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GO OUTSIDE with Michigan Science Standards using Place-based Learning

Gabe Knowles (Whitehall Schools)
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Michigan Science Teachers Association Conference
Putting Legs to the New Michigan Science Standards
March 24, 2017

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CREATE for STEM Institute

- Based at Michigan State University
- COLLABORATIVE research and innovation projects
- Curriculum, teaching strategies, assessment development
- Elementary grades through undergraduate courses
- Grounded in 3-dimensional learning, project-based learning, NGSS/ Michigan Science Standards
- Partners in K-12 schools, higher education, research institutes, community organizations
- In Michigan, across the U.S., and around the world
- Funding from MSU, NSF, NIH, foundations

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- MSU's largest off-campus research and education complex.
- Over 3200 acres of forest, agricultural fields, wetland, lake and prairie habitat.
  - Kellogg Bird Sanctuary
  - Kellogg Farm and Pasture Dairy
  - Manor House and Conference Center
- 13 faculty research in ecology, evolutionary biology, agriculture and conservation biology

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Teaching Science Outdoors

- A week long professional development program for K-5 Teachers
- Focused on building confidence and creativity with content

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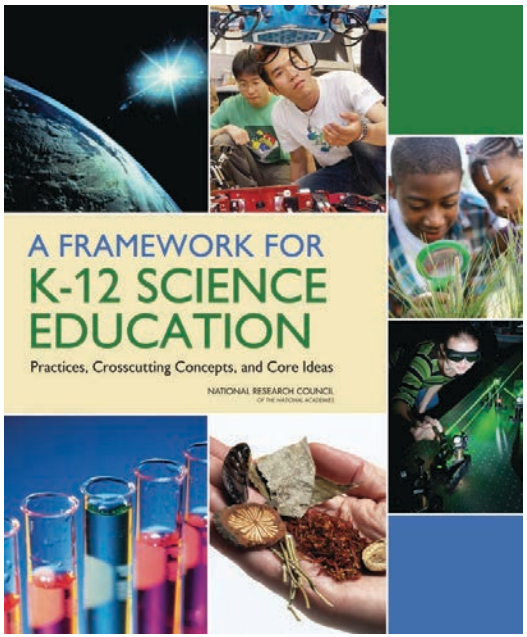
What will we do today?

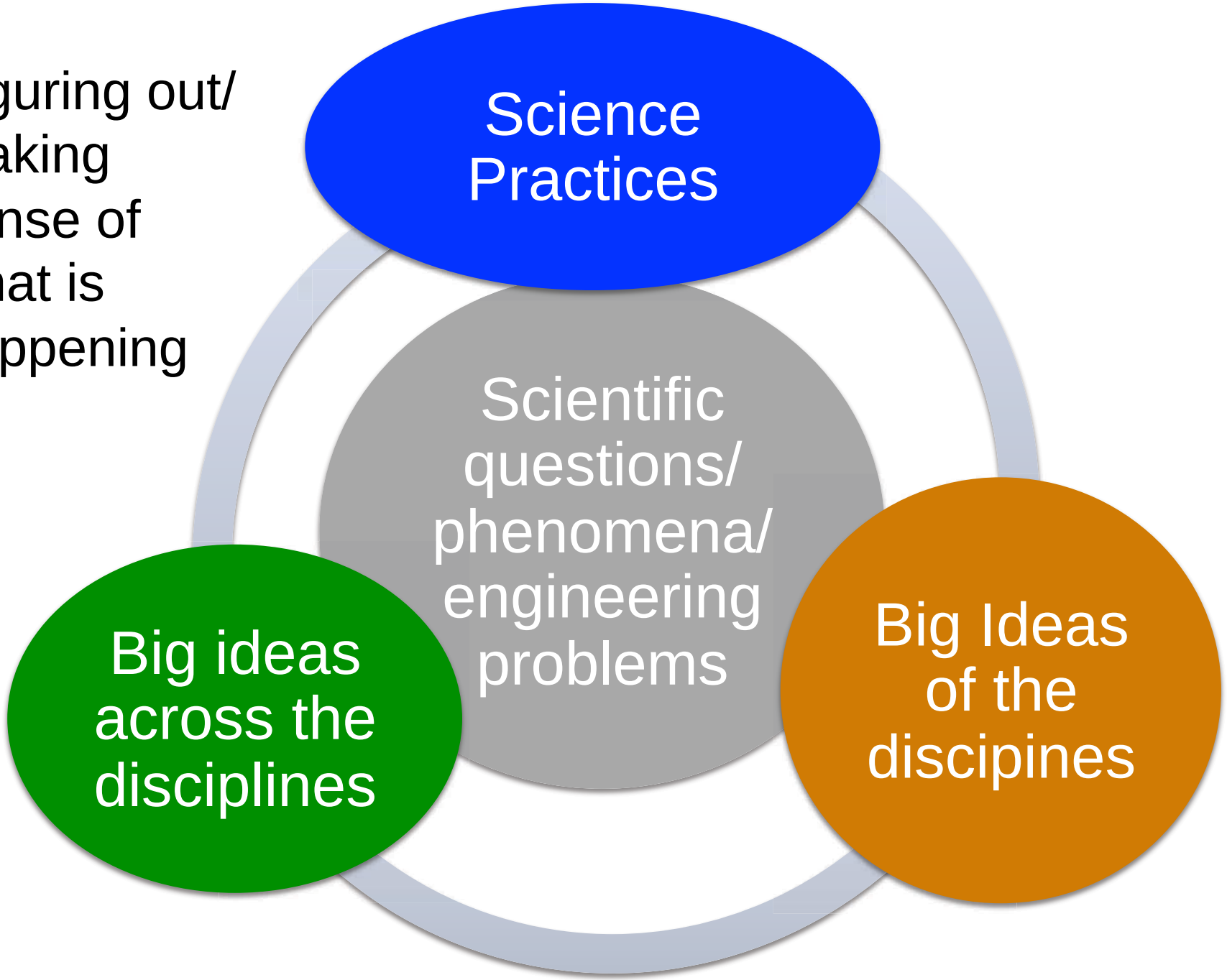
- Discuss what's new in the Michigan Science Standards (MSS)
- Explain how Project-Based Learning (PBL) supports MSS
- Demonstrate what PBL looks like in the schoolyard and GO OUTSIDE!

