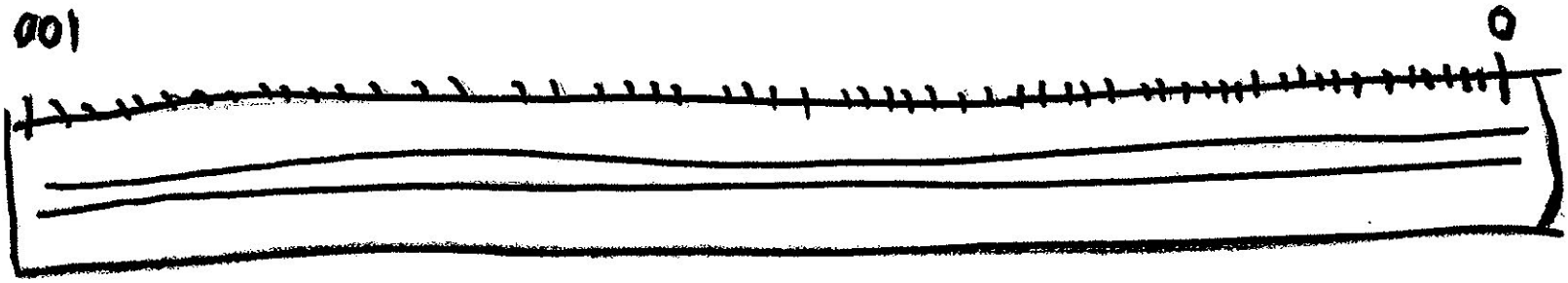
- Build the Tallest Freestanding Structure: The winning team is the one that has the tallest structure measured from the table-top surface to the top of the marshmallow. That means the structure cannot be suspended from a higher structure, like a chair, ceiling or chandelier.

- The Entire Marshmallow MUST be on Top: The entire marshmallow needs to be on the top of the structure. Cutting or eating part of the marshmallow disqualifies the team.

- Use as much or as little of the Kit: The team can use as many or as few of the 20 spaghetti sticks, as much or as little of the string or tape. The team cannot use the paper bag as part of their structure.

- Break up the Spaghetti, String or Tape: Teams are free to break the spaghetti, cut up the tape and string to create new structures (you can use scissors for cutting the string)

