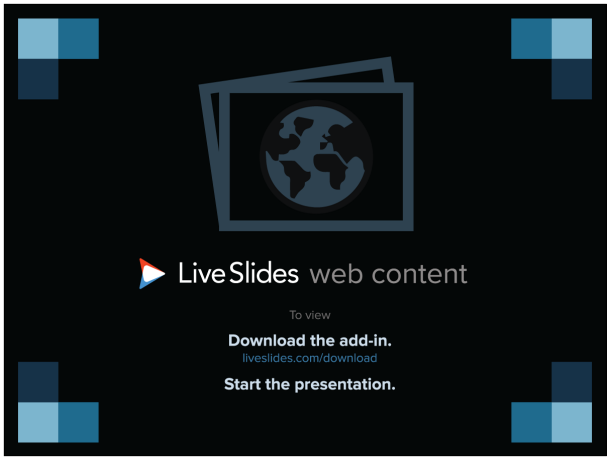
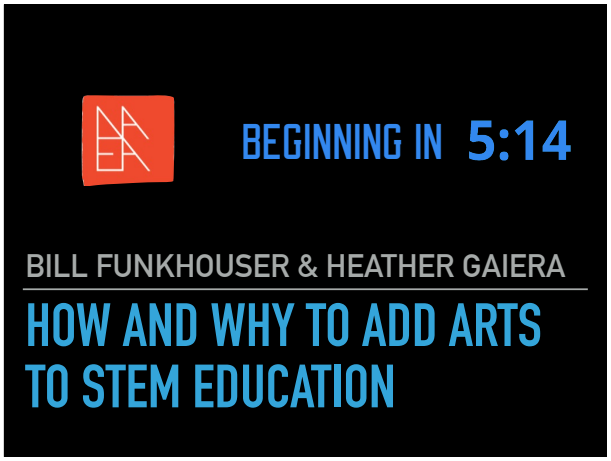


1

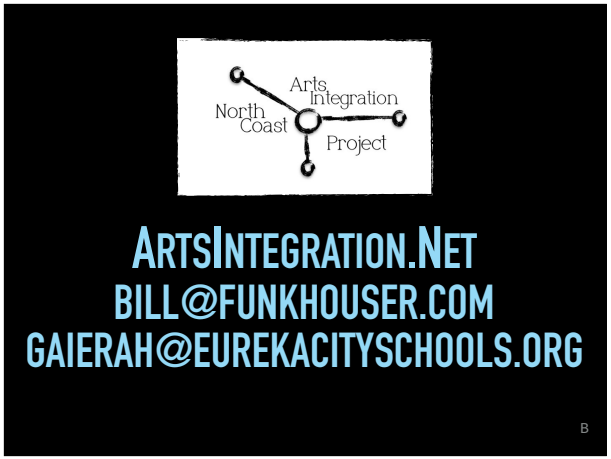
LiveSlide Site
https://vimeo.com/194647932



2

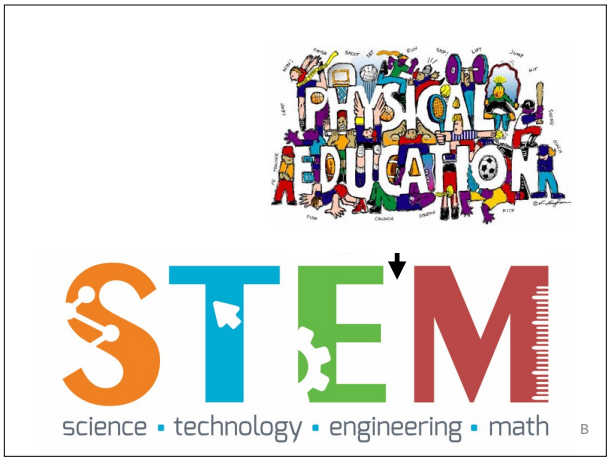
3

I'm remembering to make sure my phone is off and away. You'll get the most out of this presentation if you are fully present.



4

If it helps you to take notes, please do so but know that this presentation is on our site, or you can email us. Once you feel you have a way to access this presentation, you can relax and be here now.

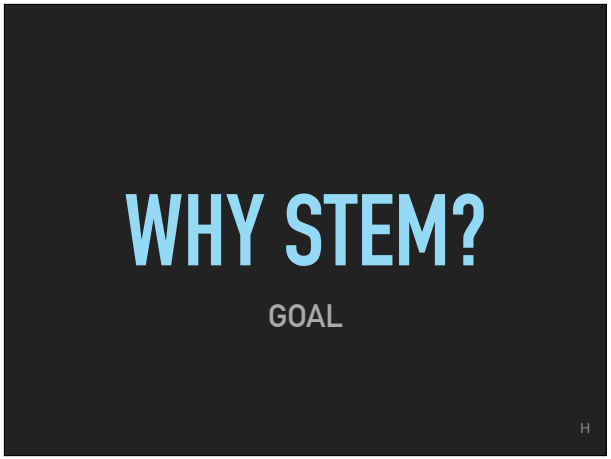


5

STEM had been around for some time when someone suggested we add the Arts to it making STEAM. Why the arts and not some other subject?

6

Before we can answer why we should add the arts, we need to ask another question first.

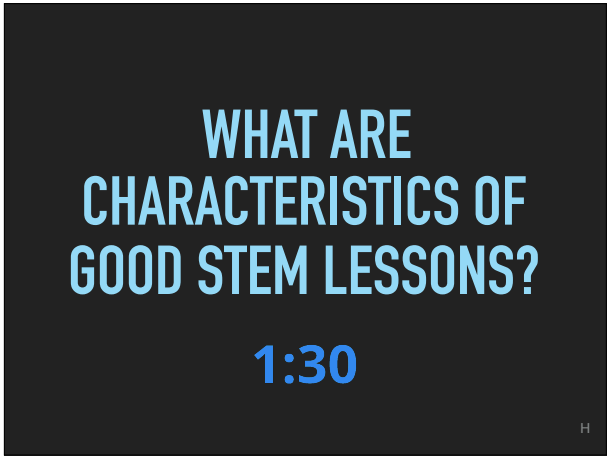


7

Why STEM in the first place?

8

The goals of STEM education was to increase enrollment and literacy in STEM subjects especially for women and minorities.

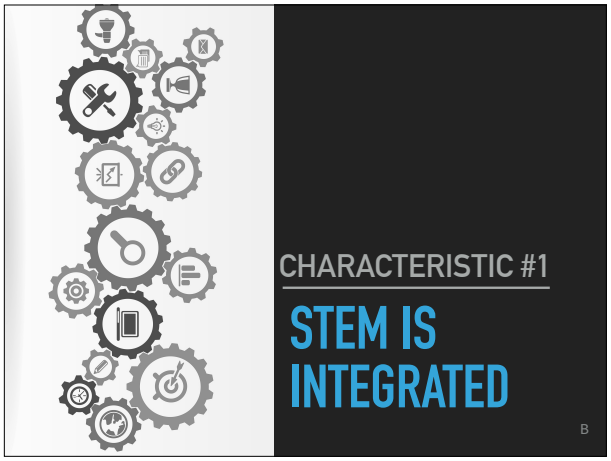


9

So what are the characteristics of exemplary STEM lessons? If you process better by thinking and writing go ahead and jot down ideas. If you prefer to discuss with others, please do. In 90 seconds, I would like you to have created a few characteristics of what makes a good STEM lesson.

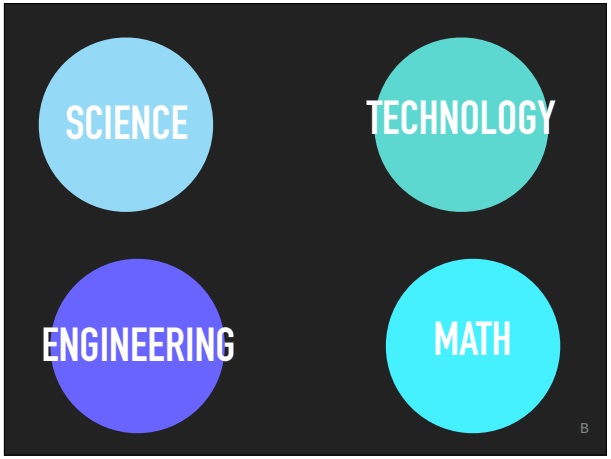
10

You had many great ideas. Many publications identify six characteristics of outstanding STEM lessons



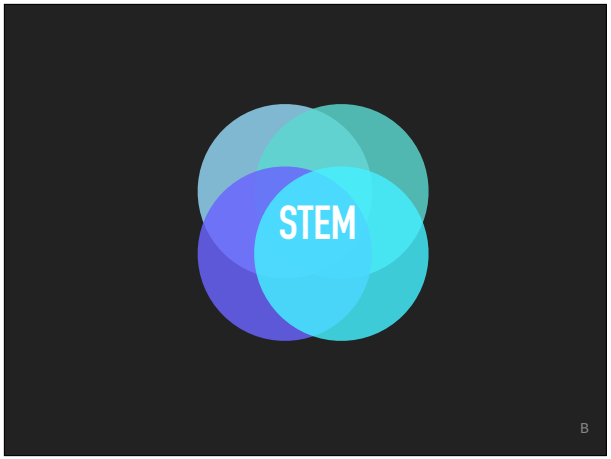
11

The first one and most cited is STEM is integrated



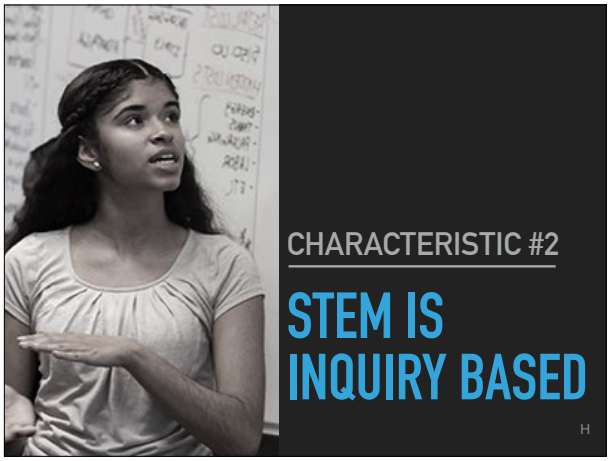
12

Some schools approach STEM like this. Students walk from one class to another. Teachers plan by themselves and don't share prep periods with other teachers. Topics are silo-ed and crossover is rare. This is not the intent of STEM.



