Let’s Be Scientists!

Confratute 2023

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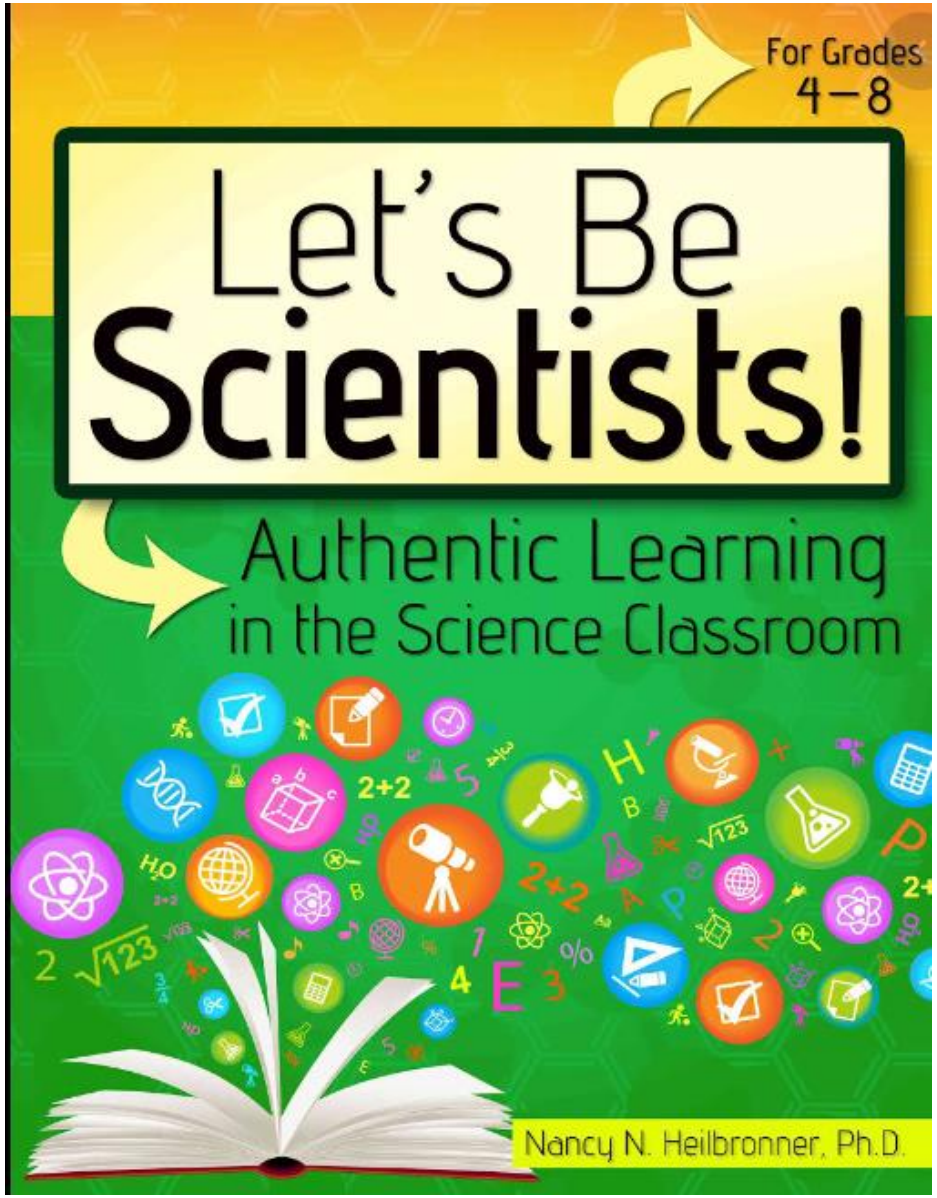


Introductions

Who are you?

Where are you from?

What’s your job?

Introductions

Type into the chat box to each of the following:

- Dogs or cats?
- Chocolate or vanilla?
- Text or call?
- Yankees or Red Sox?
- Ketchup or mustard?
- TP under or TP over?

