High Impact Indicators:
A Thematic Approach – Part 2 (Reasoning through Language Arts, Science, and Mathematical Reasoning)

Resources for the Adult Education Practitioner

Webinar Handbook, November 28, 2018

Institute for the Professional Development of Adult Educators

RESOURCES FOR THE ADULT EDUCATION PRACTITIONER

High Impact Indicators: A Thematic Approach – Part 2

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Guiding Questions

Think about the following guiding questions as you participate in today's session. Write down your thoughts and be prepared to share your ideas.

Slide(s)	Guiding Questions	My Thoughts
4	Think about what you want to take-away from this session.	
6	What are some advantages of thematic teaching?	
9 -16	List the standards, objectives, and indicators used in this webinar. Why are they important in teaching thematically?	
17	What are the High Impact Indicators and how will it improve your student's learning outcomes?	
18-19	Why is it important to understand the relationship between High Impact Indicators and other related indicators?	
22	How is evidence utilized in the four content areas of the GED® exam?	
23	Where can you locate resources from Part 1 of this webinar series?	
26-27	Where can you find some example activities of reasoning in Mathematics?	
30	What are the steps in the scientific method that lead to the formation of a conclusion?	
33	Share one thing that you found most useful from this session.	

Are They Correct?

1. Emma claims:

Tomorrow it will either rain or not rain. The probability that it will rain is 0.5.

Is she correct? Explain your answer fully:

2. Susan claims:

If a family has already got four boys, then the next baby is more likely to be a girl than a boy.

Is she correct? Explain your answer fully:

3. Tonya claims:

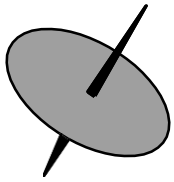
If you roll a fair number cube four times, you are more likely to get 2, 3, 1, 6 than 6, 6, 6, 6.

Is she correct? Fully explain your answer:

Are They Correct?

1. Andrew claims:

A spinner has 4 sections - red, yellow, green, and blue. The probability of getting the red section is 0.25.



Is he correct? Explain your answer fully:

2. Stephen claims:

In a group of ten students the probability of two students being born on the same day of the week is 1.

Is he correct? Explain your answer fully:

3. Madeline claims:

The school bus will either be on time or late. The probability that it will be on time is therefore 0.5.

Is she correct? Fully explain your answer:

Adapted from *Mathematics Assessment Project* http://map.mathshell.org/stds.php?standardid=1163

Answers: Are They Correct 1 and 2

Adapted from Mathematics Assessment Project
http://map.mathshell.org/stds.php?standardid=1163

Assessment Task: *Are They Correct? 1*

1. This statement is incorrect. It highlights the misconception that all events are equally likely. There are many factors (e.g. the season) that will influence the chances of it raining tomorrow.
1. *Assuming that the sex of a baby is a random, independent event equivalent to tossing a coin*, the statement is incorrect. It highlights the misconception that later random events can 'compensate' for earlier ones. The assumption is important: there are many beliefs and anecdotes about what determines the gender of a baby, but 'tossing a coin' turns out to be a reasonably good model[1].
2. This statement is incorrect. This highlights the misconception that 'special' events are less likely than 'more representative' events.

Assessment Task: *Are They Correct? 2*

1. This statement is incorrect. It is not known whether the four sections on the spinner are in equal proportion. The probability of getting the red section would only be 0.25 if this were the case.
2. This statement is true. There are more students than days of the week.
3. This statement is incorrect. There are many factors that could affect whether or not the school bus is on time. There is also a chance that the bus is early.

Card Set: True, False or Unsure?

A. If you roll a six-sided number cube and it lands on a six more than any other number, then the number cube must be biased.	B. When randomly selecting four letters from the alphabet, you are more likely to come up with D, T, M, J than W, X, Y, Z.
C. If you toss a fair coin five times and get five heads in a row, the next time you toss the coin it is more likely to show a tail than a head.	D. There are three outcomes in a soccer match: win, lose, or draw. The probability of winning is therefore 1/3.
E. When two coins are tossed there are three possible outcomes: two heads, one head, or no heads. The probability of two heads is therefore 1/3.	F. Scoring a total of three with two number cubes is twice as likely as scoring a total of two.
G. In a 'true or false?' quiz with ten questions, you are certain to get five correct if you just guess.	H. The probability of getting exactly two heads in four coin tosses is ½.

Answers: Card Set Activity

Collaborative Activity: *True, False or Unsure?*

A. If you roll a six-sided number cube and it lands on a six more than any other number, then the number cube must be biased.

False. This statement addresses the misconception that probabilities give the proportion of outcomes that **will** occur. With more information (**How many** times was the cube rolled? **How many** more sixes were thrown?) more advanced mathematics could be used to calculate the **probability** that the number cube was biased, but you could never be 100% certain.

B. When randomly selecting four letters from the alphabet, you are more likely to come up with D, T, M, J than W, X, Y, Z.

False. This highlights the misconception that 'special' events are less likely than 'more representative' events. Students often assume that selecting the 'unusual' letters W, X, Y and X is less likely.