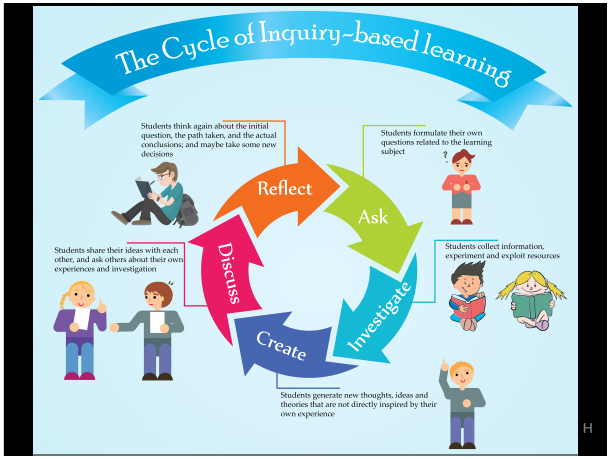
13

Outstanding STEM education is integrated. Students don't feel like they're in an isolated "science" or "math" class- they learn those subjects and use them regularly as tools towards solving problems.



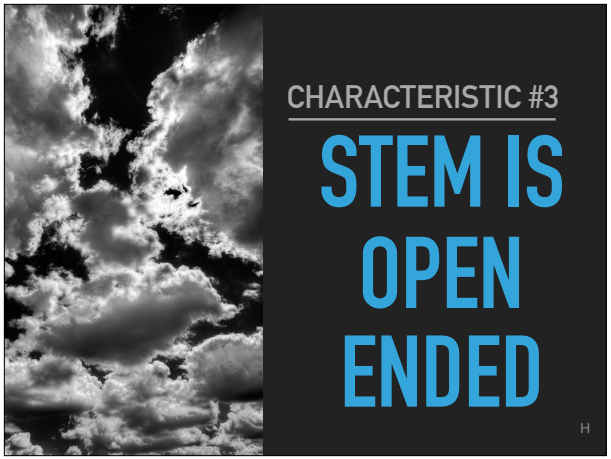
14

STEM fosters curiosity and transfers ownership of learning to students. It is less teacher centered. Students create their own understandings.



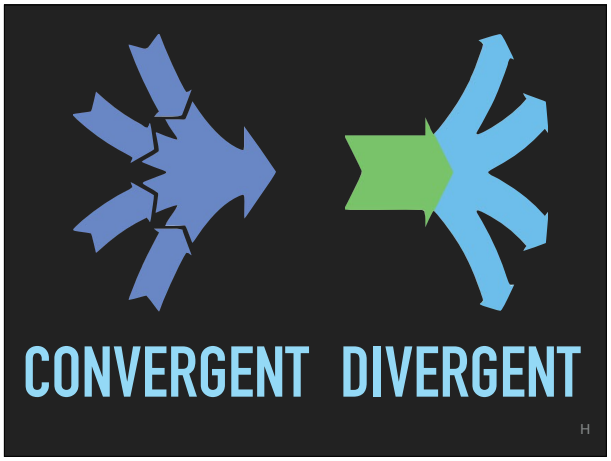
15

The typical cycle of Inquiry based learning starts with asking questions. This leads to investigation, creation, and evaluation before the next iteration of the cycle begins.



16

(Heather) The third characteristic is STEM is Open Ended.

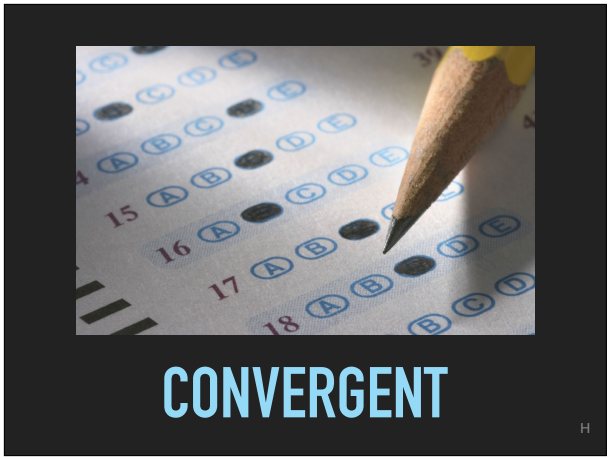


17

The issue of open ended questioning brings up the concept of convergent vs. divergent thinking.

18

<u>Science</u> teaching is frequently convergent- focused on getting the right answer and efficient delivery of the learning objectives.

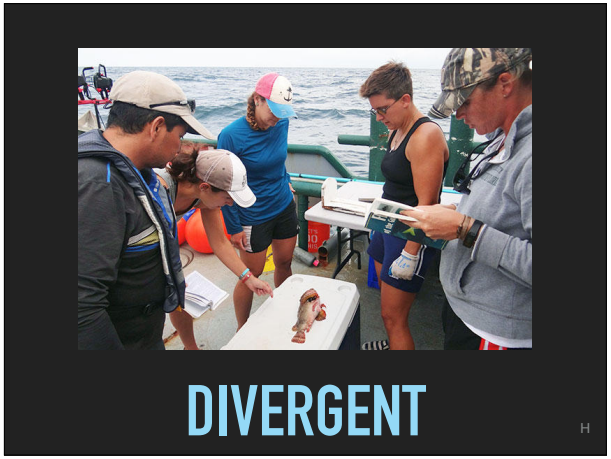


19

Convergent teaching is asking routine questions with standard answers. Math teaching is often done in a convergent manner as well.

20

Yet a 2014 study concluded…85% of business leaders say they can't find job applicants with creativity & innovation skills… in other words, divergent thinkers

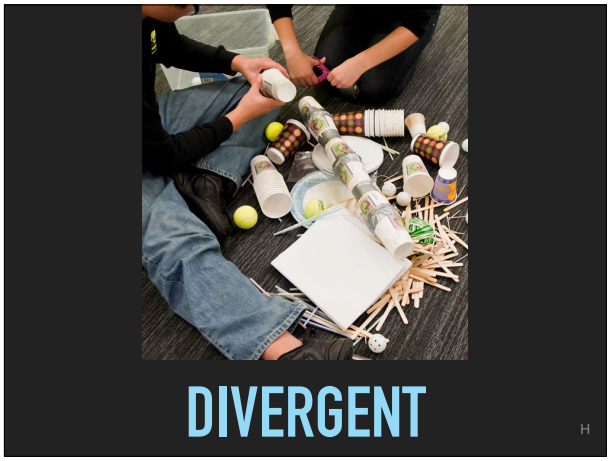


21

People who work in STEM fields encounter problem solving opportunities which require a divergent mindset.

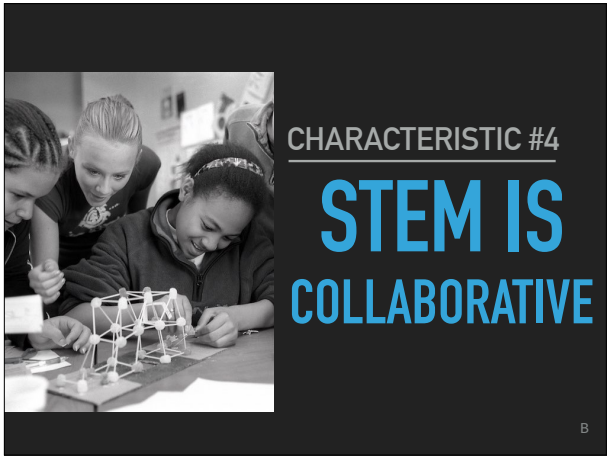
22

Within reason, more people, with more ideas come together to solve problems with more innovation and creativity than people working alone.