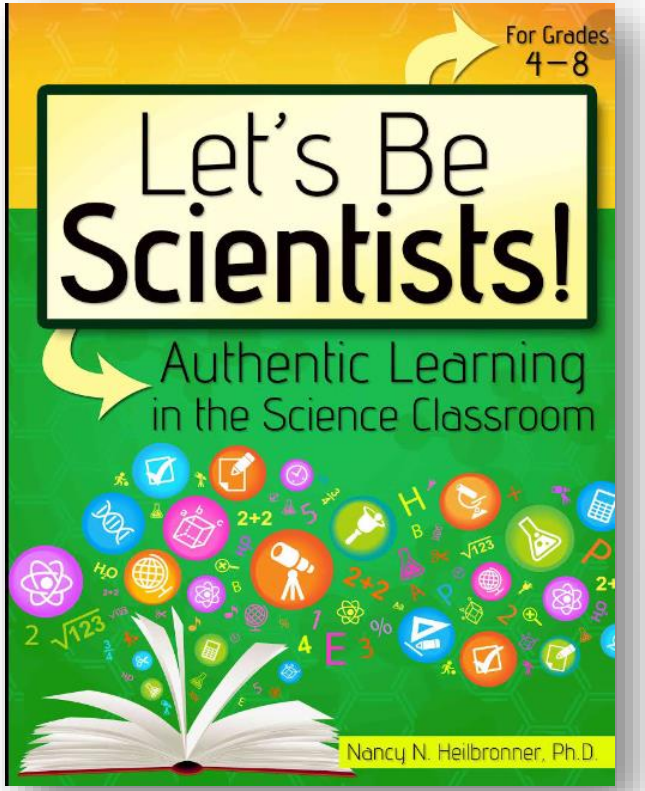
Purpose of the Strand

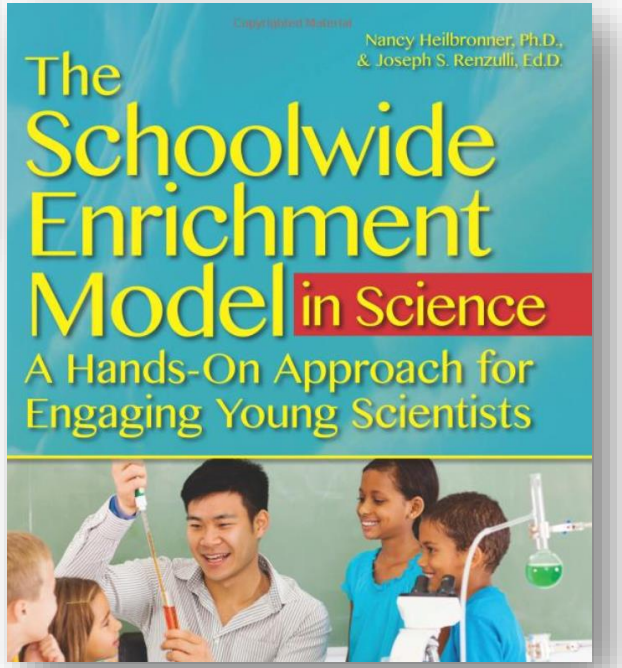
1. Discuss authentic practices in science –
   What do real scientists “do?”

2. Expand ways to introduce students to authentic practices.
   Consider ideas other than science fair.

3. Provide year-round structure and materials to teach science in an authentic manner.

Focused on grades 4-8.

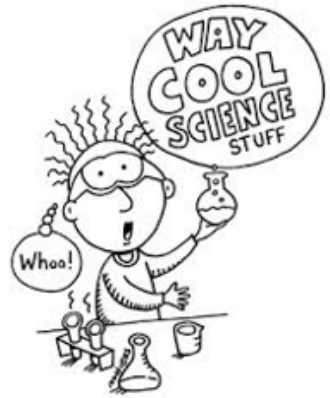




Strand Agenda

- **Day 1** – Lay the groundwork for an alternative approach and provide an overview of that approach.
- **Day 2** – Work through the first part of the school year with an example.
- **Day 3** – Work through the final part of the school year with an example. If time permits, work on own ideas for projects.

Questions?



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Books – order by clicking links below:

Let's Be Scientists – order from Amazon

Schoolwide Enrichment Model in Science (co-authored with Dr. Joseph Renzulli) - order from Amazon

Articles by Dr. Heilbronner Available on Confratute Strand Site:

Mentoring Talented Science Students: Knowing the Options (Gifted Education International - Co-authored with Dr. Diana Payne)

Raising Future Scientists (Gifted Child Today)

Science Safaris (Science Scope)

Think Instruments, Think Apps (Science Scope)

What's "Up" with Science Fair?

How many of you participate in a science fair? Type "yes" or "no" in the chat box.

What are your perceptions of science fair? Type them into the chat box.

In short…

Nothing is wrong with science fair!

But that’s not all students need to learn the scientific process or other practices of science.

The Acorn Challenge:
Why Do We Need to Change the Way We Teach Science?

The Oak Tree

- Where did the acorn get most of the matter from to turn that little plant seed into a giant oak tree?

  - Air
  - Dirt
  - Sun
  - Water
  - Other:_____

Problems with Science Education in the United States

“Mile Wide and Inch Deep”