- The Challenge Lasts 18 minutes: Teams cannot hold on to the structure when the time runs out. Those touching or supporting the structure at the end of the exercise will be disqualified.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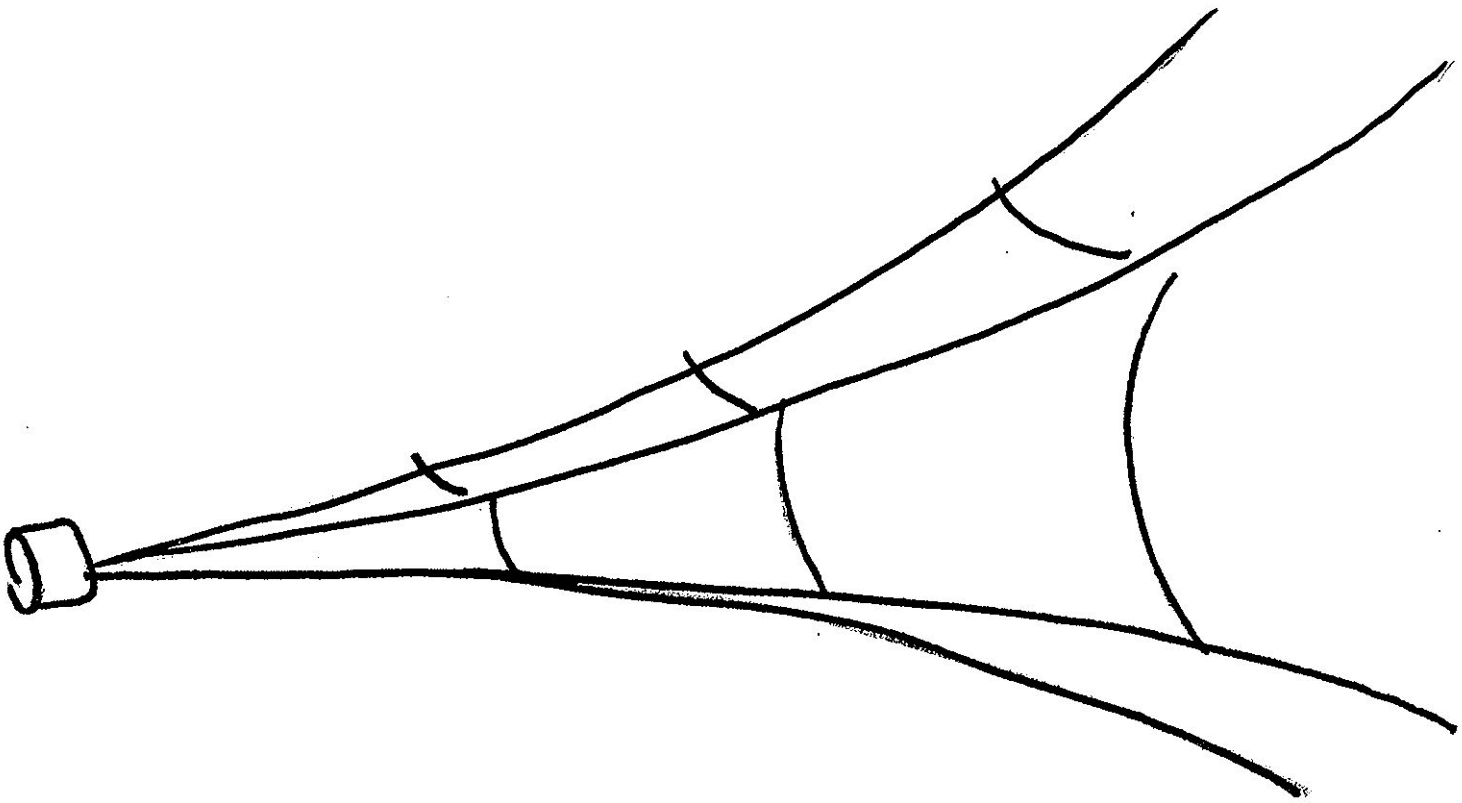