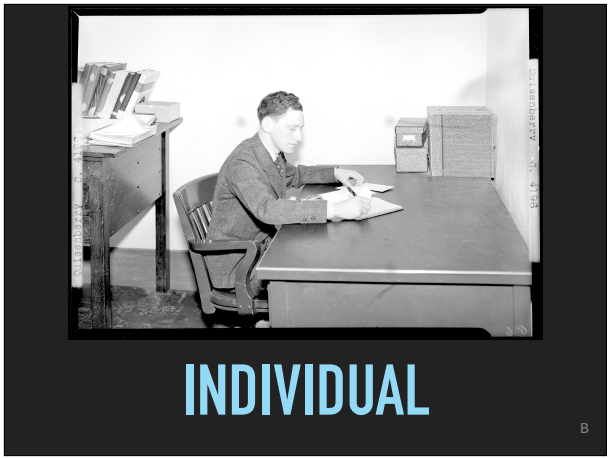
23

This mindset of creative problem solving and divergent thinking can come into our classrooms as well.



24

(Bill) This leads to characteristic #4: STEM is collaborative.



25

This image of the lone scientist or mathematician is obsolete.

26

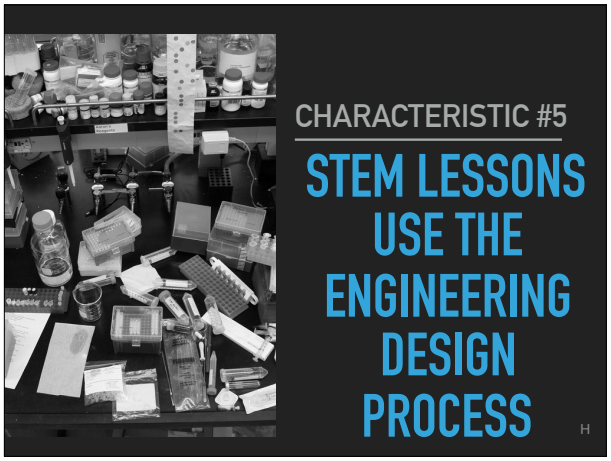
People working in STEM careers are working together.

27

The same happens in outstanding STEM classes.

28

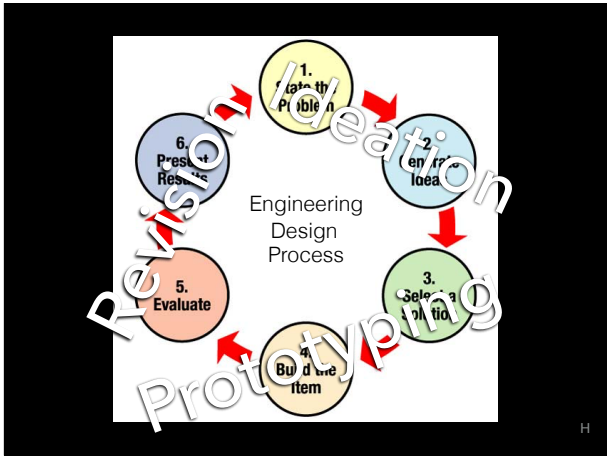
Notice the teacher in this photo. He is wise enough to know when to step in and when to let students work together to figure things out.



29

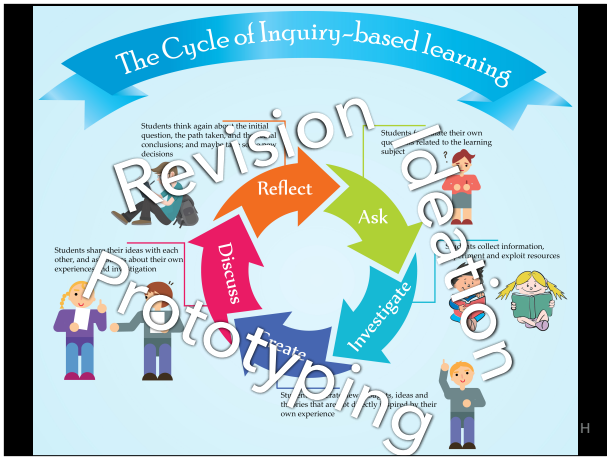
(Heather) Characteristic 5: STEM lessons use the Engineering Design Process

---



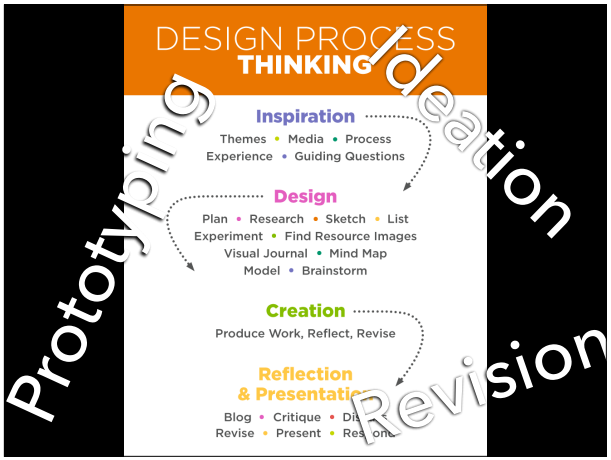
30

There are many variations on what defines the Engineering Design Process, but ultimately it comes down to ideation, prototyping and revision.



31

The specific names in the inquiry based learning model are different, but the concepts are the same.

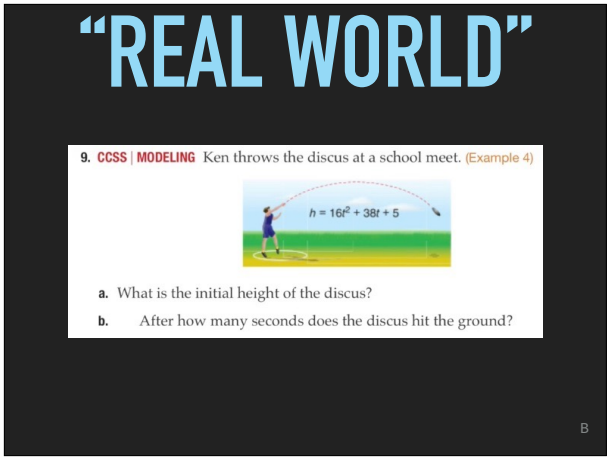


32

Here they are in visual art design process thinking

33

(Bill) The term “real world” is overused

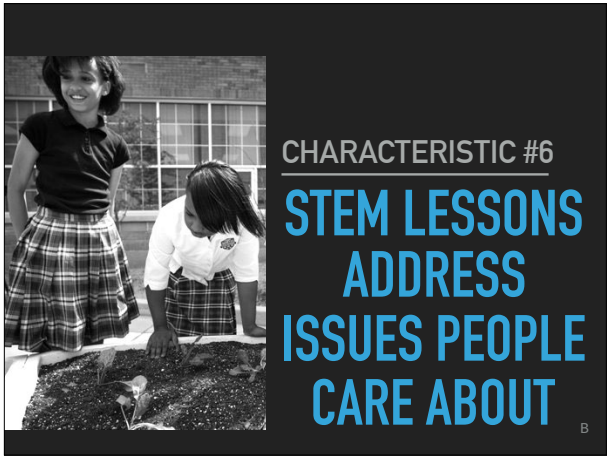


34

This question, for example… is what some people might call "real world" but it is not what I want to communicate. This isn't at the heart of what exemplary STEM lessons contain. This question is not "real world" in a way that makes people care. I prefer to say…

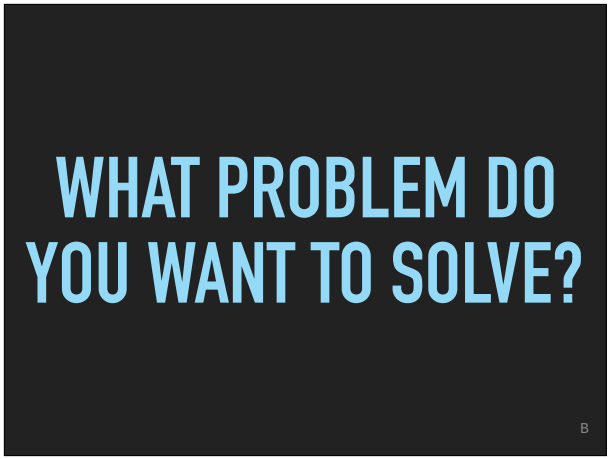
35

Characteristic 6: STEM lessons address problems that matter. This can mean big world issues such as social, economic, or environmental problems. While issues such as air pollution, water quality and endangered species are important, they often land outside the world of what students feel they can really solve. Do you sometimes address big issues like these in your visual art classes?



36

The number of big world issues that students can actually tackle is few. So instead of looking at the big world, let's consider their small world. In a visual art class, students often illustrate personal feelings and experiences. What if STEM students were empowered to identify and solve real world problems right on their campus?

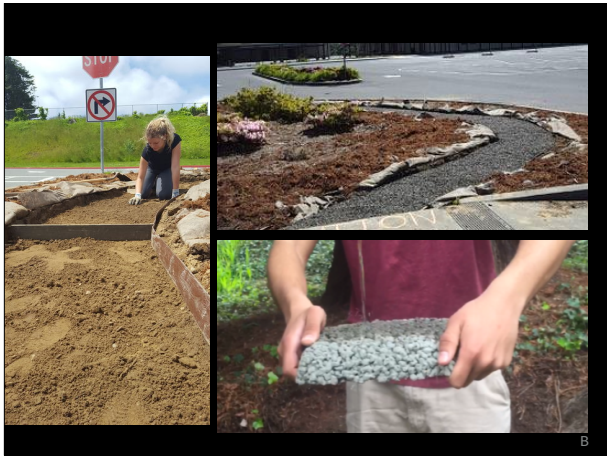


37

We need to have students learn to solve problems for others. Tackle these problems and you're neck deep in a great STEM project.