Memorization of content

No time

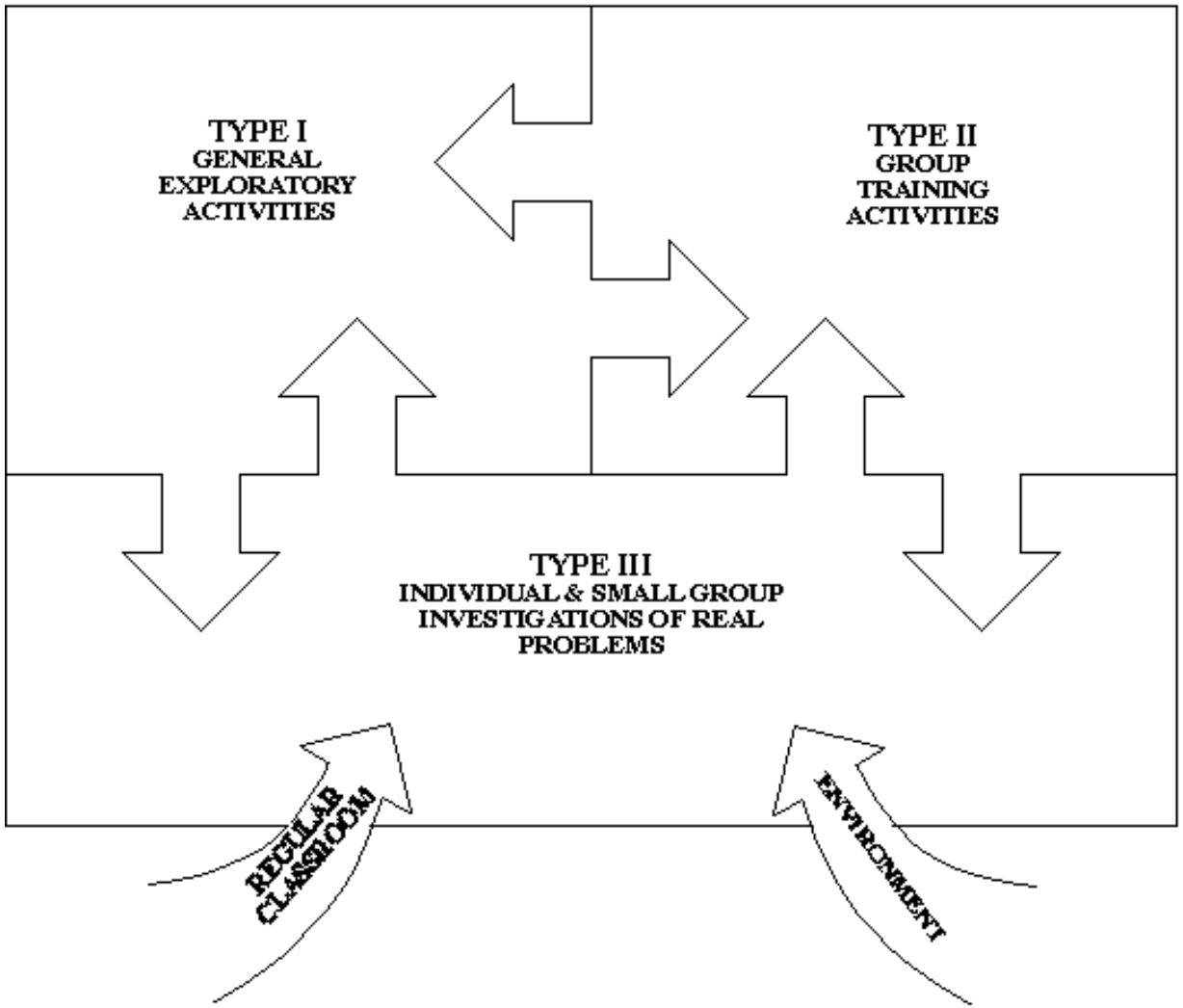
Lack of teacher training/support

…Leads to surface learning

How Can “Authentic Learning” Help? What Is It?

- Acting as junior practitioners in a field.
- Using the actual practices of science and scientists.

Renzulli's Triad: Based on Authentic Practices



It Starts with Student Engagement

Type I Activities

- Engage students
- Interest-based
- Frequently (but not always) hands-on

Engage Students with Type I Experiences

People

Speakers, mini-courses, demonstrations, artistic performances, panel discussions

Media/Technology/Library

Films, slides, audio, DVDs, books, newspapers/magazines, Internet, World Wide Web Apps

Other

Field trips, displays, museum or nature center programs

Props

Scientific or mathematical instruments, historical artifact, primary source (such as a diary)

What Skills Are Required?

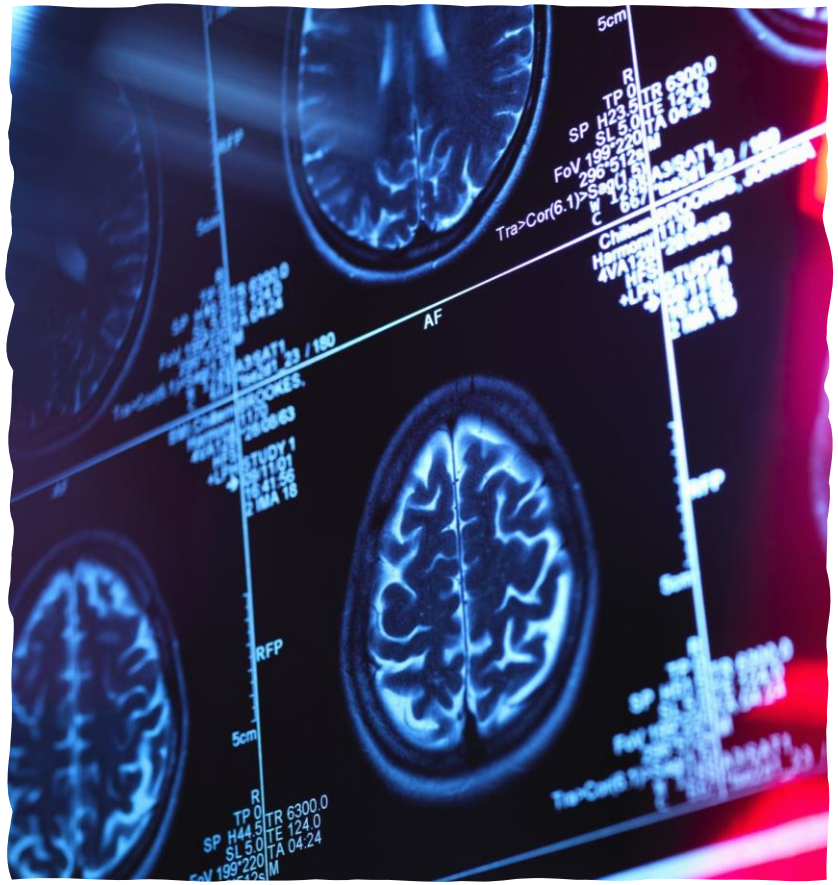
Dr. C. entered the conference room where her three team members were already chatting. Today's meeting was about the progress to-date in developing the new drug for the treatment of Alzheimer's. "Are we all set?" asked Dr. C. "Yes, the projector is ready." Dr. C. plugged her flash drive in and for about 20 minutes presents her ideas to the other team members. She had been working on ideas for how to design the investigation into whether this drug will work. Should they run a double-blind study? How many participants should they recruit? How will the participants be selected? There were many considerations, especially in light of how difficult it was to have human research approved. The team members listened attentively then offered their suggestions. What about if we tried four groups instead of two? What about the safety risks? How will we minimize those? Two of the team members disagreed about the size of the number of participants. "We'll never get such a large number," they stated. The remaining team members, including Dr. C., provided evidence for why the group size was appropriate and how they could recruit additional participants. The group bandied about ideas for awhile, eventually reaching consensus as to the best direction. No member of the group was sure that what they had decided was right; they took their "best guess" and moved forward. Each team member agreed to take on a task to initiate the study.