C. If you toss a fair coin five times and get five heads in a row, the next time you toss the coin it is more likely to show a tail than a head.
False. This highlights the misconception that later random events 'compensate' for earlier ones. The statement implies that the coin has some sort of 'memory'. People often use the phrase 'the law of averages' in this way.

D. There are three outcomes in a soccer match: win, lose, or draw. The probability of winning is therefore 1 out of 3.
False. This highlights the misconception that all outcomes are equally likely, without considering that some are much more likely than others. The probabilities are dependent on the rules of the game and which teams are playing.

E. When two coins are tossed there are three possible outcomes: two heads, one head, or no heads. The probability of two heads is therefore 1 out 3.
False. This highlights the misconception that all outcomes are equally likely, without considering that some are much more likely than others. There are four equally likely outcomes: HH, HT, TH, TT. The probability of two heads is 1 out 4.

F. Scoring a total of three with two number cubes is twice as likely as scoring a total of two.
True. This highlights the misconception that the two outcomes are equally likely. To score three there are two outcomes: 1, 2 and 2, 1, but to score two there is only one outcome, 1, 1.

G. In a 'true or false?' quiz with ten questions, you are certain to get five correct if you just guess.

False. This highlights the misconception that probabilities give the exact proportion of outcomes that will occur. If a lot of people took the quiz, you would expect the mean score to be *about* 5, but the individual scores would vary.

Probabilities do not say for certain what will happen; they only give an indication of the likelihood of something happening. The only time we can be certain of something is when the probability is 0 or 1.

H. The probability of getting exactly two heads in four coin tosses is $\frac{1}{2}$.

False: This highlights the misconception that the same size is irrelevant. Students often assume that because the probability of one head in two coin tosses is $\frac{1}{2}$, then the probability of *n* heads in 2n coin tosses is also $\frac{1}{2}$. In fact the probability of two out of four coin tosses begin heads is $\frac{6}{16}$.

This can be worked out by writing out all the sixteen possible outcomes:

HHHH, HHHT, HHTH, HTHH, THHH, TTTT, TTTH, TTHT, THTT, HTTT, HHTT, HTTH, TTHH, THTH, HTHT, THHT.

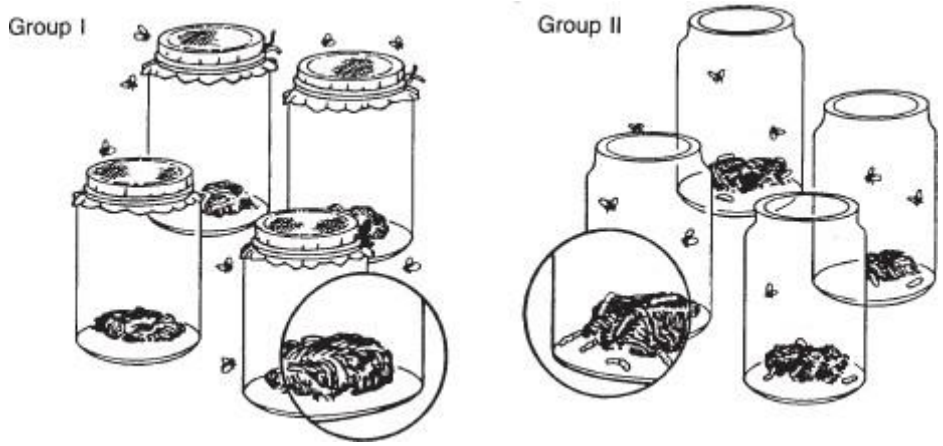
This may be calculated from Pascal's Triangle:

					1						
2 coins				1	**2**	1				4 outcomes	Probability(1 head) =
			1	3	3	1					
4 coins		1	4	**6**	4	1				16 outcomes	Probability(2 heads)
	1	5	10	10	5	1					
6 coins	1	6	15	**20**	15	6	1			64 outcomes	Probability(3 heads)

Note: Students are not expected to make this connection.

Introduction to the Scientific Method Worksheet

Long ago, many people believed that living things could come from nonliving things. They thought that worms came from wood and that maggots came from decaying meat. This idea was called spontaneous generation. In 1668, an Italian biologist, Francesco Redi, did experiments to prove that maggots did not come from meat. One of his experiments is shown below.



Redi placed pieces of meat in several jars. He divided the jars into two groups. He covered the first group of jars with fine cloth. He left the second group of jars uncovered. Redi observed the jars for several days. He saw flies on the cloth of the covered jars, and he saw flies laying eggs on the meat in the uncovered jars. Maggots appeared only on the meat in the group of jars left uncovered.