38

For example, the students at one of our local schools wanted to have fresh cooked food so they designed this wood fired oven.



39

Students at one of our Middle Schools wanted a pathway from the parking lot through the garden so they engineered a permeable pathway

40

School gardens are STEAM rich opportunities

SIX CHARACTERISTICS

- INTEGRATED
- INQUIRY BASED
- OPEN ENDED
- COLLABORATIVE
- ENGINEERING DESIGN PROCESS
- PROBLEMS PEOPLE CARE ABOUT

B

41

So here are the six characteristics of exemplary STEM lessons

---

BACK TO THE ARTS

H

42

(Heather) Back to the question of the arts.

43

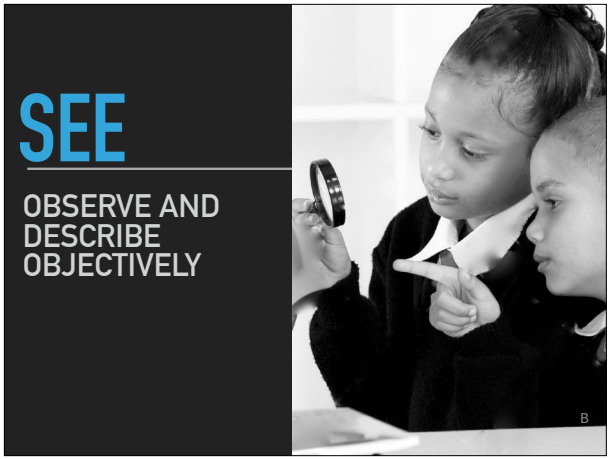
(Heather) There are several art based routines that support these STEM lesson characteristics

44

(Heather) The Artful Thinking Strategies from the Harvard Graduate School of Education are a great place to start. There are many of them, but repeated use of any one of them is good practice.

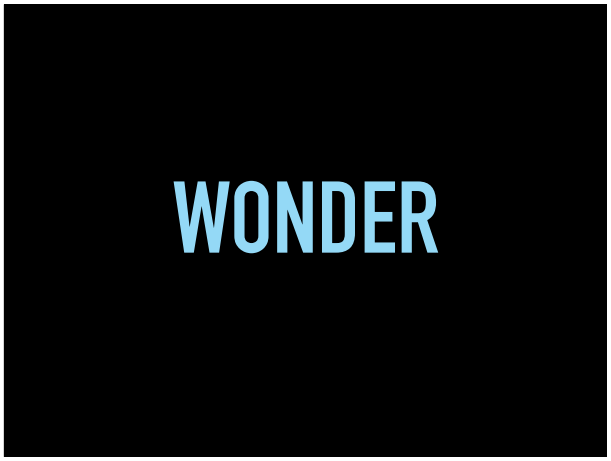
45

(Heather) This is one of our favorite artful thinking routines. It is beautiful in its simplicity and its ability to be used over and over again in many settings.



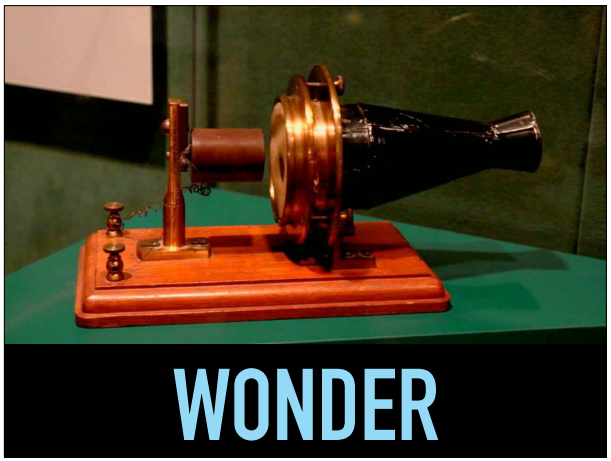
46

In this routine, learning to see means pausing long enough to really look and then describing objectively what is observable.



47

Wonder drives every innovation.

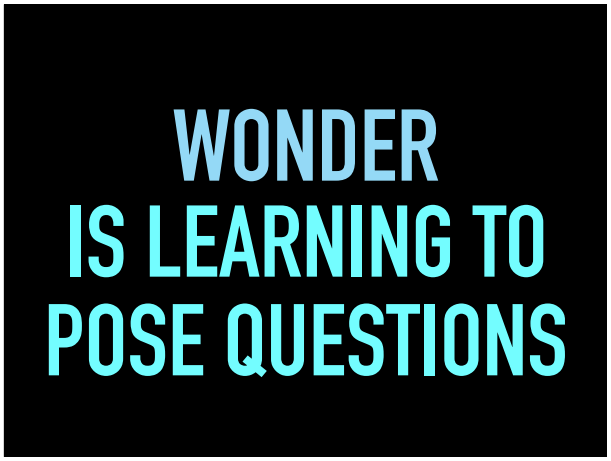


48

Alexander Graham Bell wondered if sound can be transmitted by wire

49

Steve Jobs wondered what would happen if a cell phone and a computer were combined?



50

To wonder is to pose questions whose answers may not be known, which to me is different from ASKING questions that can be answered.

51

But are we really teaching STUDENTS to pose questions? Who asks and who answers in most classrooms today?

52

Have classrooms changed much since this photo was taken? We know it is important for students to wonder and formulate their own questions but does our teaching reflect this?

53

For early childhood, exploring “See” and “Wonder” is often enough of a challenge. It takes time to develop those two skills before tackling the next one…

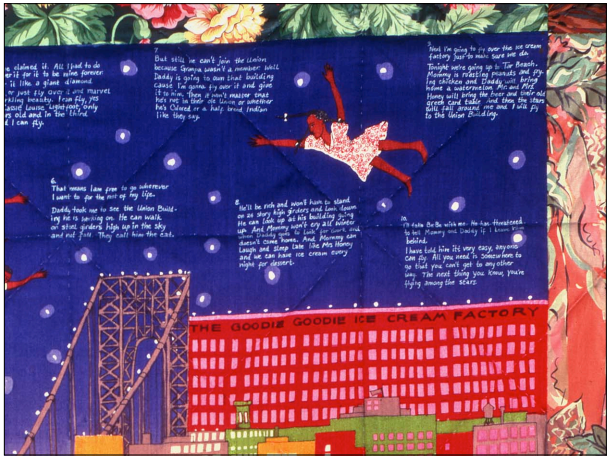
54

To THINK is to attempt to answer the questions you wondered. To hypothesize or state conjectures.

55

(Heather) Let's spend 40 seconds looking closely at this art without saying anything. We will zoom in on each quadrant but probably not close enough that you will be able to read the writing. We will return to the whole image. Be prepared to state something objective that you see.

56



57

58

59

60

(Heather) I would like to hear from a few people about what you saw. Make it objective. Instead of saying “I see a brother and sister flying through the sky” I would say “I see two children in the air”

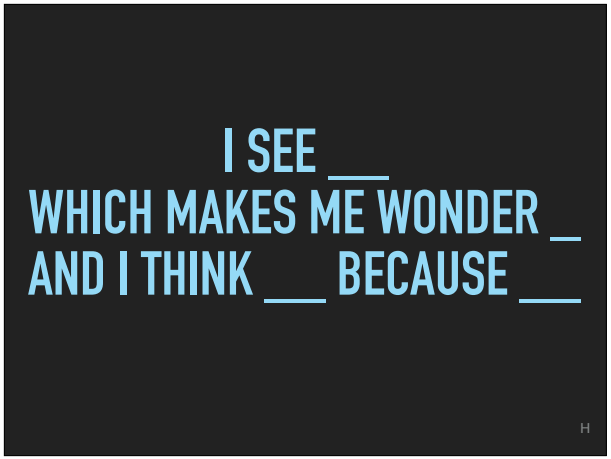
61

(Heather) Now we're going to complete the whole thinking frame in groups. So if Bill and I were a group I might say… [think time]

62

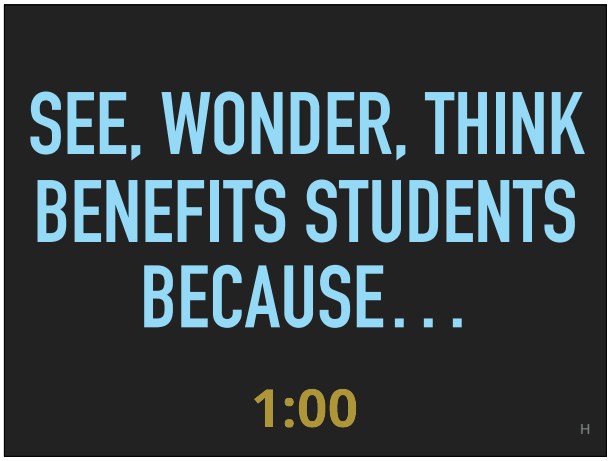
SWT is divergent. It fosters curiosity and comfort with ambiguity.