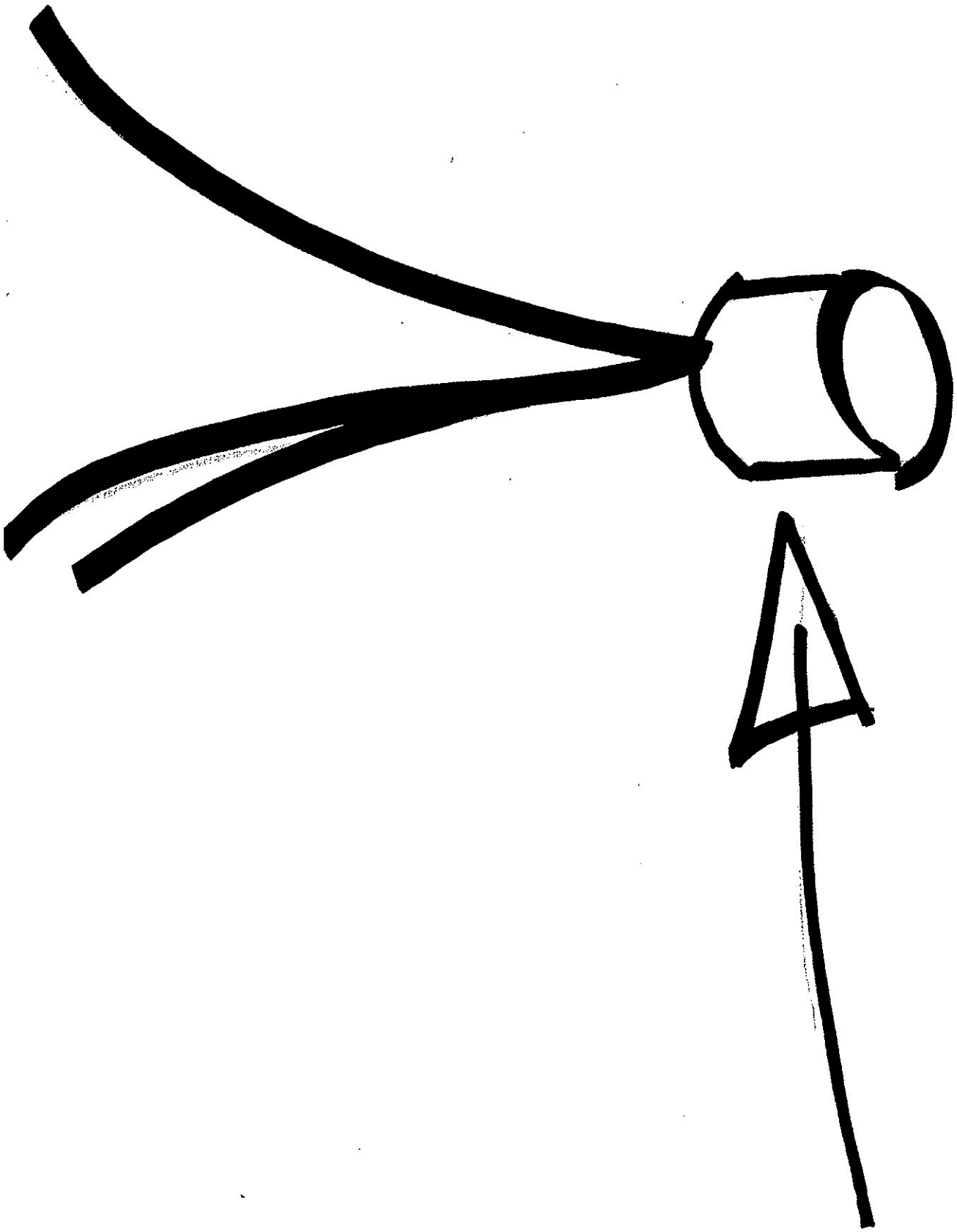

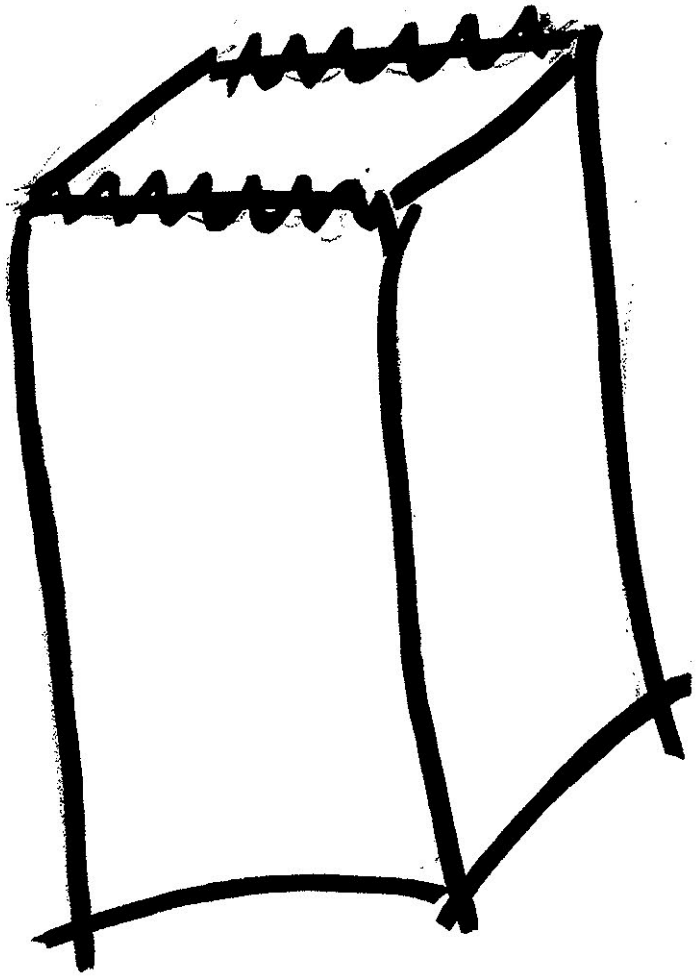

