

A - School Program:

Questions:

A good essential question:

- inspires a quest for knowledge and discovery;
- encourages and develops critical thinking processes;
- leads students to engineer real-world solutions for real-world problems;
- is all about *possibilities*.

Learning promotes starting with a question rather than looking for answers. The learning process is to use various questions and some structure of what we want to understand to have students construct their own learning.

Overall process with life-skills:

| Process | Information |
|----------------------------|---|
| Ice breaker/ Intro | |
| Overview | What's the purpose of this activity? Who is the audience? Outcomes for the student |
| Key Questions: | See ice-breaker page |
| Skills | Greeting skills, Eye contact, Non-verbal skills, Positive attitude |
| Forming the team | |
| Overview | Purpose: Outcome: Students should be able to clearly define the task they are about to undertake either verbally or in writing. They can state the purpose of the activity, the target audience, the required outcomes, the timeframe for the task, and their ideal learning approach (collaborative or individual). |
| Key Questions | Follow the flow chart and ask questions: |
| Skills | Diversity, Values of a culture, Time management, Listening skills, Collaboration, Character development, Negotiation |
| Picking the project | |
| Overview | |
| Key Questions | |
| Skills | Team work, Handling adversity Project planning, Scheduling |



| | |
|---|--|
| Research & planning | |
| Overview | |
| Key Questions | |
| Skills | Measurements, Goal setting, Scheduling |
| Problem solving | |
| Overview | |
| Key Questions | |
| Skills | Thinking skills. Self-reflection Problem-solving structure, Brain-storming, Decision making, Sorting |
| Testing & writing | |
| Overview | |
| Key Questions | |
| Skills | Feedback, Iterations, Communication (without phones) Elevator pitch, |
| Public dialogue/ Celebration | |
| Overview | |
| Key Questions | |
| Skills | Meta-cognition, Presentation skills, Communications, Info-mapping |

Class breakdown:

| | |
|--|---|
| One-hour Class Period Structure | Class Activities ... Tied to the curriculum |
| <ul style="list-style-type: none"> • 15 min. of class learning/discussion • 30 min. of Exercise / Activities by the teams • Break | <ul style="list-style-type: none"> • Improv. • Drawing exercise • Problem solving • Team building games • Socratic Questioning |
| Student ownership | Facilitation |

Discussion items:




| Module | Description | Learning Objectives Students will be able to | Behavioral Goals |
|--|--|--|---|
| Introduction | Students will form groups and do an ice-breaker exercise & discuss what they learned & observed | <ul style="list-style-type: none"> Understand goals of the course Begin to see the benefits of working together | Students will demonstrate a positive attitude about team-work |
| Team format | <p>Though a series of activities students will develop a team charter and learn various life-skills for working together</p> <p>Teams will compete in various games & Improv activities.</p> | <ul style="list-style-type: none"> Understand the similarities of a learning team to a sports team Relate the team to a community organization | <ul style="list-style-type: none"> Students will be able to work together and deal with issues in a positive manner Interpersonal skills will be practiced |
| Problem selection | Discussion of community, school & world issues to work on as teams | Setting ground rules for the task | Begin the understanding of the Cultural engineering mind-set |
| Problem solving | Students learn the problem-solving process and implement it working as a team. Skills are practiced doing this activity | <ul style="list-style-type: none"> Students use on-learning learning tutorials. Students can understand thinking skills, problem solving and decision making | <ul style="list-style-type: none"> Students will understand that all problems as opportunities Students will see learning as a fun activity |
| Testing | Questioning and finding feedback on the team's work. Listening to the community | Ability to use feedback and iterate to find details of what has been accomplished | <ul style="list-style-type: none"> Learning that failure is a method to get better at what you are doing Be able to communicate with others to gather feedback |
| Public Reporting | Prepare results of this activity through creating documents & charts about what has be learned | Gather thoughts and share results with the community organizations | <ul style="list-style-type: none"> Learning to develop conclusions of the teams activity and create what's next for the project Students will demonstrate the use of life-skills moving forward |
| Tying into the work environment | Visit & discuss what the needs of companies are. Obligation to you? | Students will understand their pluses & minus. Why you need to think of yourself as in your own business. | <ul style="list-style-type: none"> Branding Operating your business, its needs Ownership mindset |

How do we ask good questions?

