STEM is More Than An Acronym Especially in the Elementary Setting

Tomika R. Altman-Lewis, M.Ed
A.I.G. Facilitator/Teacher Durham Public Schools

tomika.altman-lewis@dpsnc.net
http://integration-station.weebly.com
@prettysqueaky on Twitter

Every week it seems as though they are adding a new letter to STEM. "A" for Art (S.T.E.A.M.) or "R" for Reading/Research/wRiting (S.T.R.E.A.M.) According to Dr. Sam Houston, President and CEO of the NC Science, Mathematics, and Technology Education Center, "S.T.E.M. is more than an acronym for Science, Technology, Engineering and Mathematics. They are Strategies that Engage Minds."

Five Strategies to Engage Their Minds

1. Collaboratively Speaking
2. Writing Across the Curriculum
3. The Power of LEGOs
4. Getting the F.A.C.Ts
5. The Engineering Design Process

Collaboratively Speaking

Number Talks

By Kathy Richardson

A Number Talk is a short, daily routine that provides students with meaningful ongoing practice with computational fluency. Children solve problems using mathematics that they know and understand up to that point. Children are asked to make connections and look for relationships as they engage in mathematics. They share their strategies with others, learn to clarify and express their thinking, and develop their mathematical language and understanding.

Number Talks can be held with both the whole class and with small groups. When children are working with the whole class they will have opportunities to experience a wide range of strategies as they listen to their peers. Advantages of conducting number talks with small groups are that the problems can be tailored to that group's particular needs and they will have more opportunities to share their thinking.

It is important to keep Number Talks short, as they are not intended to replace current curriculum or take up the majority of the time spent on mathematics. In fact, teachers need to spend only 5 to 15 minutes on Number Talks. Number Talks are most effective when done every day. Frequent and consistent practice will yield the greatest results.

All Number Talks follow a basic six-step format. The format is the same, but the problems and models used will differ for each number talk.

Number Talk Format

1. **Teacher presents the problem.**
   This can be using manipulatives (ten frames, dot cards, models), word problems or a number sentence.
2. **Students figure out the answer.**
   Give students time to figure out the answer on their own. You can have them wink, "thumbs-up," or some other quiet signal that's between you and the students. (Using a quiet signal makes students feel safe and allows them to take risks.)
3. **Students share their answers.**
   Four or five students volunteer their answer and the teacher records them on the board.
4. **Students share their thinking.**
   Three or four different students share their thinking. Time permitting they can share with an elbow partner. Teacher writes two or three of the students' thoughts.
5. **The class agrees on the "real" answer for the problem.**
6. **The steps are repeated for additional problems.**

Visual Thinking Strategies – VTS Facilitation Method 101

http://www.vtshome.org/what-is-vts/method-curriculum--2

Teachers are asked to use three open-ended questions:

- What's going on in this picture?
- What do you see that makes you say that?
- What more can we find?

3 Facilitation Techniques:

- Paraphrase comments neutrally
- Point at the area being discussed
- Linking and framing student comments

Students are asked to:

- Look carefully at works of art
- Talk about what they observe
- Back up their ideas with evidence
- Listen to and consider the views of others
- Discuss many possible interpretations

Making Thinking Visible: How to Promote Engagement, Understanding and Independence for All Learners

By Ron Ritchhart, Mark Church, and Karin Morrison

- See-Think-Wonder
- I Used to Think..., Now I Think...
- Headlines
- Chalk Talk

See-Think-Wonder

Looking at an image or object:

- What do you see?
- What do you think is going on?
- What does it make you wonder?

Headlines

Think of the big ideas and important themes in what you have been learning.

- Write a headline for this topic or issue that summarizes and captures a key aspect that you feel is significant and important.

I Used to Think…, Now I Think…

Reflect on your current understanding of this topic, and respond to each of these sentence stems:

- I used to think…
- Now I know…

Chalk Talk

Looking at the topic or question written on the chart paper:

- What ideas come to mind when you consider this idea, question, or problem?
- What connections can you make to others' responses?
- What questions arise as you think about the ideas and consider the responses and comments of others?