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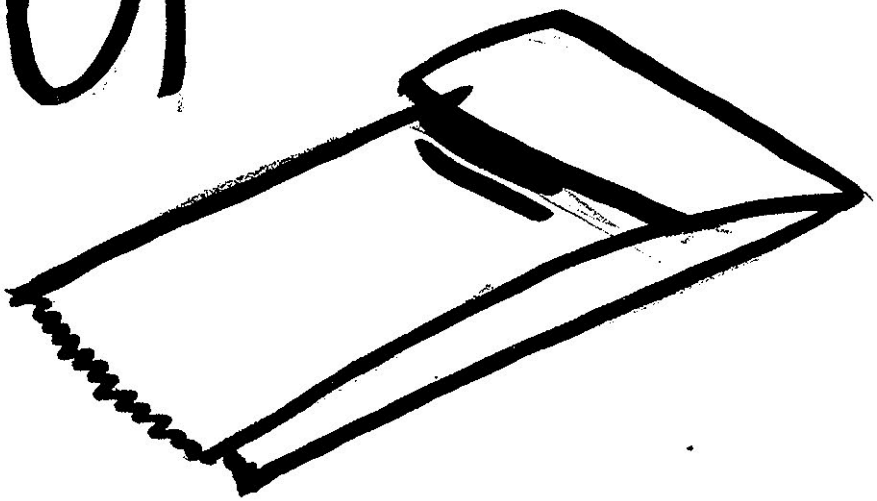