What's new in the the Michigan Science Standards and Framework



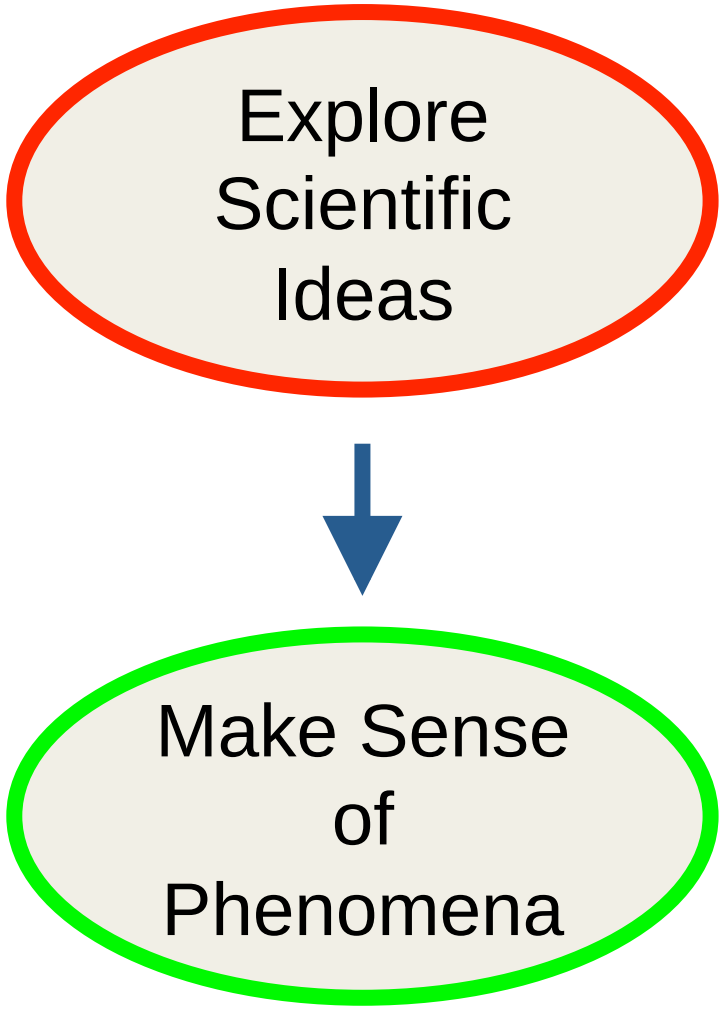
1. Focus on explaining phenomena or designing solutions to problems
2. 3-Dimensional Learning
    1. Organized around disciplinary core explanatory ideas
    2. Central role of scientific and engineering practices
    3. Use of crosscutting concepts
3. Instruction builds towards performance expectations
4. Coherence: building and applying ideas across time
5. Engineering as a DCI

Figuring out/ Making sense of what is happening



"Figuring Out" vs. "Learning About"

- **Explanatory ideas** are important so that students are figuring out phenomena and not just learning about facts and details.
- **Science and engineering practices** build explanatory ideas.