Writing Across the Curriculum

One-Pagers	Advertisements	Autobiographies/Biographies
Blogs	Exit Tickets	Make a Web
Design a Book Cover	Draw a picture and label it	Definitions in your own words
Create examples of the skill/concept and explain	Write about a real-life use of the concepts or skills	Reflections
Pencil Talks	Learning Logs	Bumper Stickers
Brochures	Cartoons	Catalogs
Number Stretches	Comics	Journals
Open Responses	Recording Different Strategies	Claims, Evidence, and Response (CER)
Anchor Charts	Posters	Vocabulary Books
Instruction Manuals	Letters	Observations
Plays	Quizzes	Speeches
Fact Sheets	Games	How-to Articles
Create word Problems	Surveys	Stories
Summaries	Tweets	Timelines
Want ads	Songs	Reviews
Documentation for center/station activities	Frayer Model	Scripts/Storyboards
Student created task cards	Paper Slides	R.A.F.T.

Specific Examples

- Write a letter to a friend explaining why a popsicle stick is better to measure with than a paper clip or vice-versa.
- What would life be like if we did not have clocks, watches, or cell phones to help us tell time? Design a way to tell time without these devices.
- After a mini-lesson, have students explain and illustrate two different approaches to solving a problem.

- Explain in your own words the meaning of _____(doubles +1, a fact family, 30 past the hour, area, perimeter, volume and etc.) *Basically grade-level concepts and vocabulary.*
- Research the height of bears…based upon their height what do you think a small, medium, or large size-bowl would look like? Think about our plates. Compare and contrast it to a human's bowl. Did you estimate correctly? Explain why or why not?
- Review the last three entries in your journal. Select one to revise.
- Learning Logs….
    - I learned…
    - I was surprised that I…
    - I noticed that I…
    - Two questions I still have are…
    - Something I'm puzzled about…
    - The strategy or strategies I used today were…
    - Something that stuck with me today…

The Power of LEGOs

Math	**Literacy**	**Engineering**
Building arrays	Illustrate a Historical Story	City Planning Challenge
Multiplication and Division	Fractured Fairy Tales	Computerless Coding Project
Area and Perimeter	Multimedia Storytelling Project (iMovie and Stopmotion Animation)	LEGO WeDO or Mindstorm Coding and Roboics
Volume	Demonstrate Speaking and Listening Skills	Balloon Car
Fractions	Elements of a Story (Characters, Plot and Setting)	Design a new toy
Counting	Following Directions	Make a catapault
Exponents	Create a story, commercial, newscast, or comic strip.	Simple Machines
Part-Part Whole	LEGO Apps	Forces and Motion
Subtraction and Addition	Argumentation – have students build based on a concept and talk about the different representations	http://www.legoengineering.com
Patterns	Write high frequency words on them and use them to create sentences.	Chemical Reaction Powered Cars (LEGOs + Alka Seltzer + Water + Film Canister)
Symmetry	LEGO StoryStarter	LEGO Earthquake. Can you build a city that will withstand an earthquake? (Build the tallest building possible that can withstand an earthquake…shaking the LEGO base plate back and forth. ☺)

LEGOs are expensive so how do I get them?

- Rent them. http://www.pley.com - Receive your first set free then $15/month.
- Write a proposal on http://www.donorschoose.org or http://www.adoptaclassroom.org
- Look for used LEGOs on Craigslist, Ebay, or Secondhand stores.

Getting the F.A.C.Ts (Formative Assessment Classroom Techniques)

Keeley, Page. (2008). Science Formative Assessment: 75 practical strategies for linking assessment instruction, and learning. Thousand Oaks, CA, Corwin Press.

1. Engineer effective classroom discussions
2. Provide feedback that moves learning forward.
3. Clarify learning intentions and success criteria.
4. Activate students as owners of their own learning.
5. Activate students as learning resources for one another.

FACT – Fist to Five

Description: Students hold up their fist and/or fingers to show their level of understanding of a question or concept. A fist represents no understanding and five fingers represent full understanding. Students can hold their hand close to their chest so that it is only visible to you.
When to use: Can be used at any time and can be used to check for understanding after the teacher gives directions. Students can initiate at any time; especially when they are confused.
Why: Quick way to assess the entire class' level of understanding.