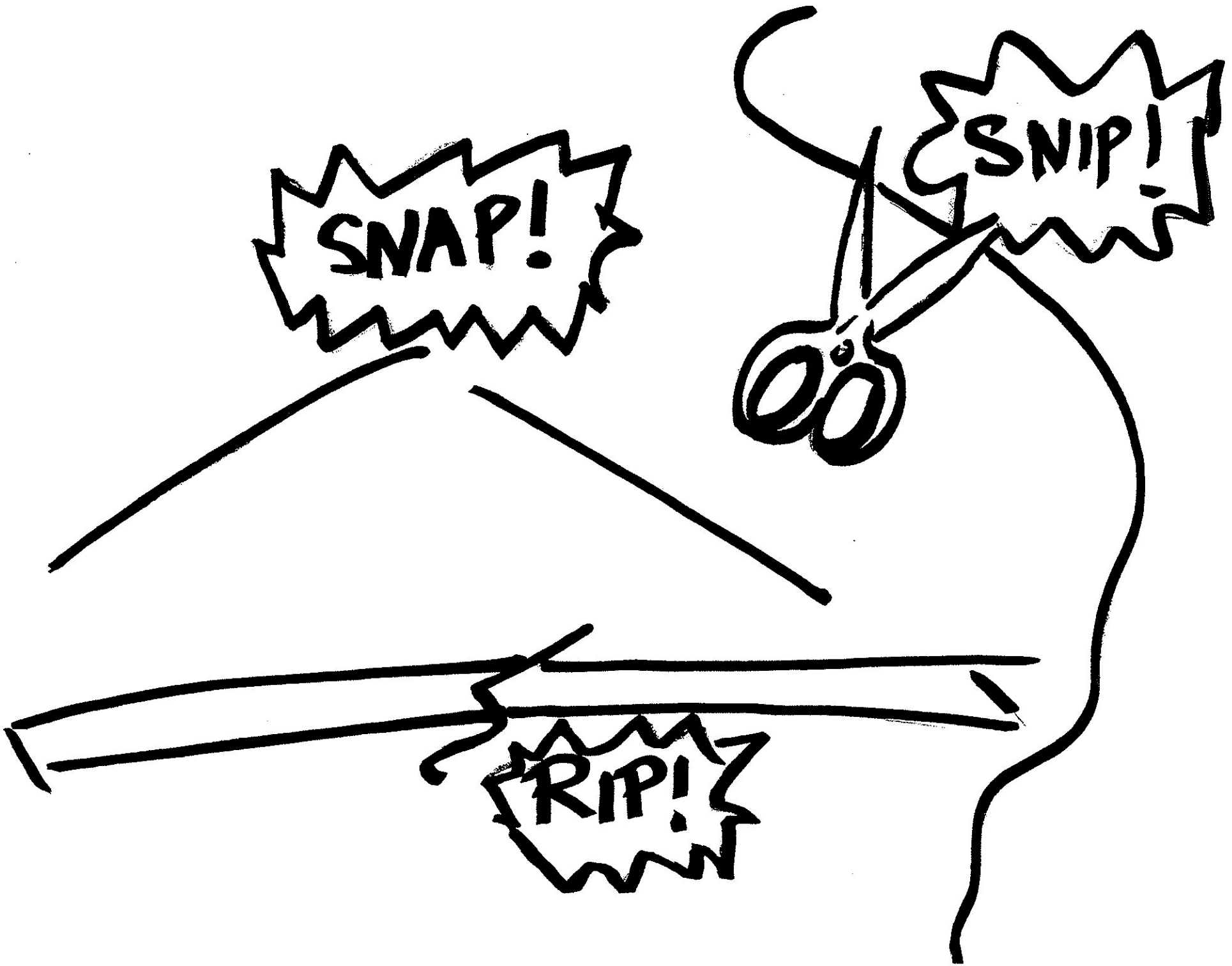
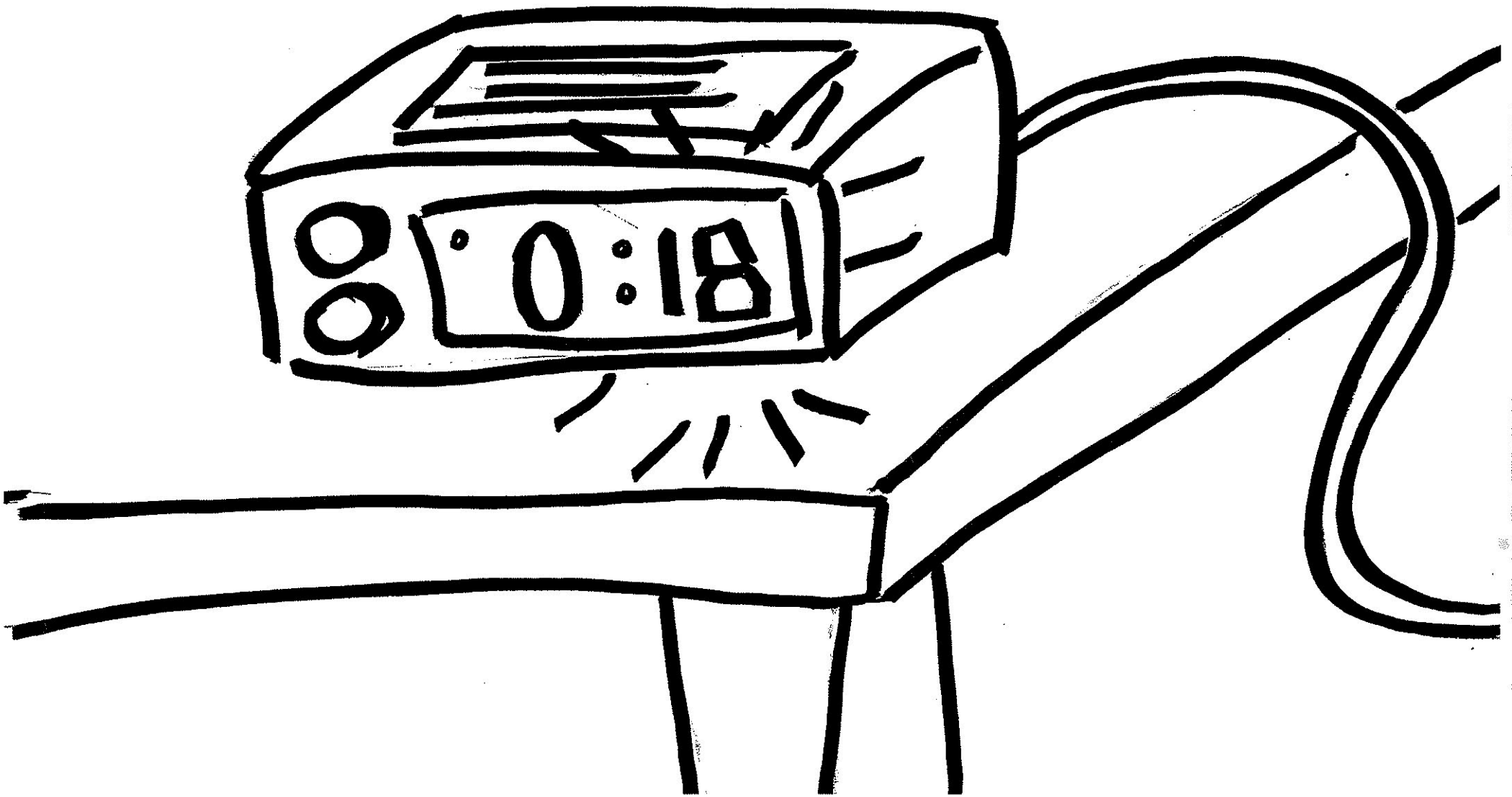