- Questioning is at the heart of effective thinking, yet many schools provide too few opportunities for your child to ask or investigate questions flowing out of his or her own curiosity



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- A good question possesses qualities that typify good questions: **clarity of purpose, proper framing, sincerity of intent** and **respectfulness**

Process documentation:



Title: Ice Breaker

Ground rules:

I am a facilitator who guides you and asks questions. You are the owners of your learning and will make decision about what you do and how you will measure your success.

Overview

- **1.0 Ice Breaker ... [Marshmallow project](#) (Begin our thoughts on the problem to be solved)**

Essential Questions

- Why are we doing this?
- How are we going to do this?
- What outcome do we expect?
- What can we learn from this?

Material & Preparation

<http://www.projectacademy.org/Documents/marshmellow-short-intr.pdf>

Each team needs 1 yard of tape, 1 yard of string, 20 pieces of spaghetti (uncooked, of course), and one marshmallow. I also recommend making available one or two small scissors for all teams in the group to access during the activity.

Each team has 18 minutes to build the tallest, free-standing structure using the materials supplied to each group. The marshmallow must be attached to the top of the structure you build. After 18 minutes, I will measure the height of each structure that remains standing with the marshmallow on top. The winner is the team whose free-standing structure is the tallest.

Tasks

- Introduce each other
- Create <5 people teams

No more than 5 people per team. If the total group size is just 5 or 6 people, divide the group into teams of 3, if at all possible. Team size is more important than total number of participants involved in the activity.

- Create name tags
- Hand out instructions for the exercise

Purpose:

Get the students to work together and begin to cooperate in a team format to solve a problem.

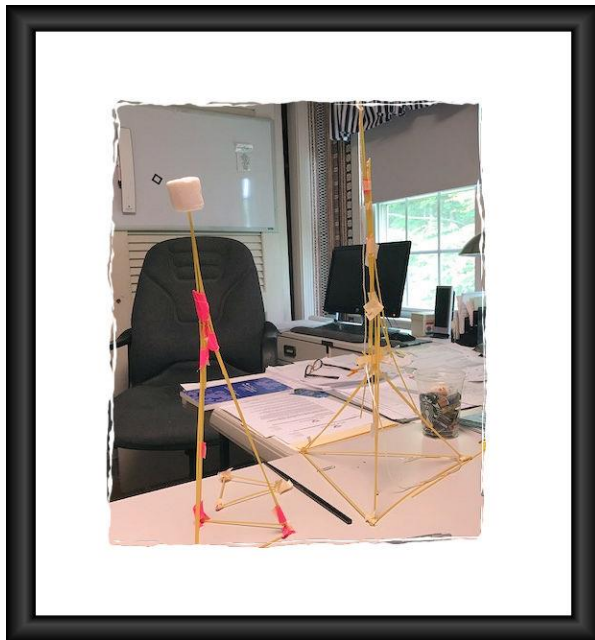
Time: 45 minutes or less 5 minute introduction; 18 minute activity; 5 minute video. Additional time for discussion. The 18 minute exercise is fixed. Other times can be adjusted as needed.

Follow-up questions to ask of the group to facilitate discussion and further learning

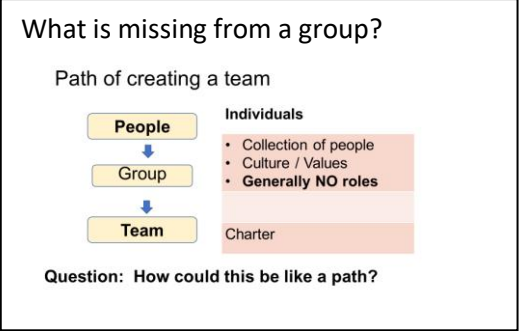
1. Was there a leader on your team? Who was it and who decided who the leader would be?
2. If you had no leader, do you think having designated someone a leader would have helped?
3. If you had a leader, how did he/she do? Of the leadership practices we have learned so far, which did your leader use?



4. How helpful was everyone on your team in challenging the process of building the tallest structure? Did anyone appear to be an expert?
5. Did any team members tune out of the activity—out of frustration with other members or for some other reason? What could you have done to keep all members of the group fully engaged?
6. Did you feel everyone's ideas were well received during the activity?
7. How did you feel as the time limit was approaching? Did pressure increase? If yes, was that helpful or not?
8. In retrospect, what could you have done better to enhance your ability to Challenge the Process?
9. Did you practice oversight? Where might new ideas have come from given your time constraint?
10. Did you celebrate small wins? If yes, how did you do this?