What Skills Are Required?

After the 2-hour meeting ended, Dr. C. walked to her lab to study the FMRI images of brain scans from the patients with Alzheimer's. Something appeared different about these images than scans of "normal" brains. Puzzled, she turned to her medical database, searching for images of brain scans that were about the same age and gender as the individuals before her. What could it be? Another couple of hours passed quickly as she was deep in thought, with no results. Frowning, she realized she was hungry and had skipped lunch. She decided to walk to the cafeteria –she would put the problem of what was different on hold for a while and come back to it later.

At lunch, she ran into a colleague – Dr. S. was in the field of neurobiology, but he was not involved with the Alzheimer's project. Over lunch, she discussed her unsolved problem with Dr. S. "Have you tried looking at the scans from different angles?" queried Dr. S., "Sometimes that helps me." "What do you mean?" asked Dr. C. "Look at them on their sides or upside down—anything to get your brain out of the mold of what to expect." "That's really creative," thought Dr. S. "I'll try it!"

What Skills Are Required?



Returning to the lab, Dr. C. retrieved the images. Turning them first upside down, then on their sides, she studied them again. Suddenly, she stopped. She noticed that one section of the brain was slightly different in the Alzheimer's patients. Why hadn't she seen that before? Could this be a fluke, or could it provide a necessary clue to the treatment of the disease? Tomorrow, she decided, she would arrange to collect some more preliminary scans of additional patients to verify what she was seeing, and she'd propose to the group that they collect higher-resolution images of the area of the brain that was different, focusing their scanning power. She glanced at the clock. Time had passed…immersed in her work, she had missed dinner again. She smiled as she locked the lab on her way out—it was joyful, hard work, but satisfying. Who knew what new discoveries tomorrow would bring?

The Work of Scientists

Let’s type some of the skills that are required in the daily life of the scientist into the chat box.

Type II Skills in Science

The “toolkit” of science

- Develop Content Knowledge
- Investigate
- Think Creatively
- Collaborate
- Debate
- Communicate

Authentic Practices…

…Lead to Authentic Student Projects

Examples of Authentic Science Practices – Group (Type III Project)

Your students love to hike, but there is no guide to the natural features on the local trail. They hike the trail and return with pictures of the flora and fauna. They identify these and create and trail guide app for that a hiker can download and use.

Examples of Authentic Science Practices – Individual (Type III Project)

- Dan, an elementary-school student, develops a comic book depicting the adventures of superhero “Sunny” and uses it to alert children to the importance of using sunscreen. He researches the effectiveness of various sunscreens on the market and includes the information on a website he develops. He creates a marketing campaign with the help of his teacher and a mentor from the business world to sell his comic book. He donates the proceeds to the American Cancer Society.

Reasons We Avoid Authentic Learning

- Time-consuming
- Difficult to plan
- Difficult to implement

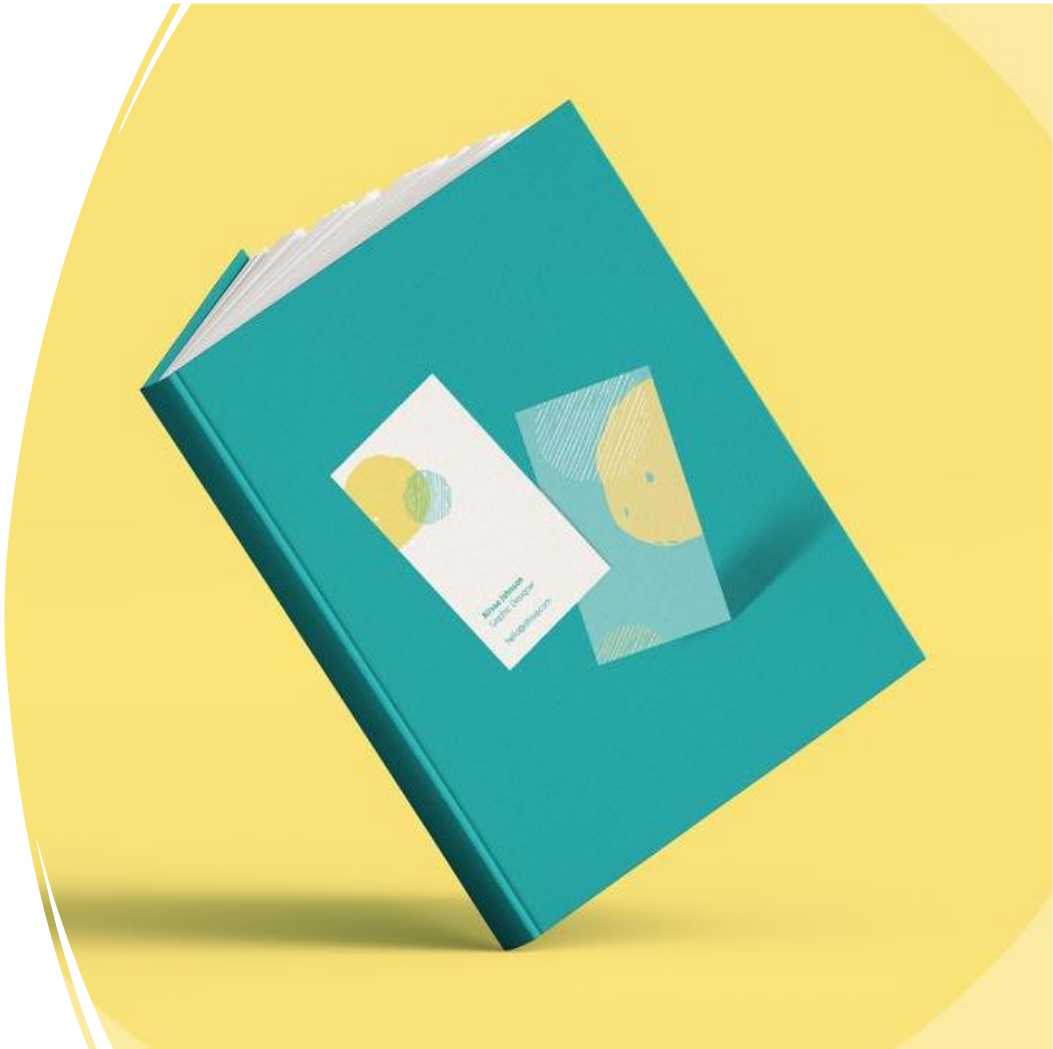
This session (and the book) are designed to provide a structured approach that will reduce these concerns.