63



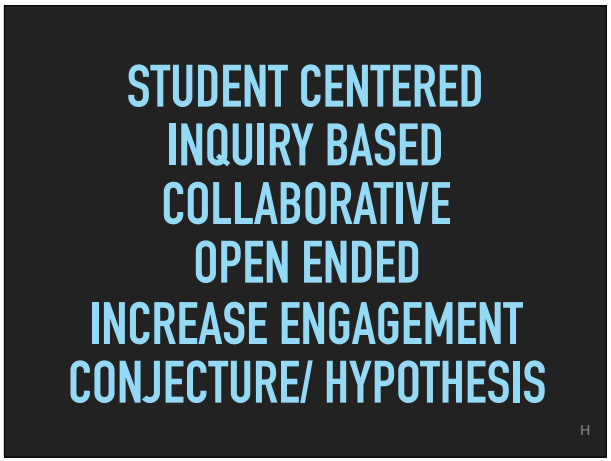
64

Ultimately, our goal is to train students to think with this mindset.



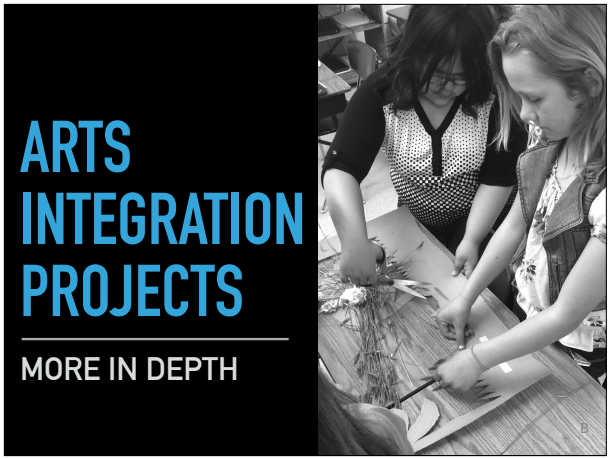
65

Take 60 seconds to discuss or jot down why you think SWT benefits students.



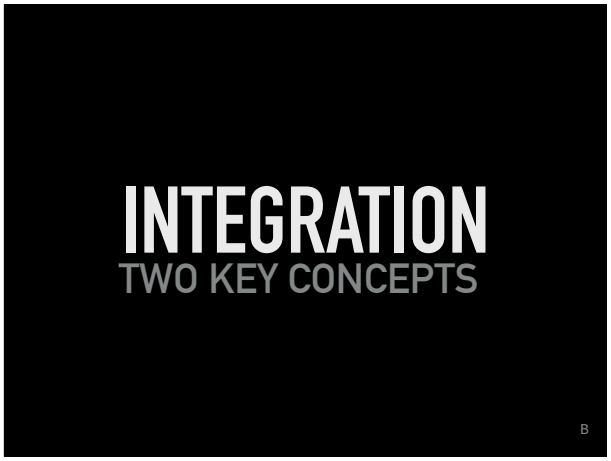
66

We heard lots of good ideas. Here are some that people have had about how SWT benefits students.



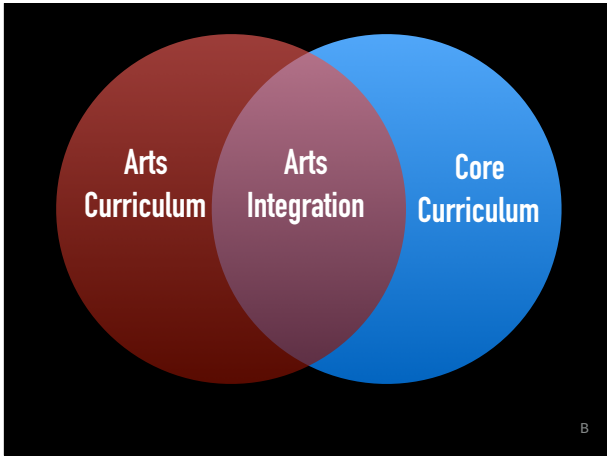
67

So now arts integration projects, as in STEAM



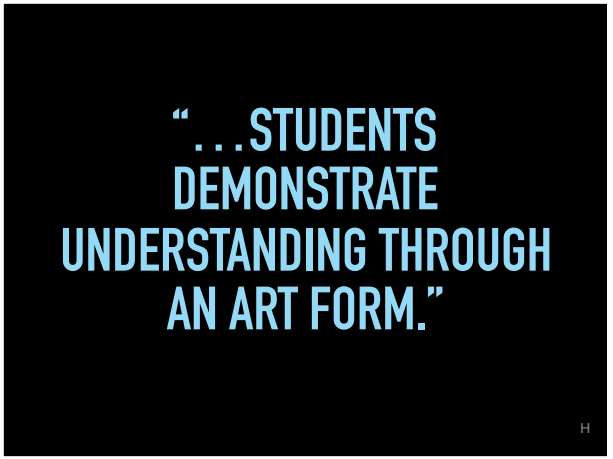
68

There are two key things needed for true arts integration



69

First, art standards must be taught ideally by an arts specialist. As the Kennedy Center definition for arts integration states,, “Students connect an art form and another subject and meet evolving objectives in both.” Just like you would teach different math topics to a 7th grader than a 2nd grader, the same should be true of art standards as well. When the core content and arts curriculum are mutually supporting and reinforcing, we have the first requirement of arts integration.

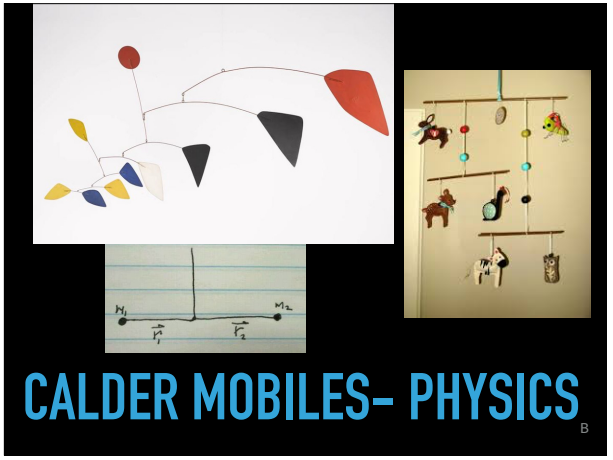


70

(Heather)
Second, "Students demonstrate understanding through an art form." This is often challenging to achieve.

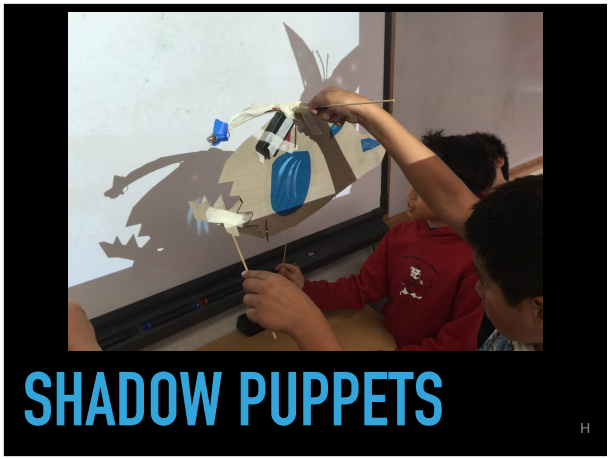
71

Here students at Bates Middle School in Maryland are demonstrating their understanding of rotation vs. revolution by choreographing a dance in a science class.



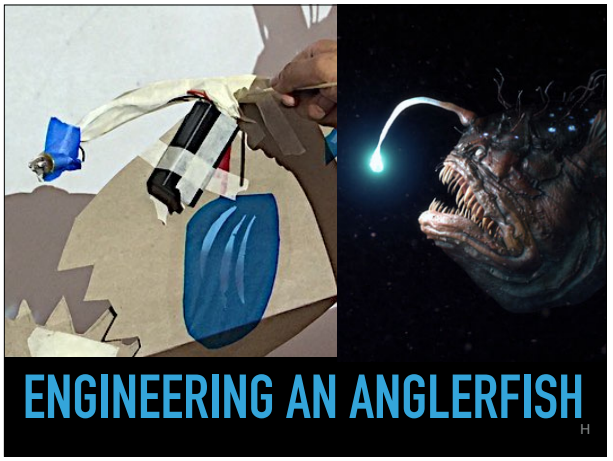
72

(Bill) The law of Archimedes can be better understood by creating mobile sculptures like the ones of Alexander Calder



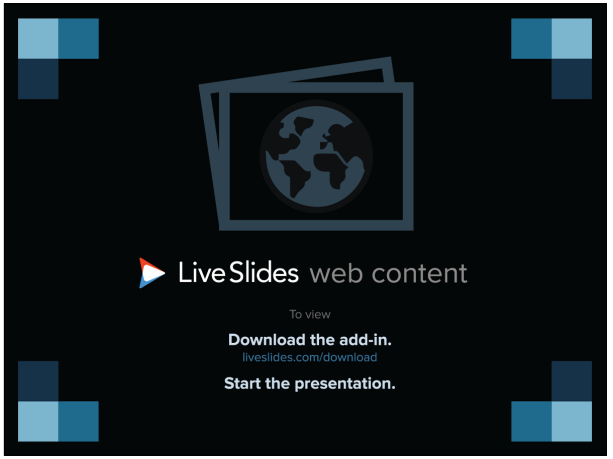
73

(Heather) Shadow puppets are one of our favorite arts integration projects. In this photo Eureka students are working on demonstrating their understanding of a deep sea habitat.