Introduction to creating a team:
 Why do we need a team?
 Review U-Tube video's, searches



Essential Questions I must answer:

- 1. What do I bring to the team?
- 2. What are our commitments to one another?
- 3. What differences exist between us?
- 4. How will we operate?
- 5. How will we know we are succeeding?

What benefits does a team approach help in solving problems?

How are we going to work together – handle conflicts

Is diversity good for a team? WHY?

Do Organizations have a Culture?

Discussion of the elements of the community culture

What is the culture of the team? Language, Symbols, Values, Beliefs, Norms, Rituals

How is a learning team like a sports team?

Write up the results

le; The school will foster a **Team/community** based culture of a learning environment, key values and treating all as adults and with respect.

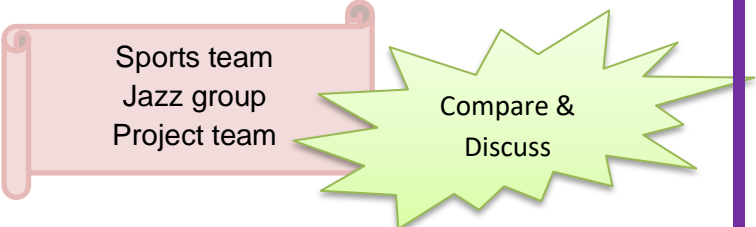
Creating a team charter

The Charter Covers:

- Goals (Fun,),
- How will we be measured at the end,
- Roles that the team will do, (Scribe, Captain, Planner, Advisor, Tester, Public reporter,)
- Deliverables?
- How will we handle conflicts?



- Elements of Culture
 - Language
 - Communication
 - Symbol
 - Gesture, sound, color, design
 - Values
 - Goodness and beauty
 - Beliefs
 - Shared ideas
 - Norms
 - Rules and expectations
 - Rituals
 - Rites and Public ceremony



Picking a project (Facilitating by the teacher)

Overview

Deciding as a team what problem we will work to solve. Think of something you can add value to and provide useful results. Community, School, World

Essential Questions

- What excites us?
- What bothers us?
- What are typical problems facing us in our community, school and the world?
- Can we use existing items to build upon in choosing our project?

Material & Preparation

The bigger the problem, the bigger the opportunity(Vinod Khosla)

<https://youtu.br/f9LM88h-I-U>

Tasks

- Brain storm project ideas
- Discuss and agree on a project
- What are the desired outcomes for the project?
- Develop a project plan
- Are there community organizations that we should contact for support?
- Plan out our roles for the project
- Create a charter... like forming a team

project

Given:

What do we know about the problem?

Are there unique items around the project?

How has the problem existed prior to us trying to solve it?

Picking a project by the team:





| Groups | Problem examples | | | | | | | | | | | | |
|--|---|-----------------------|-----------------------|----------------------|--------------------|--------------|----------------------|--|------------------|------------------|-----------------------------|-------------------|---------------------|
| Community Can also modify world problems to the community | <ul style="list-style-type: none"> • Use of tap water instead of bottle water • Improve public transportation system • Create social media for the community • How would we create a better down town? • How to improve the recreation facilities in our community? • How can we design a food growing place for the community? | | | | | | | | | | | | |
| School | <ul style="list-style-type: none"> • How to develop friendships? • Preventing bullying • How do get along with the teachers? • How would we create a better school? • How do we develop a better measurement system for students? | | | | | | | | | | | | |
| World <table border="1" data-bbox="212 1031 630 1404"> <tr><td>● Connect the World</td></tr> <tr><td>● Entertain the World</td></tr> <tr><td>● Sports of the World</td></tr> <tr><td>● Music of the World</td></tr> <tr><td>● Record the World</td></tr> <tr><td>...activites</td></tr> <tr><td>● Dance of the World</td></tr> </table> | ● Connect the World | ● Entertain the World | ● Sports of the World | ● Music of the World | ● Record the World | ...activites | ● Dance of the World | <table border="1" data-bbox="724 1024 1338 1310"> <tr><td>● Feed the World</td></tr> <tr><td>● Heal the World</td></tr> <tr><td>● Clean the World / Recycle</td></tr> <tr><td>● Power the World</td></tr> <tr><td>● Respect the World</td></tr> </table> | ● Feed the World | ● Heal the World | ● Clean the World / Recycle | ● Power the World | ● Respect the World |
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| ● Respect the World | | | | | | | | | | | | | |
| Skills | What games or process can we create to bring learning a skill? | | | | | | | | | | | | |
| Business | <ul style="list-style-type: none"> • Create a business to serve the community • How do we develop a financial system for the youth? | | | | | | | | | | | | |