Project-Based Learning (PBL)

- Project-based learning allows students to
  - learn by doing,
  - apply ideas, and
  - solve problems.
- In so doing, students engage in real-world activities similar to those of professional scientists.

Krajcik, J.S. and Shin, N. (2014) 'Project-Based Learning', in Sawyer, R.K. (ed.) *The Cambridge Handbook of the Learning Sciences:*. Cambridge: Cambridge University Press, pp. 275–297.

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Project-Based Learning (PBL)

Learning sciences research has found that teaching integrated knowledge allows students to:

- draw on their understanding to solve problems,
- make decisions, and
- learn new ideas.

Drawing on this research, the goal of PBL is to increase students' engagement and help them develop deeper understanding of important ideas.

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6 Key Features of PBL

Students:

1. Start with a **driving question** about a phenomena or a problem to be solved.

2. Focus on **learning goals** that require a demonstration of mastery on key science standards and assessments.

3. Explore the driving question by participating in **scientific practices** – processes of problem solving that are central to expert performance in the discipline

4. Engage in **collaborative activities,** along with teachers and community members, to find solutions to the driving question.

5. Are **scaffolded with learning technologies** that help them participate in activities normally beyond their ability.

6. Create a set of **tangible products** that address the driving question.

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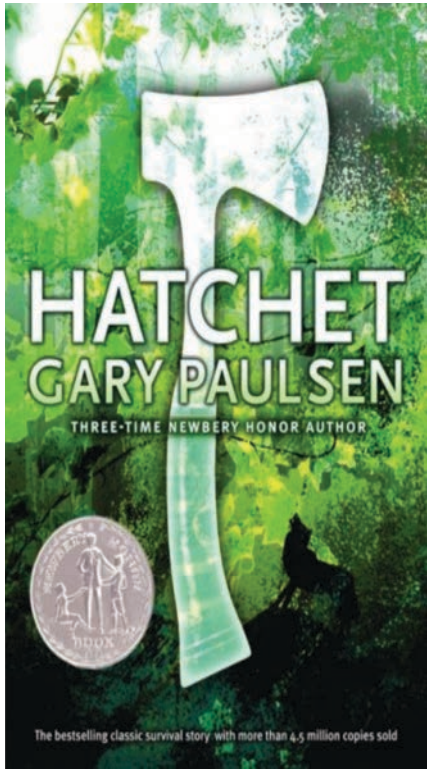
Ealy Elementary – Whitehall, MI

What does PBL look like in the classroom?



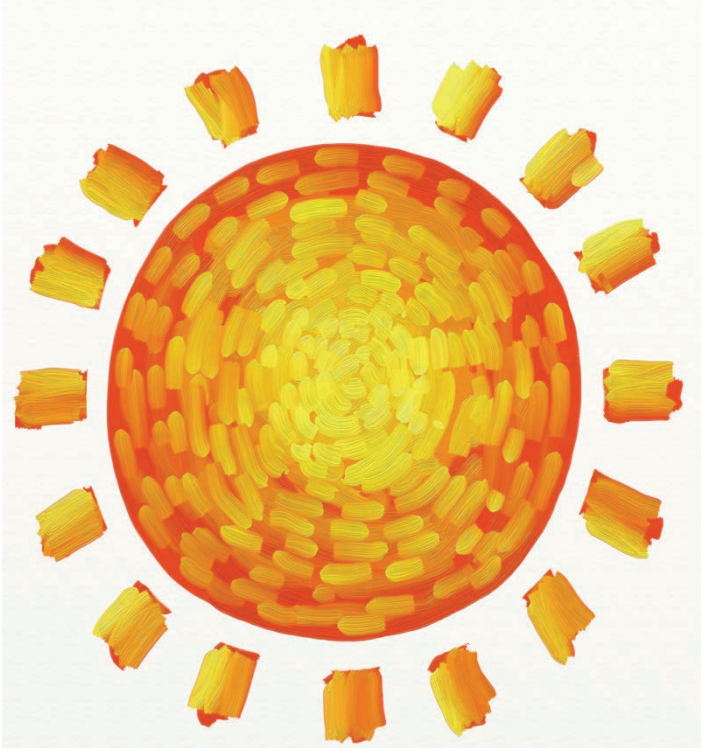
"His eyes fell upon the stone ridge to his left and he thought at first he should build his shelter against the stone. But before that he decided to check out the far side of the ridge and that was where he got lucky.