SNAP!
SNIP!
RIP!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Applied Design, Skills and Technologies Student Self-Assessment

What inspires me to come up with new ideas?

How did/do my ideas change over the process of designing?

How best do I share my curiosity?

How do my ideas contribute - to me, to my classmates, to the community?

Applied Design, Skills and Technologies Student Self-Assessment

What have I learned about being a design thinker?

How did the design process go? What worked? What was difficult?

Where to next? What will I / could I do differently next time?

A core competency I demonstrated was

_____ *because*

Applied Design, Skills and Technologies "I" Statements:

I identify needs and opportunities for design through exploration.

I generate ideas from experiences and interests.

I choose an idea to pursue.

I go through a process of trial and error to make changes, solve problems and incorporate new ideas.

I reflect on my ability to work effectively both as an individual and collaboratively in a group.

Applied Design, Skills and Technologies Student Self-Assessment questions:

What inspires me to come up with new ideas?

What matters to me when I think about designing something?

How did/do my ideas change over the process of designing?

How do I refine my ideas?

How do my ideas contribute - to me, to my classmates, to the community?

How do I share my curiosity?

How best do I represent my understanding? What helps me to explain/recount and reflect on my learning?

What have I learned about being a Maker?

How did the design process go? What worked? What was difficult?

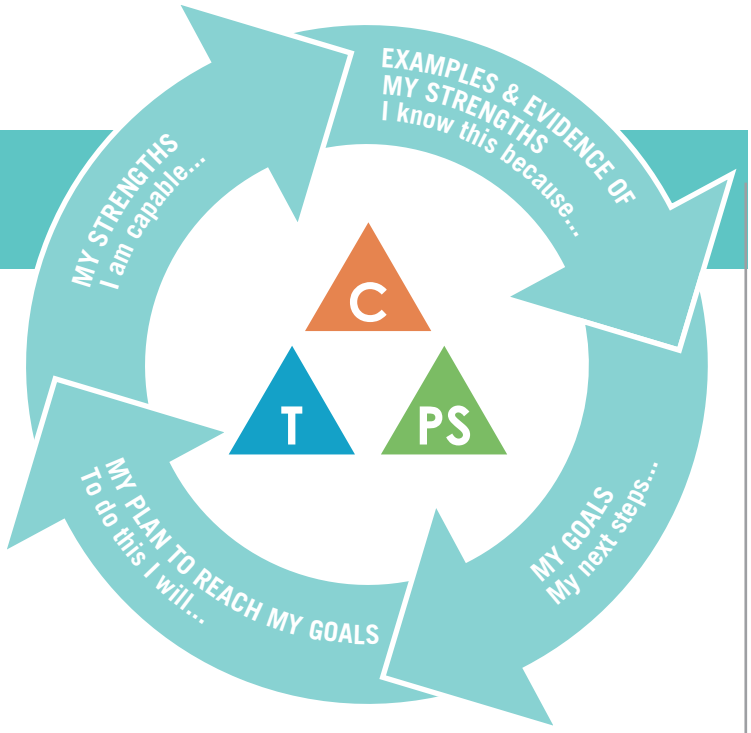
Where to next? What will I do differently next time?

A core competency I demonstrated was _____ because

CORE COMPETENCIES SELF-ASSESSMENT

Name: _____ Date: _____

I can reflect on my learning and describe or draw how I have demonstrated or developed my competencies.



Self-assessment can take many forms and may focus on one, a few, or all of the core competencies.

Adapted from School District No. 36, Surrey

What worked?	What was difficult?	What would you do differently next time?
		
Collaboration	Names: _____	

What was difficult ?

What worked ?

What would you do differently next time ?

Design Challenge

Names: _____