Introducing the Science Portfolio

- Students participate in a variety of activities throughout the school year.
- These activities are designed to promote the in-depth exploration of a topic by using authentic science practices.
- Activities may be completed individually or in groups.

Introducing the Science Portfolio

- Students showcase their work in a science portfolio.
- The portfolio may be digital or paper-based.
- The portfolio may be graded (assessed) or not.



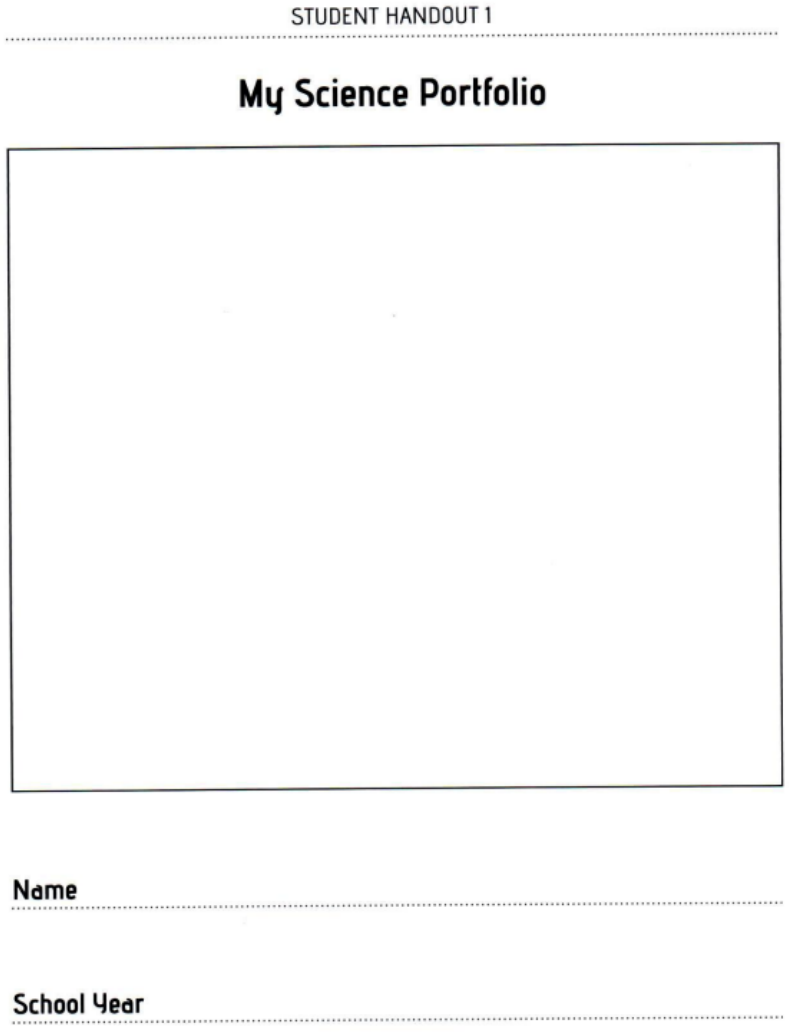
Introducing the Science Portfolio

- Activities are initially focused on a STAR topic (Science Topics are Real), selected by the student or by a group of students.
- Later, students transition to a more-in-depth exploration of a GEM topic (Great and Engaging Matter).
- Students work on their projects once a week throughout the year, or daily as desired.

How Does It Work?

Week 1	Introduce the Science Portfolio
Week 2	Conduct an Interest Inventory
Weeks 3-10	STAR Topics
Weeks 11 - 34	GEM Topics
Week 35	Students Reflect

Week 1 – Introduce the Science Portfolio



STUDENT HANDOUT 1

My Science Portfolio

Name .....

School Year .....

