Curiosity as a Tool for STEM Workshop Handout

General Principles

Goal: To use curiosity as a means for appealing to students and enhancing their interest in STEM subjects

How curiosity affects the brain:

- ✓ Assists with learning information
- ✓ Increases brain activity related to reward
- ✓ Helps to remember facts – even those unrelated to the original activity

Activities for Curiosity

Ice-Breaker

Decoder

Players: 1 to 30

(The game is usually best to play as individuals in groups of up to five people, with more people playing, split into teams of two.)

Time: 2 to 15 minutes

Materials: Cards with particular pictographs or rebuses

Instructions: Each card has a pictograph that creates a word or phrase that the players are required to guess. The idea of the game is to find word or phrases that are hidden pictures.

Example:

Answer: Fish tank

Start Up

Two Truths and a Lie (True or False)

Players: 5-10

Time: 15 to 30 minutes

Materials: None

Instructions: The leader arranges all the players into a circle. The leader then instructs each player to think of three statements about themselves. Two of the statements must be true, and the other one must be a false statement. For each round, a single player shares the three statements in any order to the group. The goal is for the group to determine which statement is false. The group votes on which statement is false. At the end of each round, the person reveals which one was the false statement.

Notes: This game can also be used by the leader to introduce themselves to a group. The only round is played with the leader. The audience can follow up with questions that clarify the leader's statements.

An interesting variation is "Two Truths and a Dream Wish." Instead of telling a lie, a player states a wish. The statement is not true, but is something that the player wishes to be true. For example, someone that has never been to Europe might say: "I often travel to Europe for vacation." This interesting spin on the icebreaker can often lead to unexpected, fascinating results, as people often share touching wishes about themselves.

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The Mystery Object – What is it?

Players: 4+

Time: 5 minutes

Materials: A curious and unusual object(s), something to write questions upon, writing instruments

Instructions: The leader displays a mystery object to the players. If possible, the leader can share the object to the players, allow them to handle and examine the material closely. The Leader asks the players to pair off and come up with two questions that they have about the object. The leader writes down some of the questions that the players have about the object. The leader has the players select those questions that could be tested through an experiment with the object. If there are none, have the entire class come up with some testable questions. The Leader explains to the players that they have been using Creative Thinking Skills. The leader explains those skills.

The Creative Thinking Skills

The leader goes through the following list of creative thinking skills that scientist and engineers use in their work. The leader points out to the players how those skills were used in the previous activity to come up with the list of testable questions:

1. Make careful observations
2. Ask questions that can be investigated
3. Take risks and learn from mistakes
4. Work with and learn from others
5. Use evidence to support my conclusions.

The leader can then explain what the object is and how it relates to the topic of the class, but it is best at the end of the session.

Skill-Related Activities

What is It?

Players: 2-30 players

Time: 5 minutes

Materials: Series of unusual pictures

Instructions: The leader displays a photograph or illustration that is unusual, odd, or thought-provoking. Good examples would be optical illusions, scientific phenomena, or strange objects. The group can guess what the object is, what has happened in the picture, or how it got that way. The goal is spur imagination or have players ask questions.

Note: This activity can be used as a starting point for scenes – players can imagine how the scene in the photo starts, ends, or is the middle of a short story.

Connection Web

Players: 2-20 players

Time: 5 - 15 minutes

Materials: 9-12 photographs or illustrations of different objects

Instructions: The leader sets out the pictures, side-by-side, for the whole group to observe. After the players have a chance to look at all the pictures, the leader asks if anyone can think of a way that two of the pictures are connected. Players then offer different ways that the pictures are related to each other. There are no wrong answers, but the players must provide an explanation of how the objects are related. (e.g. they are the same color/shape/size or their names start with the same letter or they are used for the same purpose or are made of similar materials)

The leader can then ask if anyone can connect three of the pictures or if anyone can link two pictures that have not yet been related. The goal is for players to stretch their imaginations and consider unusual or unique ways that the objects are related.

Note: This activity works best when player answers are kept short and full participation by the whole group is encourage.

Audio Challenges

Players: 2-30 players
Time: 5-10 minutes
Materials: Series of unusual or even common sounds
Instructions: The leader plays sound or note that is unusual, odd, or thought-provoking. Good examples would be animals, musical instruments, or even household items. The group can guess what the sound is. The goal is spur imagination or have players recognize awareness of world of sound around them.

Note: This activity can be used as a starting point for storytelling or illustrating a scientific principle.

Close Up Pictures

Players: 2-30 players
Time: 5 minutes
Materials: Series of extreme close-up pictures
Instructions: The leader displays a photograph taken of an object that is extremely close up. The group can guess what the object is and what evidence helped them decide. The leader can provide hints if the group cannot determine the object. The leader then reveals what is the object.