74

Notice the battery & light contraption THE STUDENT created to show the anglerfish light lure.

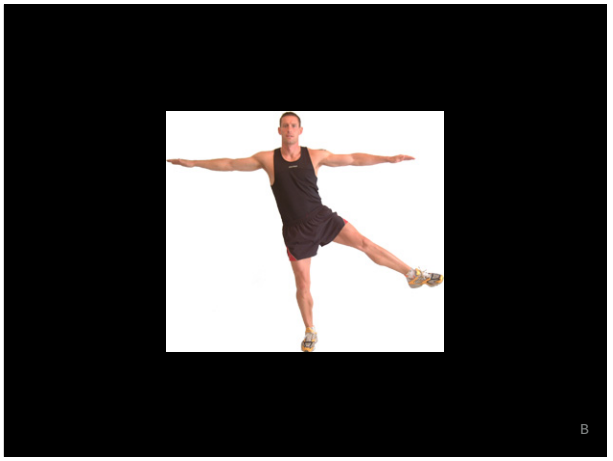


75

LiveSlide Site
https://youtu.be/fUvxvEq28_Q

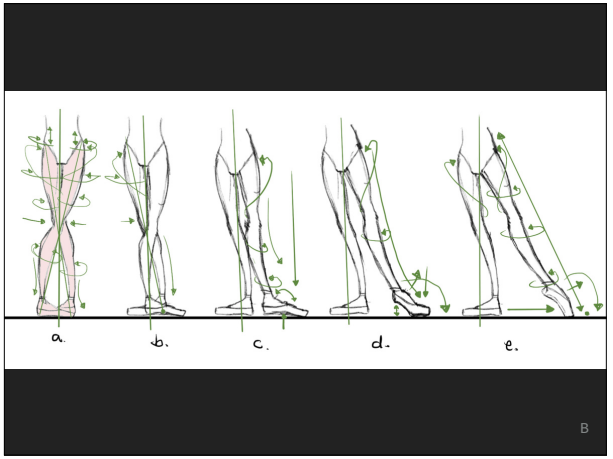
76

(Bill) Most true arts integration projects take weeks, not minutes as both the core and arts standards have to be taught. We'll speed up the process. We considered a visual art project but our presentation time is limited. You can use your imagination for how the movement project we'll do is similar to the creative process used in any art project.



77

Stand and give yourself generous arm and leg space around you. When I say 'action' you stand on one leg and shake the other leg around while rotating your arms around as well. Ready, focus, action.

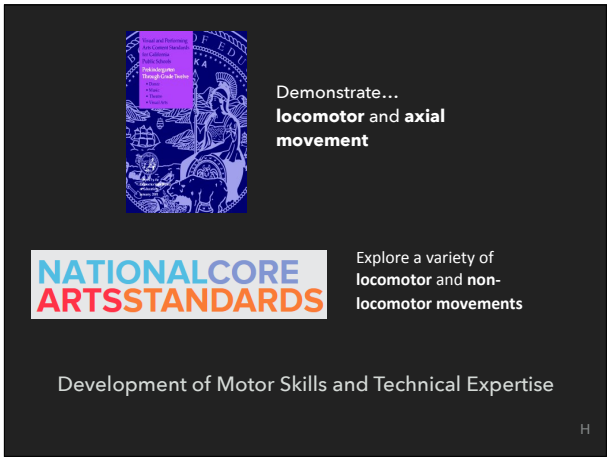


78

Stay standing. You were exploring a type of movement known in dance as "Axial" or "non-locomotor" movement. Our bodies have many axes on which we can move such as our shoulder, our elbow, hip, knee, etc.

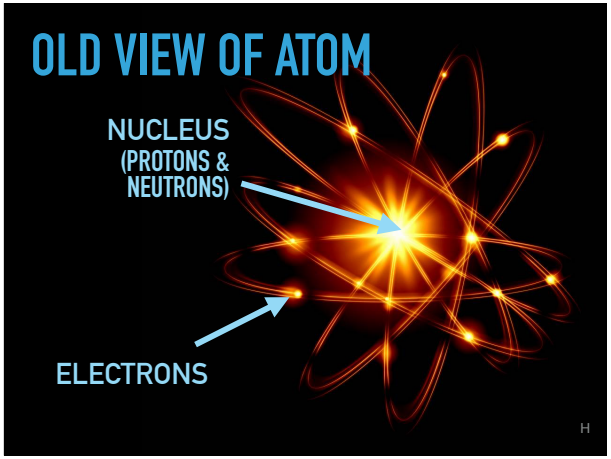
79

Another type of movement we could explore is “locomotor” movement. When I say Action, take two slow steps to the left, pause for four counts, and take two slow steps right. It will look like this…[demonstrate] [slow count] 1, 2, 3, 4…Action!



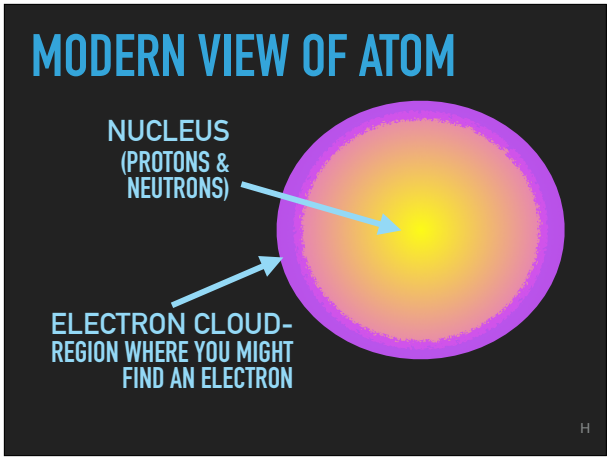
80

Go ahead and sit down. Locomotor and axial movement are in most art standards. If this was a longer arts integration project, we would spend more time learning about dance and movement.



81

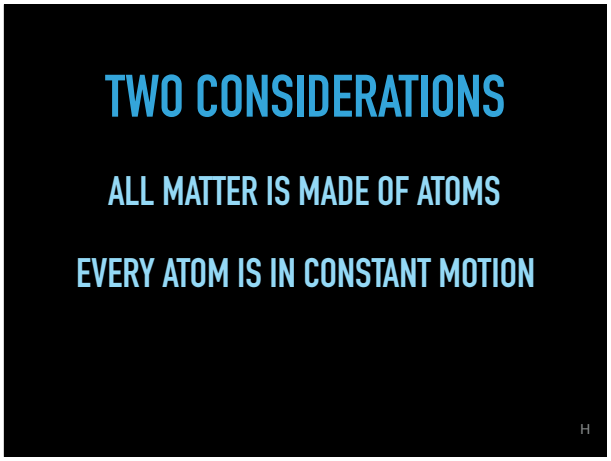
Let’s move on to some quick science standards. You probably remember this image of how we used to visualize atoms?



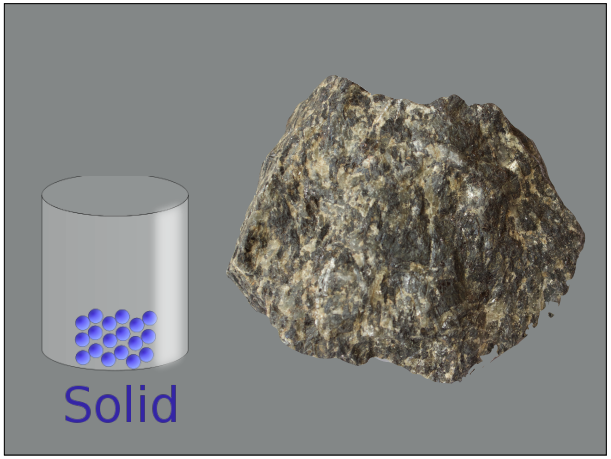
82

Now scientists suggest we think of an electron cloud region of activity. We will let your body represent the nucleus and your hands & feet the electrons

---

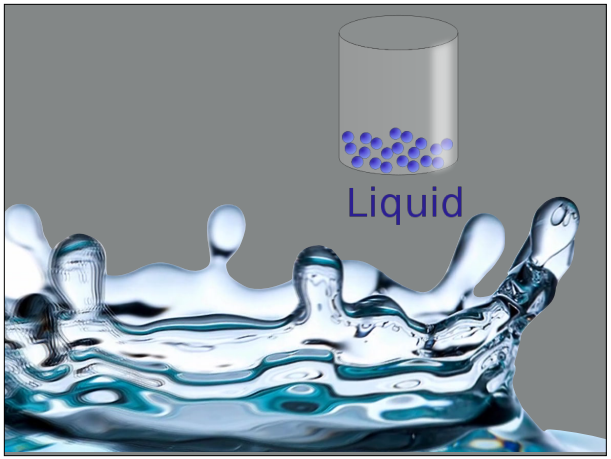


83



84

Are rocks made of atoms? Are those atoms in constant state of motion? Can they travel with locomotor motion? When might that happen? If Heather and I were atoms in a rock, we could look like this… We are tightly bound in a matrix, we move in unison, but we remain in motion.