Title: Requirements & Measurements





Overview

In doing a project we need to establish criteria on how we will judge our design and how will we measure our work effort. These needs to be discussed during the project and corrects made to improve.

Essential Questions

• What thinking skills do I bring to this process? • What are our learning targets, goals for this project? • How do we want to be measured? • How will I use meta-cognitive skills to improve my learning

Learning Outcomes

Learning outcomes are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course or program. In other words, learning outcomes identify what the learner will know and be able to do by the end of a course or program.

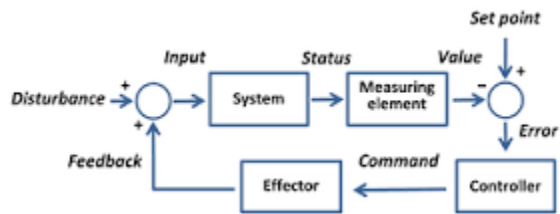
Tasks

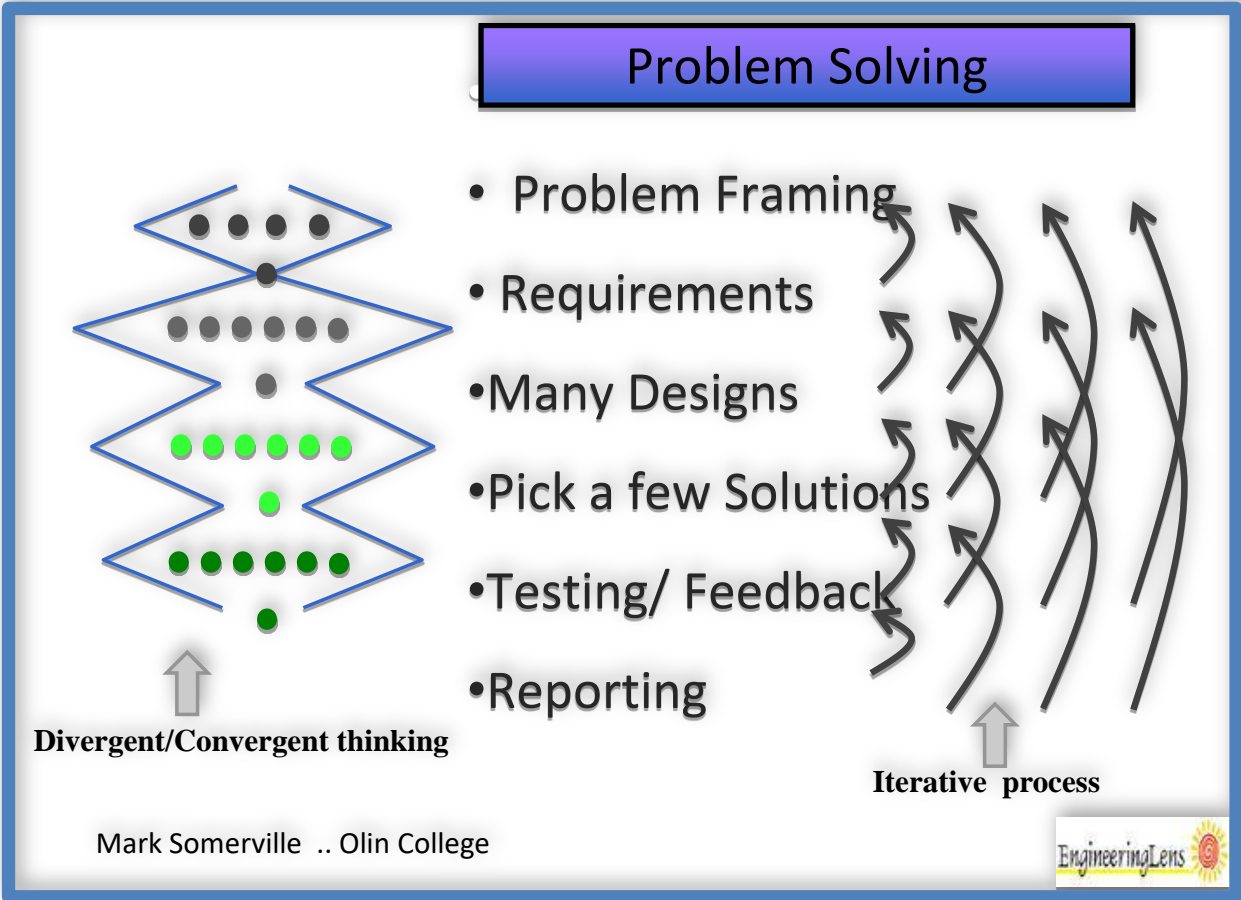
- How are we going to judge our design?
 - Ability to implement within the community
 - Complexity
 - Innovative
 - Ability to measure and manage
 - Cost
- How are we going to measure our work on the project?