Using the sun and the fact that it rose in the east and set in the west, he decided that the far side was the northern side of the ridge."

Hatchet, Gary Paulsen

Students question: “How did Brian know where North was?”

Can we replicate how Brian used the sun in the story, *Hatchet*, to decide what direction north is, as well as the other cardinal directions?



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Observing a Phenomenon in Our Courtyard

SUN SHADOW OBSERVATIONS, DAY 01

Knowles Sun Shadow Data from September 14, 2016

Time of Day	Length of Sun's Shadow
8:45 AM	--
9:45 AM	175 cm
10:45 AM	119 cm
11:45 AM	--
12:45 PM	70 cm
1:45 PM	69 cm
2:45 PM	72 cm
3:45 PM	--
4:45 PM	90 cm

SUN SHADOW OBSERVATIONS, DAY 02

Knowles Sun Shadow Data from September 15, 2016

Time of Day	Length of Sun's Shadow	Direction of Sun's Shadow
8:45 AM	278 cm	W
9:45 AM	173 cm	NW
10:45 AM	113 cm	NW
11:45 AM	80 cm	NW
12:45 PM	70 cm	N
1:45 PM	27 cm	N
2:45 PM	72 cm	NE
3:45 PM	85 cm	NE
4:45 PM	--	--

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SUN SHADOW OBSERVATIONS, DAY 03

Knowles Sun Shadow Data from September 19, 2016

Time of Day	Length of Sun's Shadow	Direction of Sun's Shadow
8:45 AM	271 cm	282°
9:45 AM	173 cm	292°
10:45 AM	120 cm	310°
11:45 AM	90 cm	327°
12:45 PM	71 cm	350°
1:45 PM	68 cm	360°
2:45 PM	75 cm	17°
3:45 PM	85 cm	32°
4:45 PM	127 cm	50°

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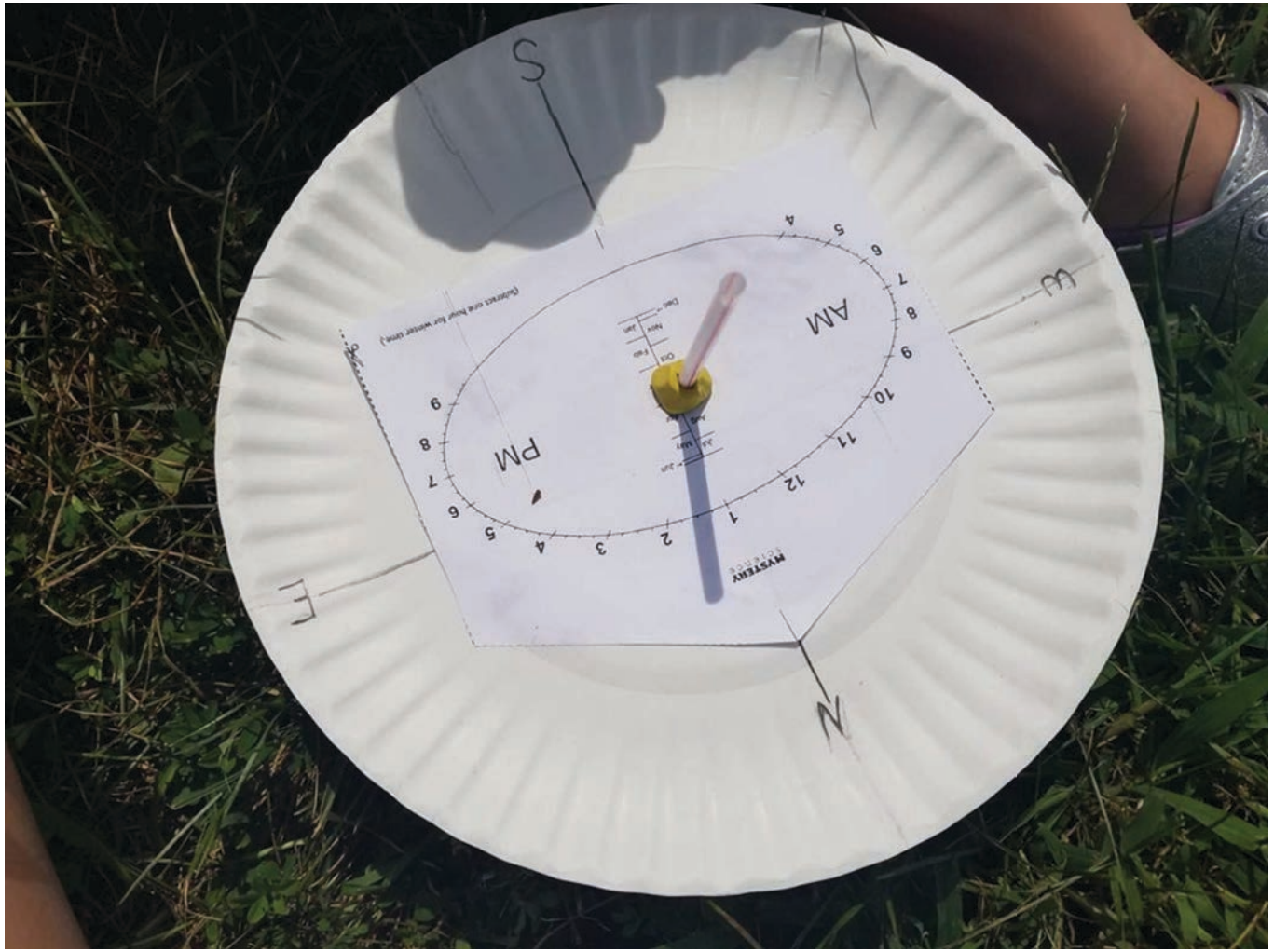
Using a Model to Explain the Phenomenon We are Observing


