Expanding STEM Skills Workshop Handout

General Principles

Goal: To expand students STEM skills with varied act ivies which are playful and increase engagement

STEM Skills addressed:

- ✓ Analyze small parts of systems and see relationships; notice details in content and process.
- ✓ Recognize cause and effect relationships and distinguish fact and opinion.
- ✓ Predict and draw conclusions using data.
- ✓ Communicate with others and listen.
- ✓ Think creatively and solve problems and experiment.

Activities for Expanding STEM Skills

Ice-Breaker

Fear in a Hat

Players: 5 to 30 or more
Time: 10 to 40 minutes
Materials: Strips of paper and pens or pencils
Notes: This is a very good ice breaker and a wonderful way to start something new that people may be nervous about.

Instructions: Hand out a strip of paper pen or pencil to each player. Have each player write one fear that they have about their upcoming presentation, test, report, etc. on the piece of paper. Have the players fold their piece of paper and place it in the hat. Once all the fears are in the hat, pass it around the room and have each player draw a fear out of the hat at random and read it to the group. Talk about how many others have that same fear, and brainstorm ideas of overcoming that fear.

I Have, Who Has

Players: 6 to 30 or more
Time: 5 to 10 minutes
Materials: Pairs/sets of matching cards
Notes: This is a variation of a common matching game used to reinforce mathematic or language concepts.

Instructions: Hand out a card to each player. It is important to have a match to every card that is handed out. The leader instructs the players find the matches in the group with the card they are holding. The leader does not provide any instructions except that at least two or four of the cards are related to each other.

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Skill-Related Activities

Detail Change

Players: 5 to 30
Time: 5 to 10 minutes
Materials: None
Instructions: The players sit in a circle. The leader selects one person to stand in the center of the circle. The rest of the players observe the selected person very carefully as they turn slowly to be seen from all directions by all the players. That person is then sent out of the space to subtly change three items of their appearance.

The person then returns to the space and is observed again by the crowd. The other players take turns guessing what items of the person's appearance was changed. After three guesses, the leader asks the person to reveal what has been changed.

Which One?

Players: Whole group (10-30)
Time: Approx. 10 minutes' playing time
Materials: 1 pencil for each player (or other objects that are similar)
Notebooks and writing instruments (optional)
Instructions: Pass out one pencil to each player (or allow them to use their own). Ask players to examine their pencils, or other objects, (using any senses they like) and think of two characteristics that might make their object unique. Have players put all of their pencils into a pile in the center of the group. While players close their eyes, mix up the pencils. Ask for a volunteer to try to find his or her own pencil.
If the player finds the pencil, ask him or her to share with the group what the distinguishing characteristics are. If the player does not find the pencil, ask why this is a challenging task. Ask for more volunteers as time allows.
If players were challenged by this activity, allow them to repeat the process and try again. Players will probably make more careful observations the second time.

Note: Other objects may be used for this activity as well. Objects that work best are ones that initially all look very similar, but do have slight distinguishing features.
Optional: You may choose to ask students to record their observations in a notebook through writing and/or drawing.
If students were successful with this activity, repeat the task. This time, have players make as many observations as they think are appropriate. Ask players to choose a partner and share their pencil observations with their partner. Ask for a volunteer to find his or her partner's pencil. Is this task more challenging? Why? What could be done to make it easier?

How Many are Standing?

Players: 10 to 30 or more
Time: 5 to 15 minutes
Materials: None
Notes: Great icebreaker activity for people young and old. Helpful for young players learning to count or taking turns.

Instructions: Everyone playing sits in a circle. Anyone can stand up whenever they want to, but cannot remain standing longer than five seconds. The aim of the game is to have exactly four people standing at one time. *Variations:* Vary group size and amount standing or time standing up.

The Rules of the Game

Players: 5 to 30
Time: 10 to 15 minutes
Materials: none
Instructions: The group sits in a circle. The leader selects one person to leave the room briefly. The rest of the players choose a rule they must follow once the person returns to the room. An example of a good rule to begin with would be, "Answer every question as if you were the person on your right." Another example would be, "one gender tells lies, the others tell the truth. When the person returns, they must discover the rule by asking people questions about themselves. The players have to answer questions honestly, according to the rules.

How to set rules:

- Rules can be hard or very simple, according to age and experience.
- Rules may be visual (scratch head before answering), or structural (each answer begins with the next letter of the alphabet).

Note: **This rule game could sets one player against the others, so it should only played for fun and in a group which is cooperative internally.**

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.

Picture Sequence

Players: 4 players and spectators
Time: 2 to 5 minutes
Materials: A series of pictures that show a sequence – as in a comic strip
Instructions: The leader selects four players to hold enlarged photos or pictures of a sequence of actions. The leader then lines up the players with the pictures out of sequence from left to right. The leader then asks the audience if the sequence makes sense to them. If not, then the leader asks an audience member to indicate one change in the arrangement of the pictures that makes the story clearer. The audience members continue to suggest one change at a time until the audience agrees that the picture in the correct order. The leader then briefly describes how the story is told with the correct sequence of pictures. The leader then discusses how parts of a story are labeled – Beginning, Middle, End.