Rubrics:

| Essential project elements | Measurement scale |
|---|--|
| <ul style="list-style-type: none"> • Key knowledge, understanding • Challenging problem • Sustained inquiry • Public product • Authenticity • Student voice • Use of reflection • Critique & Review | <ul style="list-style-type: none"> • No understanding • Needs development • Includes features |

- Quality of our effort? Be the best!
- Communication within the team
- What are our goals?
- Have we written our goals, outcomes and requirements?





Major discussion items:

| Item: | Description: |
|-------------------|---|
| Brain writing | Creative thinking. Lots of ideas |
| Sorting & shaping | Critical thinking and innovation |
| Decision analysis | Using requirements to select the best |
| Iterative process | Reflecting, trying different approaches |



Brain-Writing

Brainwriting Each team member generates 3-4 ideas on their own. Pass ONE of your ideas to your right. Read your neighbor's idea, and generate an idea that is somehow inspired by it. ! ! ! ! Repeat until time is up.

Generate Possible Solutions using Brain-writing

Starting with 4-5 generative framings...



Each team member generates 3-4 ideas on their own.

Pass ONE of your ideas to your right.



Read your neighbor's idea, and generate an idea that is somehow inspired by it.

One idea per card or sticky note!

Repeat until time is up.




Sorting & shaping:

Shaping Ideas

Why generate crazy ideas?
So you can shape them into innovative ideas!

Leaves falling on the lawn...

| | | |
|-------------------|---|--------------------------|
| Use a leaf blower |  | Trees that pick up magic |
| | !? | !!!?? |

Olin College www.engineeringins.org

Olin College www.engineeringins.org

| !? !!!??

Now Shape your ideas!

- Map (i.e. mundane, magical) and shape your ideas from brain-writing.
- Remember that you can shape ideas to meet constraints and values
- Choose 2-3 “favorites”, taking values and constraints into account. Create stretch’s ideas
- Be bold!
- Be prepared to share!

Take 15 minutes to sort and select

www.engineeringins.org



Decision Process Convergent thinking ... Narrowing the # of ideas and making a selection

Discussion: During the design process or problem solving we need to apply convergent thinking to narrow our option to a selection. When we have many options and are not comparing any to an existing one, the best option is to create a decision matrix where we establish a set of judgment criteria down the Y axis and weight each to its importance to judge our possibilities.

- If we are looking to compare our options against an existing choice, we can use the Pugh-method to compare against whether the criteria are better (+), less (-) or the same (S). this allows us to see where one is better but also what still are open items that can be improved.

For the items that we are going to judge one against another, we use a scale of 1-10 to rate them and then we multiple that number by the weight

| Requirement | Weight | Option 1 | Option 2 |
|---------------|--------|----------|----------|
| environment | | | |
| simple | | | |
| low cost | | | |
| Total= | | | |