S
W
E
N
AM
PM
MYSTERY

Let’s take it outside!

How can we make accurate observations of the Sun’s shadow? Are there any patterns that emerge from our observations?

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How to tweet observations

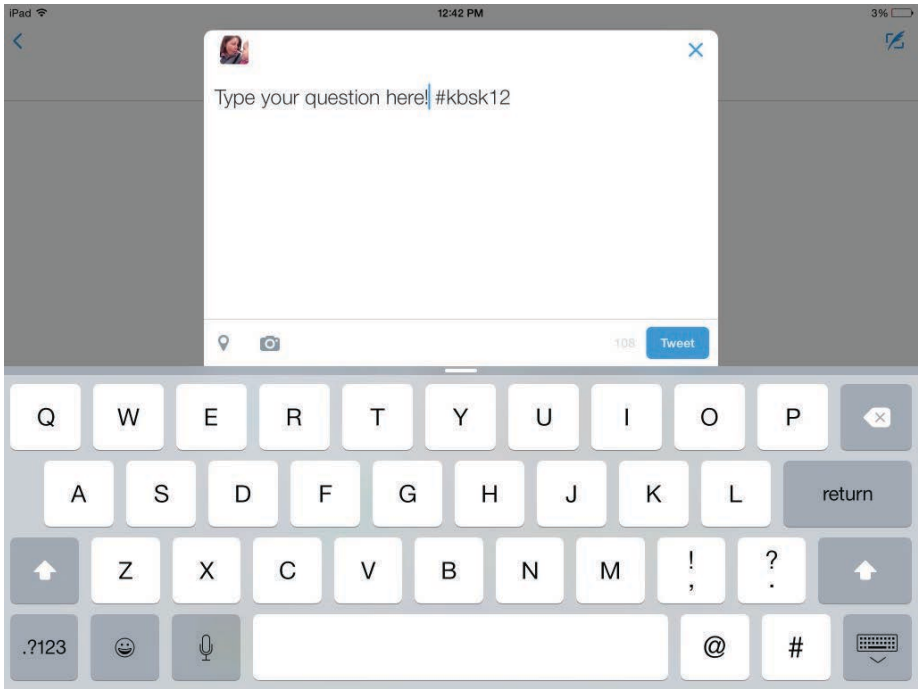
1.Press the 

2. Press the 

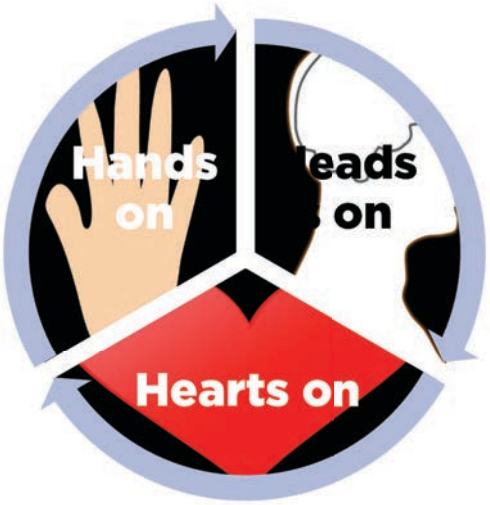
3. Take photo of observation!

4. Type question or description

5. #KBSK12



Wrap up/reflection



Hands on, Heads on, Hearts on

- **How were your hands, head and heart engaged in this activity?**
- **For your grade level, how do you envision your students hands, heads and hearts would be engaged?**

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