Organization of the Portfolio

Section

1 – Exploring Like a Scientists

2 – Introducing my GEM Topic

3 – Knowing My GEM Topic

4 – Investigating My GEM Topic

5 – Science Safaris

6 - Debating My GEM Topic

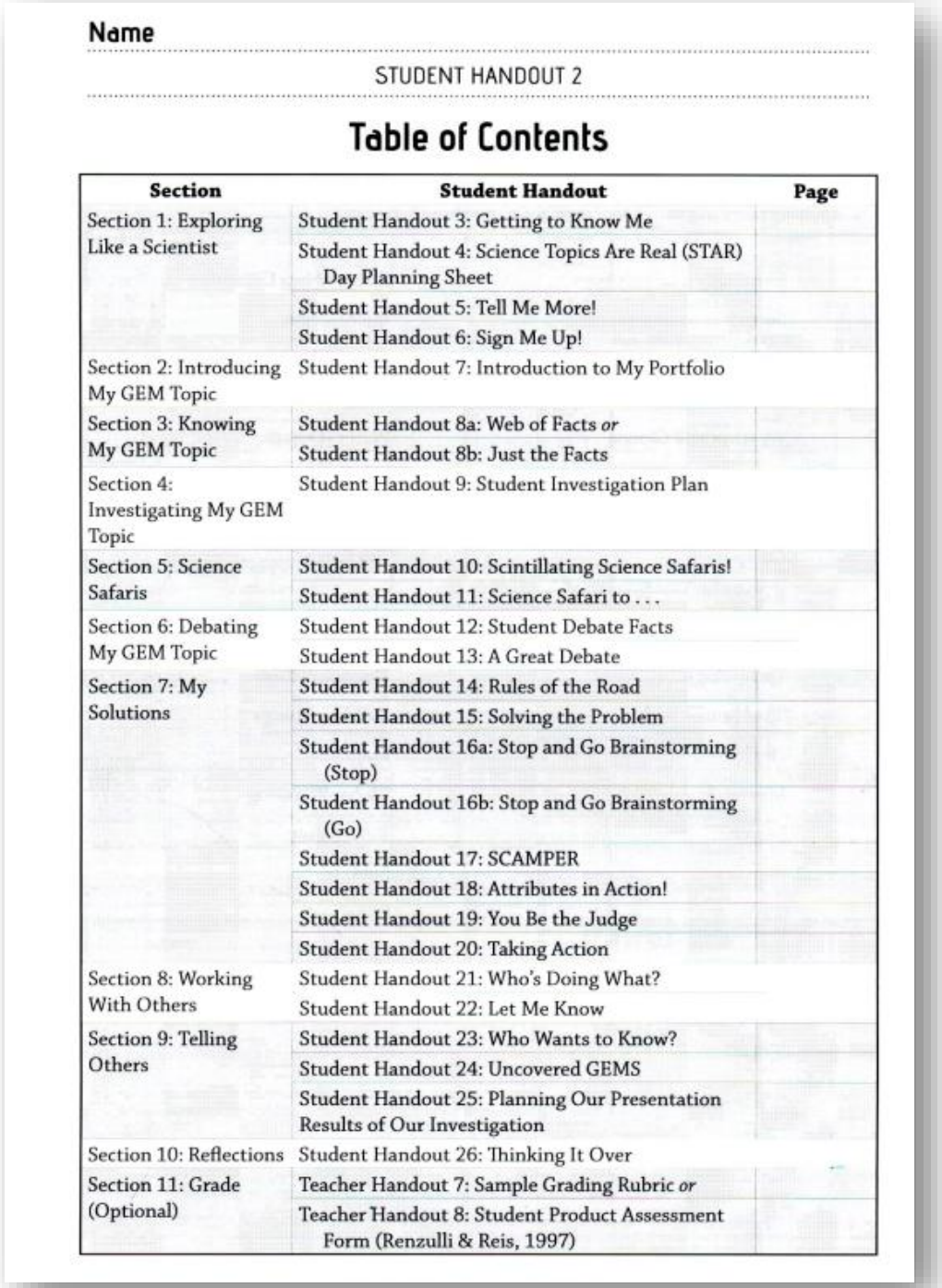
7 – My Solutions

8 – Working with Others

9 – Telling Others

10 – Reflections

11 – Grading (Optional)