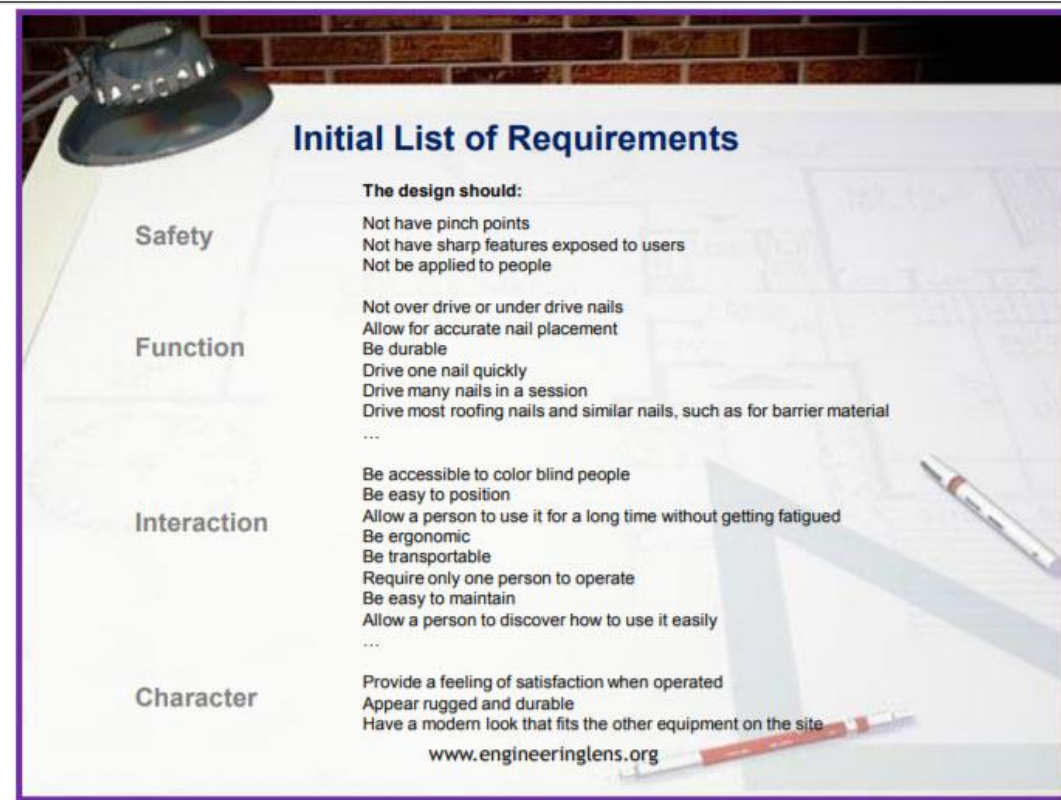
to get



the total # for that cell.

Requirements:

- Formalize what the design has to accomplish
- Safety, function, interaction, character
- “The design should...”
- Specify the need, not the solution:
 - Good: “provide space for a family of six to eat together”
 - Bad: “include a dining table in the middle of the room.”
- Science Constraints are requirements you impose on your students



Debriefing:

- How did we succeed or fall short of our goal?
- What went well, and what didn't?
- How can we improve our efforts and outcome in the future?
- How can we apply what we've done to similar problems?



Public Reporting:

Overview

Students will Work cooperatively to develop a verbal and visual presentation.

Having a public product ups the stakes for students, leading them to do higher quality work. No one wants to look bad in public.

<http://www.projectacademy.org/Documents/Quality-in-PBL-07112016.pdf>

Outline of Presentation

- Problem statement
- Issues and their accuracy
- Findings
- Measurements/Outcomes
- Proposed solutions
- Benefits
- Next Steps
- Summary and feedback

Presentation Day Check list

- Schedule of presentations set
- Guests/audience know when/where to attend
- Guest/audience materials duplicated
- Room arranged for presenters and audience
- Equipment /student materials in place
- Equipment tested (and tech support on stand-by)
- Teacher's materials in place
- Audience role explained
- Timekeeping device ready

Tasks

When students just turn in their work to the teacher or make a presentation to the class, they (typically) don't care as much as they do when sharing their work with people from the "real world." A side benefit of a public product is that it's good public relations for a school.

When parents, community members, or people in the wider world see high-quality student work in a project, they're impressed. The school's test scores might tell part of the story, but student work tells more of it

Possible Audience:

- Fellow students
- Family
- Community organizations
- Political guests
- Teaching and staff personnel

Celebration and feedback:


- Honor fellow students with awards
- Cake and soda
- Fun

Leave a time capsule for the next team as advice and feedback.



Outcomes: The debrief reflection leads to personal growth, and refinement of both the product and the process.





Learners have a thorough understanding of their best moments, as well as what they could have done differently or better. They also consider how they can apply their solution to similar problems in the future.