Notes: The members of the audience may contend that the story can be told in a number of ways. This can lead to a discussion about different ways that stories are told and also how events can be linked in different ways that make the story more interesting.

Fairy Tale/Picture Book

Players: Groups of 3-5
Time: 10 to 20 minutes (depending on number of groups)
Materials: Chalkboard or Whiteboard to write suggestions down
Instructions: The leader asks the groups to brainstorm a list of fairytale or common stories which are known by most everyone in the group. The individual groups then select a story and create a set of frozen pictures or snapshots with their bodies. The pictures are of the beginning, the middle, and the end of the selected story. Once each group has practiced their pictures, individual groups act out their snapshots for the other groups. The other groups attempt to guess which story is being acted out.

Main Activity

Photo Stories

Players: Small teams of four or five players (5-30)
Time: Approx. 10-20 minutes' playing time
Materials: Series of interesting photographs
Instructions: The group is given a problem posed based on a photo or series of photos (i.e. How did batteries get into a two year old child and how to you get them out?) The whole group is split into teams of 4-5 players. Each team decides on how they would solve the problem and how they would answer the questions posed. They then rehearse the scene and make sure to include all the team members. The scenes are performed for the rest of the group.

Wrap Up

Chair Contact

Players: Group (5-20)
Time: Approx: 10 minutes
Materials: Chair
Instructions: Invite a player to approach the chair and ask them to "interact" with it in 3 different ways. For example: the player may put a foot on it (1), may sit on it (2), and may pick it up (3). Congratulate them and ask them to take a seat. Invite another player to approach the chair and ask them to interact with it in 3 new different ways. Continue until all players have had the opportunity to interact with the chair in their own unique ways.

STEM Skills Resources:

Research Articles and Books

Master, Allison, "Group work gets kids more engaged in STEM"
http://theconversation.com/group-work-gets-kids-more-engaged-in-stem-65710

Ramirez, Ainissa "Creativity is the Secret Sauce in STEM"
http://www.edutopia.org/blog/creativity-secret-sauce-in-stem-ainissa-ramirez

Ramirez, Ainissa "Save Our Science – How to Inspire a New Generation of Scientists"
file:///C:/Users/User/Downloads/Save%20Our%20Science_%20How%20to%20Inspire%20a%20New%20Generation%20of%20Scientists%20-%20Ainissa%20Ramirez%20(2).pdf

Samson, Patricia L. Samson, "Fostering Student Engagement: Creative Problem-solving in Small Group Facilitations" Collected Essays on Learning & Teaching
file:///C:/Users/User/Downloads/421-4-PB.pdf

Tanenbaum, Courtney, "STEM 2026: A Vision for Innovation in STEM Education"
http://www.air.org/resource/stem-2026

Towar, Martin "Are Interdisciplinary Studies The Future of STEM Education?
http://www.techschool.com/blog/technology/interdisciplinary-studies-the-future-of-stem.html

"Why Teach with an Interdisciplinary Approach?"
https://serc.carleton.edu/econ/interdisciplinary/why.html

Websites

SparkEd MN
http://SparkEdMN.org

High Tech Kids
http://www.hightechkids.org/

Activity Resources

40 Intriguing Photos to Make Students Think
http://www.nytimes.com/2016/09/22/learning/40-intriguing-photos-to-make-students-think.html

101 Activities for Teaching Creativity and Problem Solving
By Arthur B. VanGundy
Pfeiffer
ISBN-10: 0787974021
ISBN-13: 978-0787974022

101 Unuseless Japanese Inventions (Chindogu)
By Kenji Kawakami
W. W. Norton & Company
ISBN-10: 0393313697
ISBN-13: 978-0393313697
Games That Promote Problem-Solving Skills
https://www.stenhouse.com/sites/default/files/public/legacy/pdfs/8247ch10.pdf

Erickson, Tim; **Get It Together: Math Problems for Groups**
ISBN-13: 978-0912511535
ISBN-10: 0912511532

KidsReads – Encyclopedia Brown Reviews
http://www.kidsreads.com/reviews/series/encyclopedia-brown

One-Minute Mysteries
http://oneminutemysteries.com

One Minute Mysteries: 65 Short Mysteries You Solve With Science or Math!
https://www.sciencenaturally.com/mystery-science

Series – Encyclopedia Brown
http://www.penguin.com/static/packages/us/yreaders/books4boys/series_encyclopediabrown.php

Team Challenges: 170+ Group Activities to Build Cooperation, Communication, and Creativity
By Kris Bordessa
Chicago Review Press
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