FACT – Card Sort

Description: Students are given a set of cards with either pictures or words on them. They are asked to sort them according to certain attributes or characteristics. They can work independently, with partners/small groups and must provide a rationale for their thinking.
When to use: Can be used at any point. To pre-assess learning, during an activity, or after a learning experience.
Why: Gives students an opportunity to activate prior knowledge, build vocabulary, analyze and categorize concepts/vocabulary, defend their thinking, and clear up misconceptions.

FACT – Agreement Circles

Description: Students are asked to form a large circle. A true or false statement is read to the group. The group is given about 10 seconds of wait time before they are asked to move into the center of the circle if they agree with the statement. If they disagree, they remain outside. Students are given a few minutes to defend their thinking within their groups. The teacher calls time and students may change their position if they change their minds or remain where they are. The teacher notes the changes and the process is repeated with another statement.
When to use: Can be used at the beginning of a unit or in the middle to reinforce concepts.
Why: Allows students to demonstrate and defend their thinking.

FACT – Fish Bowl Think Aloud

Description: This technique is used to listen in on the thinking of a sampling of students in a class. Four or five students are selected to be in a "fishbowl," sitting together in a cluster or the front of the classroom. The rest of the group listens to the conversation. Provide the students in the fishbowl with an interesting open-ended prompt for discussion to begin the thinking process. *Example: Is air necessary for gravity to act on an object?*
When to use: This FACT requires the students in the "fishbowl" to think out loud, describe their thinking, and explain the reasons for their ideas. The other students are mentally comparing their ideas to what they are hearing in the "fishbowl".

Why: As the teacher listens in on the conversation, understandings, and misconceptions can be noted so that may be addressed in subsequent instruction/conversations.

FACT Commit and Toss

Description: Students are provided a question to answer on scrap paper and are told not to put their name on it. When all students have written their answer, they are asked to crumple their sheet, and toss it into the middle of the room. Students are to pick up one crumpled ball and share the idea on that paper with a partner.

When to use: Can be used at any time.

Why: Provides the teacher with a snapshot of the whole class' thinking. Helps students to see there are other ideas besides their own. It is nonthreatening. All ideas can be shared.

FACT K-W-L Variations

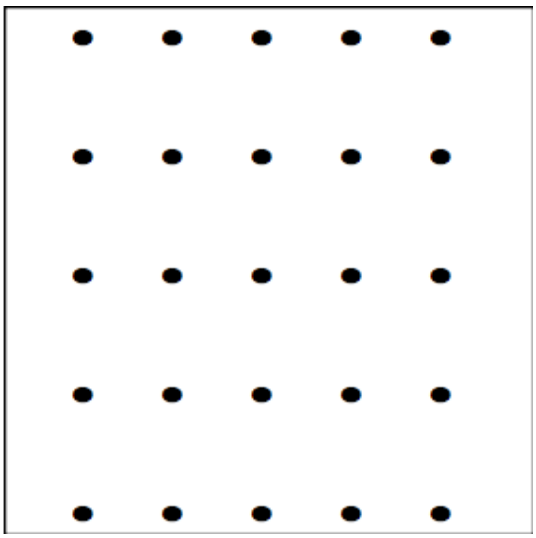
Description: Students record what they know about a concept (K) Describe what they want to know (W) and then write in detail what they have learned (L).

When to use: This strategy is used throughout a lesson/experience/activity/unit. This can be a whole class activity or students can complete it independently.

Why: Students are invested in their learning. Teachers can use this chart to address misconceptions, plan lessons that students are interested in, and ensure that desired outcomes are being met.

K-W-L Variations

- **K-W-F:** What I **Know**, what I **Wonder**, this is how I will **Find** out.
- **K-T-F:** What I **Know** for sure, this is what I **Think** I know, this is how I **Found** out.
- **O-W-L:** This is what I **Observed**, this is what I **Wonder**, this is what I **Learned**.
- **P-O-E:** This is what I **Predict**, what I **Observed**, this is how I can **Explain** it.
- **KLEWS:** K – What do we think we **Know**? L – What are we **Learning**? (Claims) E – What is our **Evidence**? W – What do we still **Wonder** about? S – What **Scientific** principles/vocabulary help explain the phenomena? (Reasoning)



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100