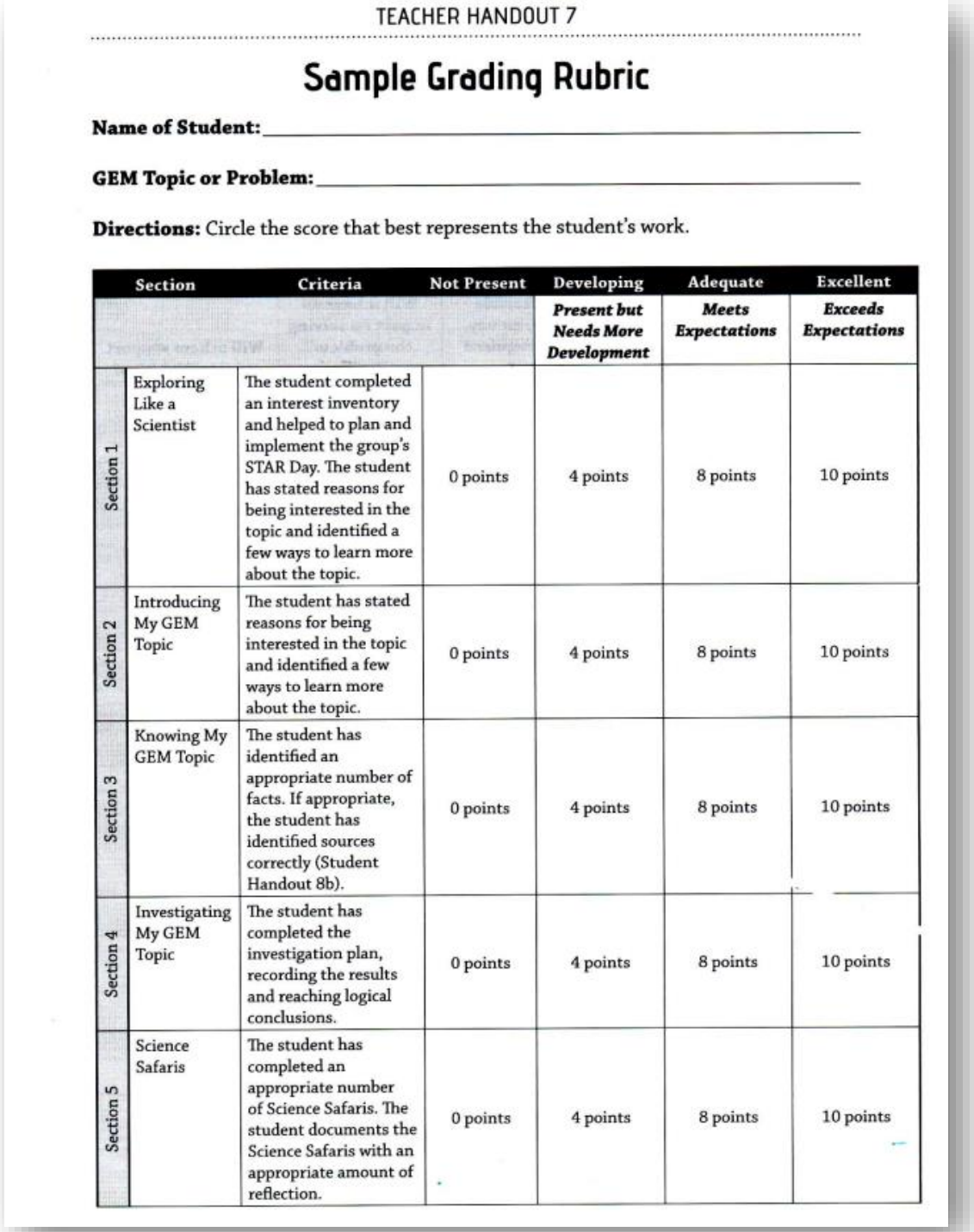


Name .....

STUDENT HANDOUT 2

Table of Contents

Optional: Grading the Portfolio



TEACHER HANDOUT 7

Sample Grading Rubric

Name of Student: _____

GEM Topic or Problem: _____

Directions: Circle the score that best represents the student's work.

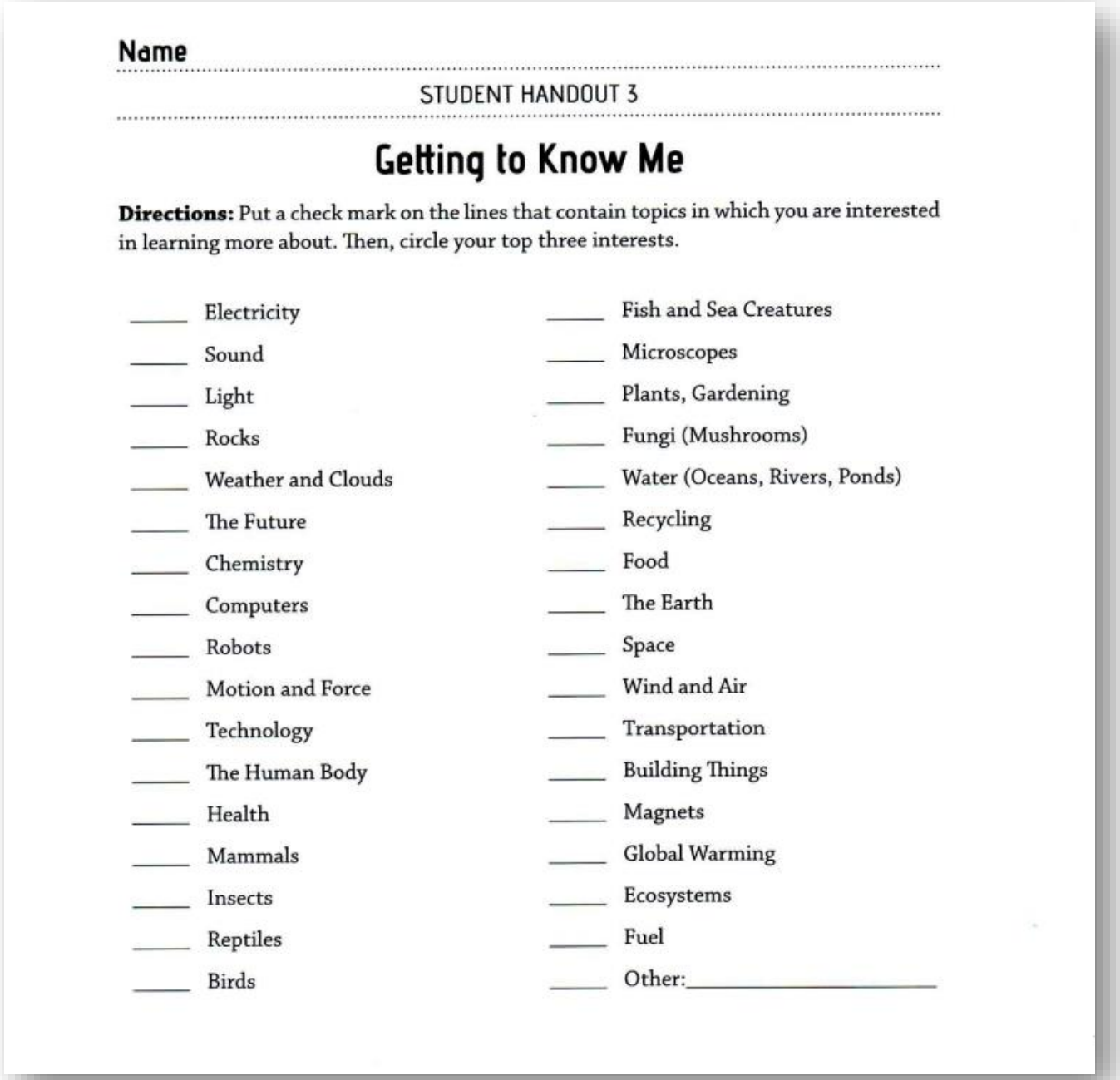
Section		Criteria	Not Present	Developing	Adequate	Excellent
				Present but Needs More Development	***Meets Expectations***	***Exceeds Expectations***
Section 1	Exploring Like a Scientist	The student completed an interest inventory and helped to plan and implement the group's STAR Day. The student has stated reasons for being interested in the topic and identified a few ways to learn more about the topic.	0 points	4 points	8 points	10 points
Section 2	Introducing My GEM Topic	The student has stated reasons for being interested in the topic and identified a few ways to learn more about the topic.	0 points	4 points	8 points	10 points
Section 3	Knowing My GEM Topic	The student has identified an appropriate number of facts. If appropriate, the student has identified sources correctly (Student Handout 8b).	0 points	4 points	8 points	10 points
Section 4	Investigating My GEM Topic	The student has completed the investigation plan, recording the results and reaching logical conclusions.	0 points	4 points	8 points	10 points
Section 5	Science Safaris	The student has completed an appropriate number of Science Safaris. The student documents the Science Safaris with an appropriate amount of reflection.	0 points	4 points	8 points	10 points