85

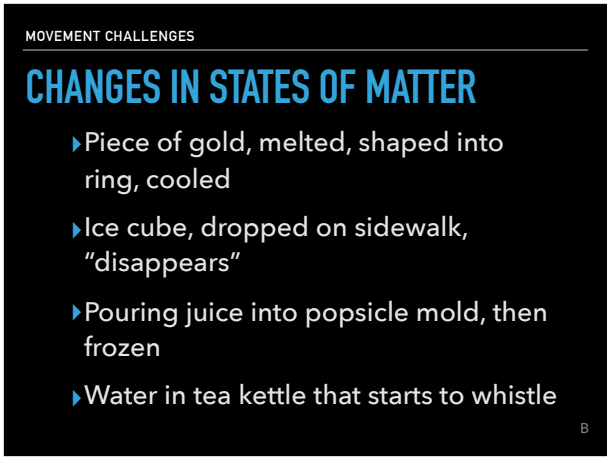
Are liquids made of atoms? Are those atoms in constant state of motion? Can they travel with locomotor motion? How do they fill the space they are in? Are we still in a tight matrix? Can we move in unison? (Demonstrate with Heather)

86

Are gases and vapors made of atoms? Are those atoms in constant state of motion? Do they travel with locomotor motion? How do they fill the space they are in? (Demonstrate)

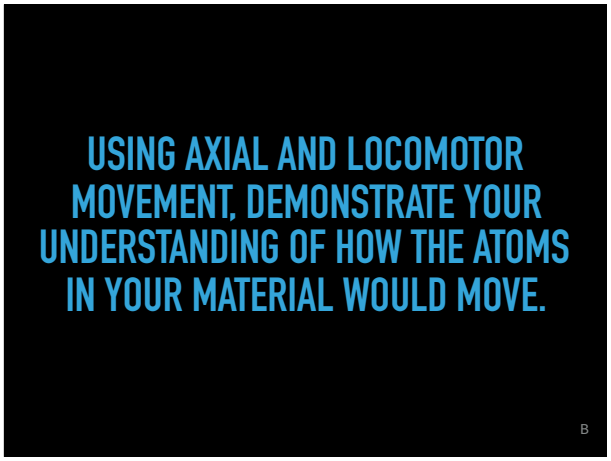
87

Let's divide the room into fourths. Here at the front on your left will be the gold ring group, on your right the ice cube, back left is Popsicle group, and back right is the boiling water.



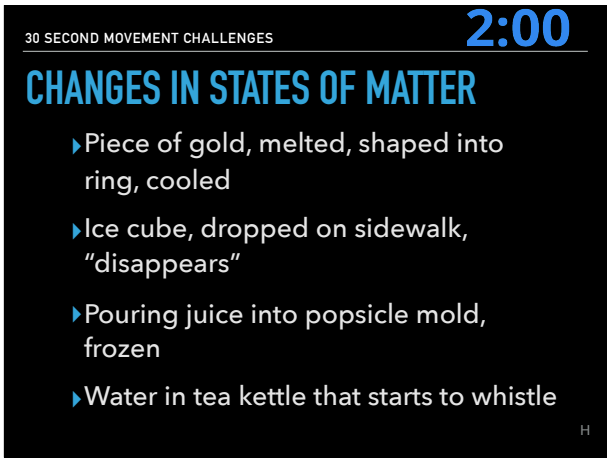
88

Let's think about the changes in states that the matter will go through.
Gold alternates between 2 states solid and liquid, while the
Ice cube goes through 3 states



89

So remembering that atoms are in constant motion, keep those electrons moving appropriately. Think about matrix formation vs. loose formation
Every group has a the state of matter that involves locomotor motion.
Remember, the performance should last 30 seconds.



90

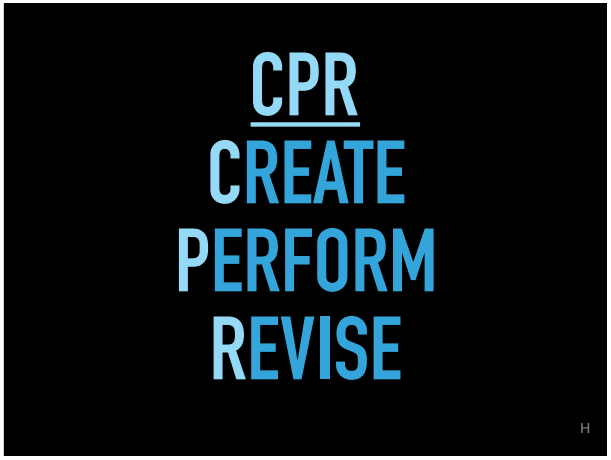
You have about 2 minutes to prepare your presentation

91

If someone in your group wants to record the performance, great, but our time is short.

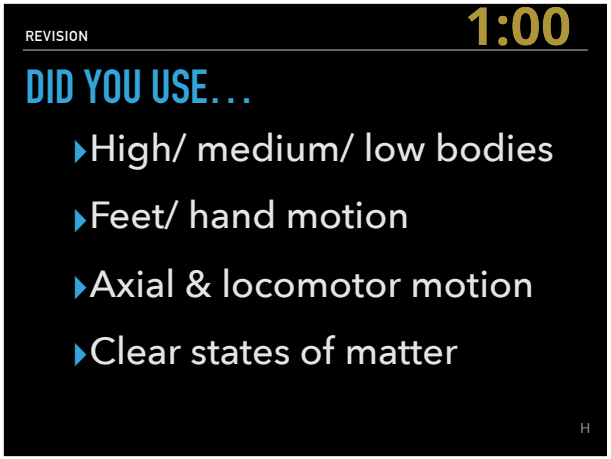
92

We will all be performing simultaneously. At the end of 30 seconds, I will say Cut!
Ready Focus Action



93

Stay in your groups. The CPR process is critical for performances to develop



94

You will have 1 minute to consider some success criteria as you revise your performance. If you recorded the performance, reviewing the video can help with this.

95

Ready- press record Focus, action

96

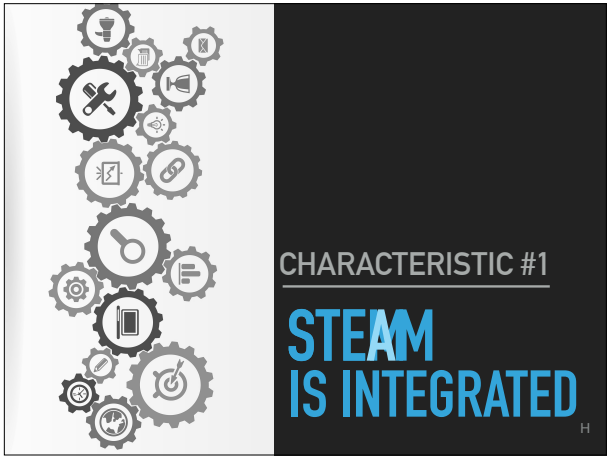
We set out to convince you of something you probably already believed.

97

We set out to convince you of something you probably already believed.

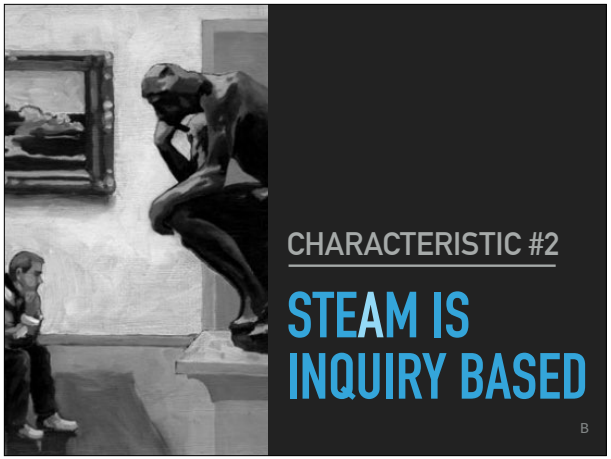
98

We looked at both daily routines such as See, Wonder, Think and larger projects like our movement project.
Let's return to the characteristics of outstanding STEM lessons and see how the arts fit into STEM



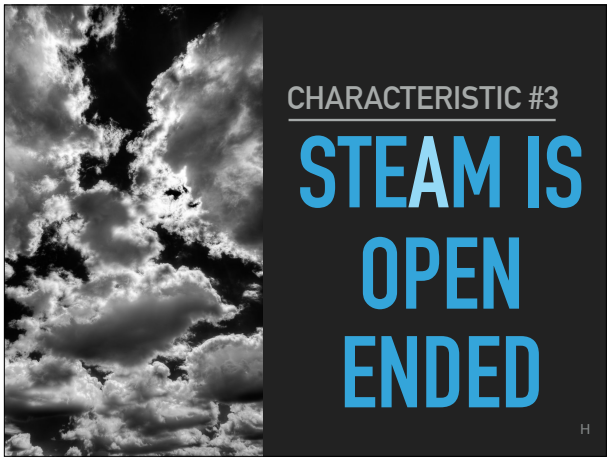
99

Let's revisit STEM characteristic #1. Arts integration is by definition integrated. Synthesis of ideas through the arts brings concepts together in new ways.