Questions

1. Which is not a step in the scientific method?
    a. Problem or question. c. Ask other people for their opinion.
    b. Research. d. Arrive at a conclusion.
2. What was the problem in Redi's experiment?
    a. How do maggots appear in meats?
    b. How do worms appear in wood?
    c. Is spontaneous generation a valid explanation for maggots in meats?
    d. All of the above are examples of problems

3. What do you think his hypothesis was?
    a. Maggots grow through spontaneous generation.
    b. Maggots come from eggs laid by flies.
    c. Maggots find their way into woods and meats.
    d. The problem cannot be solved.
4. How did he test his hypothesis?
    a. He placed food in two jars, covering one jar and leaving the other uncovered.
    b. He placed food in two jars and left both jars uncovered.
    c. He placed food in two jars and covered both jars.
    d. He put food in one jar and no food in a second jar.
5. What was the variable in his experiment?
    a. Covering both jars.
    b. Covering one jar and leaving the other uncovered.
    c. Leaving both jars uncovered.
    d. There was no variable in this experiment.
6. What do you think Redi's conclusion was?
    a. Living things come from other living things.
    b. Living things are created through spontaneous generation.
    c. He did not have enough data to arrive at a conclusion.

From: Florida IPDAE's Lesson Plans for GED® Preparation Science

Answer Key: Introduction to the Scientific Worksheet

http://www.mrscienceut.net

1. Which is not a step in the scientific method?
    - **a.** Problem or question. **c. Ask other people for their opinion.**
    - b. Research. d. Arrive at a conclusion.
2. What was the problem in Redi's experiment?
    - a. How do maggots appear in meats?
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    - **d. All of the above are examples of problems**
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    - **a. Living things come from other living things.**
    - b. Living things are created through spontaneous generation.
    - c. He did not have enough data to arrive at a conclusion.

A Few Websites in Science to Get You Started!

ABC Science. News, video clips, games, and lots of activities for the science classroom from the American Broadcasting Company.
http://www.abc.net.au/science

Annenberg: The Habitable Planet. The Habitable Planet is a multimedia course for high school teachers and adult learners interested in studying environmental science. The Web site provides access to course content and activities developed by leading scientists and researchers in the field.
http://www.learner.org/courses/envsci/index.html

Annenberg Science in Focus: Force and Motion. Explore science concepts in force and motion and come away with a deeper understanding that will help you engage your students in their own explorations. With science and education experts as your guides, learn more about gravity, friction, air resistance, magnetism, and tension through activities, discussions, and demonstrations.
http://www.learner.org/channel/workshops/force

BBC Science. From space to the human body to, this interactive site allows learners to discover many different facets of science. **http://www.bbc.co.uk/sn**

Cells Alive. This site can be used by teachers and students. Lots of great interactivity and resources on the basics of cells. h**ttps://www.cellsalive.com/notfound.htm**

Discovery Channel. The website has lots more information than even the channel. Lots of interactivity with excellent videos, interactivity, and high-level games. **http://www.discovery.com**

Exploratorium Online. Since 1993, the Exploratorium was one of the first science museums to build a site on the World Wide Web. The site contains over 15,000 articles and displays including interactivity regarding science. **http://www.exploratorium.edu**

How Stuff Works. Ever wondered why a cd works? How about the ten myths about the brain? How about what would happen if you put sugar in your gas tank? An interesting science site filled with real-world information. **http://www.howstuffworks.com**

Interactive Websites for Teaching Science. Just click on one of the topics and explore the myriad of resources on the World Wide Web. **http://interactivesites.weebly.com/science.html**

National Science Teachers Association. Don't forget the professional organization for science teachers. This site has lots of ideas, lessons, and scientific updates.
http://www.nsta.org

Newton's Apple. NEWTON'S APPLE is a production of Twin Cities Public Television from a grant from the 3M Foundation. The site is filled with free videos for use in many different areas.
http://www.newtonsapple.tv

Nye Labs.com This is indeed "Bill Nye, the science guy" with lots of activities and applications for science. **https://www.billnye.com/**

PBS: Science & Nature. Highlights and background information on every Science-based PBS program on the air; check out the Science for the Classroom link. **http://www.pbs.org/science**

Steve Spangler. This site has lots of free experiments and videos for use in the classroom
https://www.stevespanglerscience.com/lab

The Why Files. University of Wisconsin, Board of Regents. Real world articles to support all areas of science. Click on the "Why Files in Education." **http://whyfiles.org/teach**

Understanding Science. The Understanding Science website is a fun, free resource that aims to accurately communicate what science is and how it really works. It provides "an inside look at the general principles, methods, and motivations that underlie all of science.**"**
http://undsci.berkeley.edu

Resources for the GED® and ABE Math Classroom

PROBABILITY

Interactive sites for Education. Lower level math activities
http://interactivesites.weebly.com/probability.html

Math is Fun. High School Statistics and Probability Common Core Standards-games, puzzles, worksheets
https://www.mathsisfun.com/links/core-high-school-statistics-and-probability.html

Khan Academy
https://www.khanacademy.org/math/statistics-probability

Home School Math- Online games and resources for probability
https://www.homeschoolmath.net/online/probability.php

Mathematical Monk. Probability Primer- a series of videos
https://www.youtube.com/channel/UCcAtD_VYwcYwVbTdvArsm7w

Math-Aids.com. Create your own math worksheets for probability by grade level
http://www.math-aids.com/Probability/Probability_Numbers.html

Kuta Software. Worksheets and explanations
https://cdn.kutasoftware.com/Worksheets/