	Section	Criteria	Not Present	Developing	Adequate	Excellent
Section 6	Debating My GEM Topic	The student has participated in a debate and contributed one or more facts to the team. The student has presented his or her fact(s) to the class.	0 points	4 points	8 points	10 points
Section 7	My Solutions	The student has worked to develop appropriate solutions to the GEM problem.	0 points	3 points	9 points	10 points
Section 8	Working With Others	The student has collaborated with others and has provided feedback on the collaborative process.	0 points	4 points	8 points	10 points
Section 9	Telling Others	The student has helped to present his or her group's findings. The findings are relevant to an authentic audience.	0 points	4 points	8 points	10 points
Section 10	Reflections	The student has appropriately reflected on the process and outcome.	0 points	4 points	8 points	10 points
					Total Score:	_____/100

Comments:

Week 2 – Conduct an Interest Inventory (Portfolio Section 1 – Exploring Like Scientists)

Getting to Know Me - Poll



Name .....

STUDENT HANDOUT 3

Getting to Know Me

Directions: Put a check mark on the lines that contain topics in which you are interested in learning more about. Then, circle your top three interests.

_____ Electricity	_____ Fish and Sea Creatures
_____ Sound	_____ Microscopes
_____ Light	_____ Plants, Gardening
_____ Rocks	_____ Fungi (Mushrooms)
_____ Weather and Clouds	_____ Water (Oceans, Rivers, Ponds)
_____ The Future	_____ Recycling
_____ Chemistry	_____ Food
_____ Computers	_____ The Earth
_____ Robots	_____ Space
_____ Motion and Force	_____ Wind and Air
_____ Technology	_____ Transportation
_____ The Human Body	_____ Building Things
_____ Health	_____ Magnets
_____ Mammals	_____ Global Warming
_____ Insects	_____ Ecosystems
_____ Reptiles	_____ Fuel
_____ Birds	_____ Other:_____

Results of Student Interest Inventory

Directions: Record the names and numbers of students who indicated an interest in each topic below.

Electricity	**Rocks**	**Chemistry**
Names: Checked Topic: Circled Topic:	Names: Checked Topic: Circled Topic:	Names: Checked Topic: Circled Topic:
Sound	**Weather and Clouds**	**Computers**
Names: Checked Topic: Circled Topic:	Names: Checked Topic: Circled Topic:	Names: Checked Topic: Circled Topic:
Light	**The Future**	**Robots**
Names:	Names:	Names:

Weeks 3-5 - Form Science Topics Are Real (STAR) Interest Groups and Plan STAR Days.

- STAR groups are preliminary groups that will allow students to explore a topic of interest.
- Assign groups based on interest inventory or allow students to self-select.
- The group will “teach” the class about their topic.

Question for You to Think About…

What random topic you could talk about all day long?

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Weeks 3-5 - Form Science Topics Are Real (STAR) Interest Groups and Plan STAR Days.

- In addition to the content lesson, students might plan one of the following:
  - Inviting an expert speaker.
  - Planning an engaging activity for the class.
  - Creating a game for the class to play based on the topic.
  - Planning a science demonstration related to the topic.
  - Giving a talk using technology (e.g., PowerPoint or Prezi).
- Facilitate discussion among groups about what is possible and what is not.
- Assist with arrangements.

Name

STUDENT HANDOUT 4

Science Topics Are Real (STAR) Day Planning Sheet

I am in a group with the following people:

It's fun to be the teacher! You get to select a science topic and help the class to learn about it. In this activity, you will plan a STAR Day that will help you and your class discover more about your topic.

Directions: Complete the following items below.

1. With your group, write down three of your interests in science:
   a.
   b.
   c.

2. Talk about these interests with your group and your teacher. Pick **one** interest that you would like present on a STAR Day. Write it here:

3. Now that you know your STAR topic, think of a name for your group (it should be something about your topic), and write it here:

   _____

4. Now think of ways that you could help your class to learn more about your STAR topic. Discuss the ideas below with your group and write down your thoughts about what you could do.
   a. Special speaker:

   b. Activity:

   c. Game:

   d. Demonstration:

5. Select **your top two ideas** for what you would like to do. Answer the questions for your top two ideas.

a. Special speaker

- Who will be the speaker?
- How do we contact the speaker?
- Does the speaker live nearby or out of town?
- Why is the speaker qualified to speak on your topic?

b. Activity

- What is the name of your activity?
- What will you need to conduct the activity?
- How will this help the class to learn about your topic?

c. Game

- What is the name of your game?
- How is the game played?

d. Demonstration

- What is the name of your demonstration?

- What will you need to do the demonstration?

- Who will bring which materials?

- How will you do the demonstration?

- How will the demonstration help the class to learn about your topic?

Turn this sheet in to your teacher. Don't forget to put your name and the names of all group members at the top.

Approved by: _____ Date of Group's STAR Day: _____


I
have
a
Question!