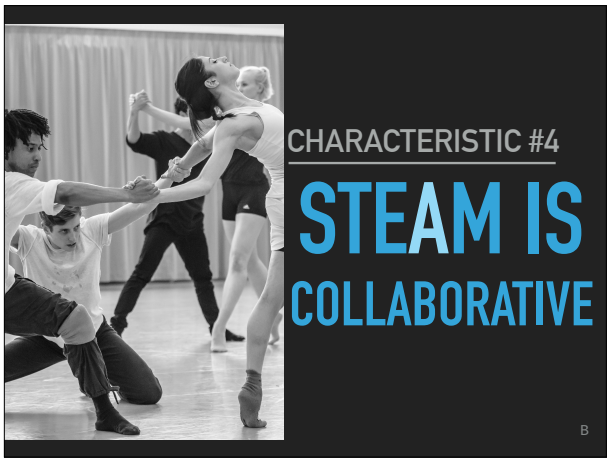
100

The arts foster curiosity and transfers ownership of learning to students. Students create and demonstrate their own understandings.



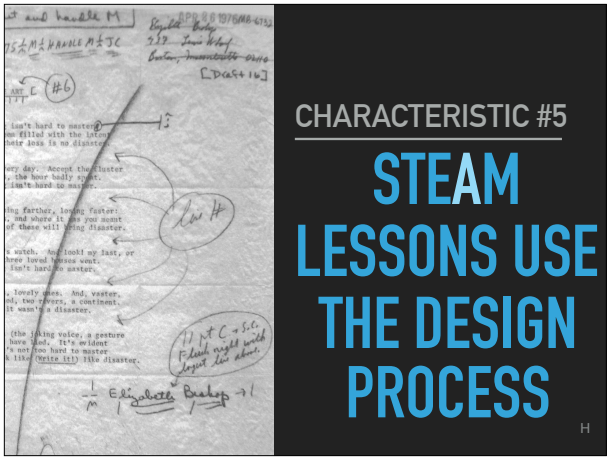
101

As we move from convergent to divergent thinking in classrooms, the arts are an ideal vehicle for this open ended approach.



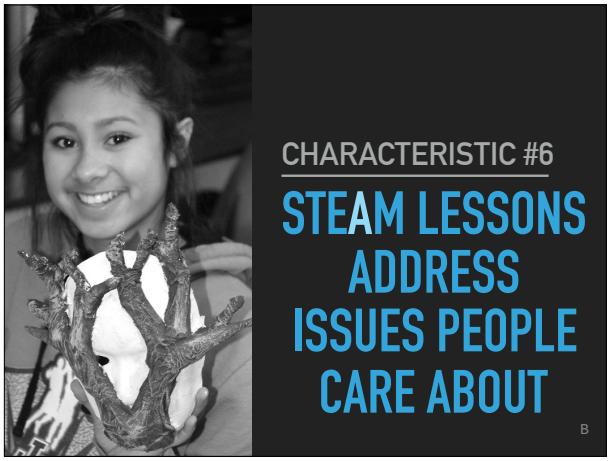
102

As computer scientist Ramsey Nasser said, “Any endeavor that requires you to create something novel is going to benefit from collaboration. The members of a collaborative group create a meta-artist that is the sum of all their skills and perspectives in a way that you simply couldn’t do as single person.”



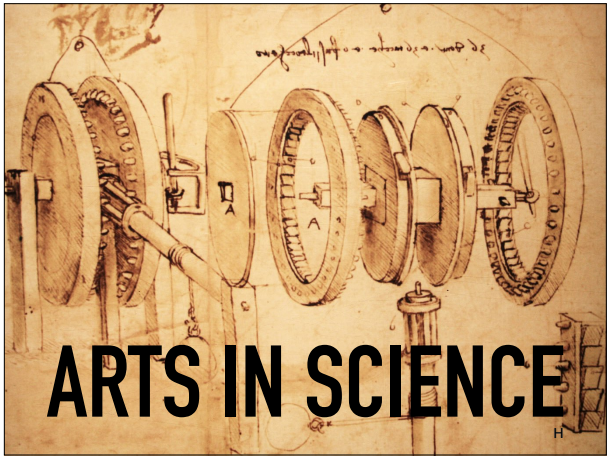
103

Did you experience how the Create, Perform, Revise process used this? Art, like engineering, is a mindset of constant revision, drafts, experiments and iterations.



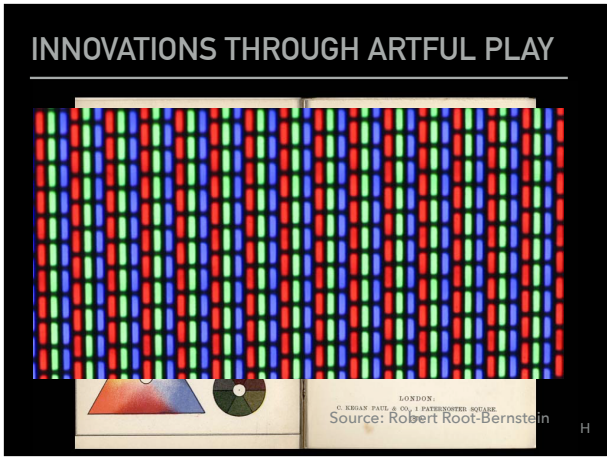
104

When students create, they care deeply about their personal expression and how they communicate themselves to the world through their artwork.



105

The arts have existed side by side with science for a very long time



106

Artist/ scientist Ogden Rood's work on color theory led to…the Liquid Crystal Display used in all modern devices such as your smart phone, television or this projector.

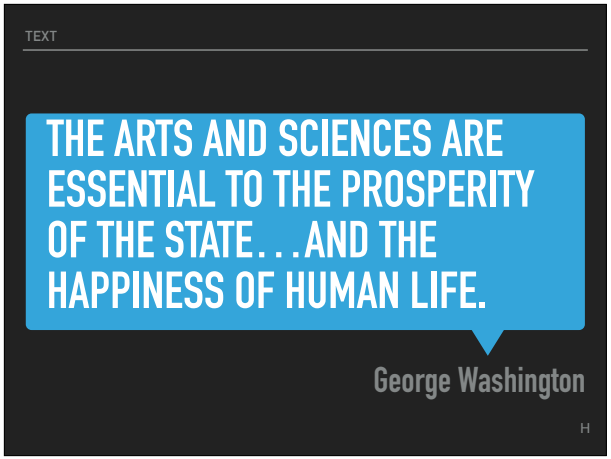
107

The best in science, our Nobel prize winners… are 17 times more likely than other scientists to be visual artists and

---

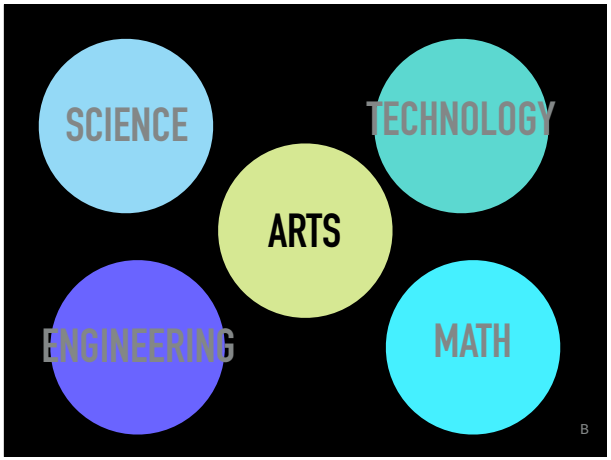
108

25 times more likely to be performing artists



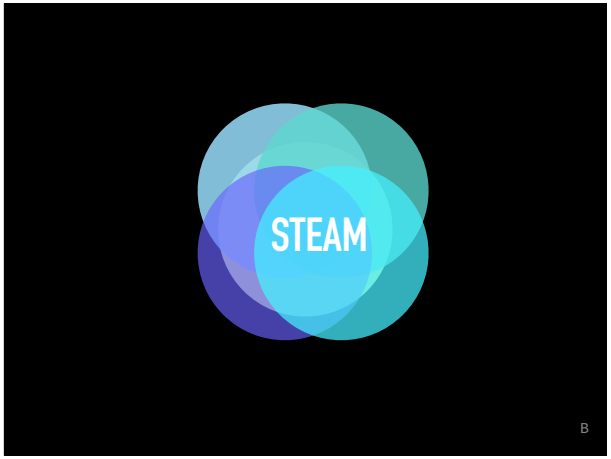
109

This is nothing new. George Washington himself said



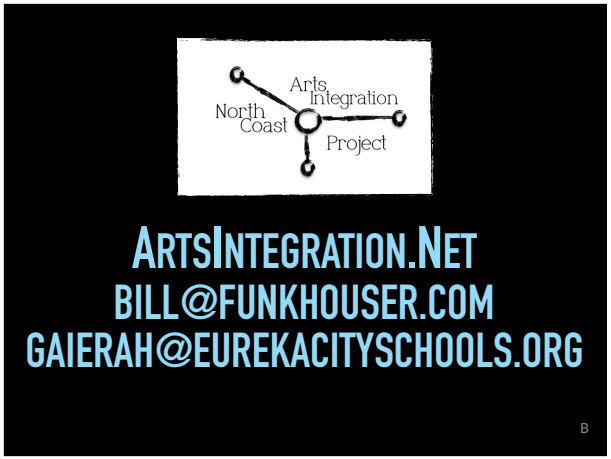
110

The arts are unique among subjects and now more than ever, we must bring these subjects together.



111

Thank you



If it helps you to take notes, please do so but know that this presentation is on our site, or you can email me. Once you feel you have a way to access this presentation, you can relax and be here now.