Part of the Whole

Players: Groups of 2-9 players
Time: 10 to 15 minutes
Materials: 9-12 extreme close-up pictures of a single object, preferable with multiple, different parts
Instructions: Nine stations are set up apart from each other throughout the playing space with a picture at each station. One member from each of the groups goes to a single station and studies the picture. The group members report back to the group about their picture. The group determines what they think the object is based on the various reports. The group creates a frozen picture of what they think is the object. The other groups can guess what is the performing group's idea or they groups can share their idea and what evidence helped them decide. The leader brings all the pictures together for the groups to examine and then reveals what is the object.

Wrap Up

Johnny Whoops

Players: 3 to 30
Time: 3 to 5 minutes
Materials: None
Instructions: The leader puts up a hand, fingers spread apart. The leader then says "Johnny, Johnny, Johnny, Johnny, Whoops Johnny, Whoops Johnny," touching the tip of each finger whenever they say "Johnny" and sliding the other finger between the outstretched fingers whenever they say "whoops." It doesn't really matter what the leader does, as long as it stays fairly consistent and gives the impression that how it is done matters. After the finger play, the leader either clasp hands together or cross arms. The leader asks the players to repeat what was just done. Unless the players clasp their hands together or cross their arms, they did not do it correctly. The players should repeat until they finally figure out to repeat everything done.

Curiosity Resources:

Research Articles and Books

Engel, Susan "Children's Need to Know: Curiosity in Schools" Harvard Educational Review, Vol. 81, No. 4 Winter 2011
http://www.arborcenterforteaching.org/wp-content/uploads/2013/06/ChildrensNeedToKnow_EngelSusan.pdf

Engel, Susan "The Case for Curiosity"
February 2013, volume 70, number 5
http://www.ascd.org/publications/educational-leadership/feb13/vol70/num05/The-Case-for-Curiosity.aspx

Flanagan, Linda "How to Spark Curiosity in Children Through Embracing Uncertainty"
http://ww2.kqed.org/mindshift/2015/10/21/how-to-spark-curiosity-in-children-by-embracing-uncertainty/

Matthias J. Gruber, Bernard D. Gelman ,Charan Ranganath "States of Curiosity Modulate Hippocampus-Dependent Learning via the Dopaminergic Circuit" *Neuron*
http://dx.doi.org/10.1016/j.neuron.2014.08.060

"Research findings could help find ways to enhance overall learning, memory"
October 3, 2014
http://www.news-medical.net/news/20141003/Research-findings-could-help-find-ways-to-enhance-overall-learning-memory.aspx

Singh, Maanvi, "Curiosity: It Helps Us Learn, But Why?"
October 24, 2014
http://www.npr.org/blogs/ed/2014/10/24/357811146/curiosity-it-may-have-killed-the-cat-but-it-helps-us-learn

101 Unuseless Japanese Inventions (Chindogu)
By Kenji Kawakami
W. W. Norton & Company
ISBN-10: 0393313697
ISBN-13: 978-0393313697

Cultivating Curiosity in K-12 Classrooms: How to Promote and Sustain Deep Learning
by Wendy L. Ostroff
ASCD (Association for Supervision and Curriculum Development)
ISBN-10: 1416621970
ISBN-13: 978-1416621973

Sites for Interesting Images/Sounds

3D Sidewalk Art
http://www.julianbeever.net/index.php?option=com_phocagallery&view=category&id=2&Itemid=8

Art of Failure Images
https://spectrum.ieee.org/the-art-of-failure

Astronomy Picture of the Day
http://apod.nasa.gov/apod/astropix.html

Atlas Obsura
http://www.atlasobscura.com/

Daily Nature Photo
https://www.flickr.com/groups/thenatureconservancy/pool/

Guess the Sound Quiz
https://www.youtube.com/watch?v=U-btSLpuybU

Hubble Images
https://science.nasa.gov/mission/hubble/multimedia/hubble-images/

Incredible Photos from Above
https://www.loveexploring.com/galleries/81954/60-of-the-worlds-most-incredible-photos-from-above

Liu Bolin: The Invisible Man
http://twistedsifter.com/2013/02/invisible-man-liu-bolin-artwork/

Mathematical Imagery
https://www.ams.org/publicoutreach/math-imagery/math-imagery

Micro-sculptures
https://www.willardwiganart.com/

The Mysteries of Harris Burdick
https://mrsgraveswebsite.weebly.com/uploads/1/2/6/8/12686140/the_mysteries_of_harris_burdick.pdf

Natural Sound Gallery
https://www.nps.gov/subjects/sound/gallery.htm

Odd Music Gallery
http://www.oddmusic.com/gallery/

Photo of the Day
https://www.nationalgeographic.com/photography/topic/best-of-photo-of-the-day

Principles of Curiosity
https://principlesofcuriosity.com/

Ridiculous Products
http://removeandreplace.com/2013/05/28/ridiculous-products-stupid-strange-funny-and-weird-things-you-can-actually-buy/

Today is Science History
http://www.todayinsci.com/