THE FOURTEENTH ANNUAL SCIENCE AND MATH EDUCATORS CONFERENCE (SMEC 14)

Science and Mathematics Education Center (SMEC)
Faculty of Arts and Sciences
American University of Beirut, Lebanon

SMEC 14 – CONFERENCE PROCEEDINGS

(ENGLISH AND FRENCH SECTION)

PART THREE: INNOVATIVE IDEA SESSIONS

THE FOURTEENTH ANNUAL SCIENCE AND MATH EDUCATORS CONFERENCE (SMEC 14)

Science and Mathematics Education Center (SMEC)
Faculty of Arts and Sciences, American University of Beirut, Lebanon
March 31st, 2012

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We do apologize for any significant omissions.

SMEC 14 MISSION STATEMENT

The SMEC Conference is an annual event designed to promote the continued development of a professional community of mathematics and science educators across Lebanon and throughout the region. Specifically, the conference aims to:

- Provide an intellectual and professional forum for teachers to exchange theoretical and practical ideas regarding the teaching and learning of mathematics and science at the elementary, intermediate, and secondary levels

- Provide a forum for teacher educators and researchers to share their findings with science and mathematics teachers with a special emphasis on the practical classroom implications of their findings

- Provide an opportunity for science and mathematics teachers to interact with high-caliber science and mathematics education professionals from abroad

- Contribute to the ongoing development of a professional culture of science and mathematics teaching at the school level in Lebanon and in the region

- Raise awareness of science and mathematics teachers about the array of curriculum and supplemental classroom materials available to them through publishers and local distributors

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Part Three
Interactive Sessions: Innovative Idea

MATHEMATICS

Virtual Manipulation in Classrooms: Using the Internet in the Math Classrooms

Rima Basha Houssami

Introduction

The participants were introduced, using a power point presentation, to different uses of the internet through different websites. One of the activities, for instance, explored the library of virtual manipulatives and showed the participants how to use these virtual aids in teaching specific math concepts such as base 10 blocks. Other activities aimed at showing the uses of 'games' in teaching mathematics such as the concept of fractions. During the presentation the participant were given a set of questions to answer according to their own teaching practices. The purpose behind these questions was for the teachers to reflect on their own beliefs and teaching practices and to be able to link the virtual activities with the math concepts. At the end of the presentation, a brochure was distributed to all participants with all the resources that were used in the workshop.

The presentation explored three main uses of the internet. The first use stressed individualized learning where learners can practice a skill using the internet. The second use was to promote exploration and discovery in the mind of the learner. The third use explored simulating activities. Multimedia environment using virtual manipulatives can facilitate students' engagement and increase student's exploration and learning. Such multimedia environments provide visual representations which, in turn, support understanding of more abstract, symbolic concepts (Butler, Miller, Crehan, Babbitt, & Pierce, 2003. Therefore, learners will be able to translate from one form of representation to another which is an important factor in problem-solving (Gagatsis & Shiakalli, 2004). When the representations are dynamic and interactive they can aid students in seeing underlying patterns and recognizing critical elements, which also is important for grasping math concepts (Ahmed, Clark-Jeavons, & Oldknow, 2004).

With respect to individualized learning, participants were introduced to a math-drill website which presents a variety of math concepts that varies in grade level and level of difficulty. Such websites present the learner with a vast number of practice questions. A learner can compete against himself by going from one level of difficulty to another. Moreover, it supports the learner with a direct feedback of his/her wrong answer with a tutorial of a full explanation of the solution. Many activities of the "National Library of Virtual Manipulatives for Interactive Mathematics" website were introduced. This website presents "virtual" manipulatives to represent physical manipulatives, such as base 10 blocks or algebra tiles. These virtual manipulatives clarify misconceptions and build connections between mathematical concepts and representations, fostering more precise and richer understanding (Butler et al., 2003; Cass et al., 2003). This environment can benefit learners with diverse learning needs. One example is the Pan Balance which is a manipulative that is based on the balance pans that are used with younger

children to demonstrate the concept of equality. Such technology-based representations of physical manipulatives can also help learners with disabilities improve their understanding of the abstract symbolic language of mathematics.

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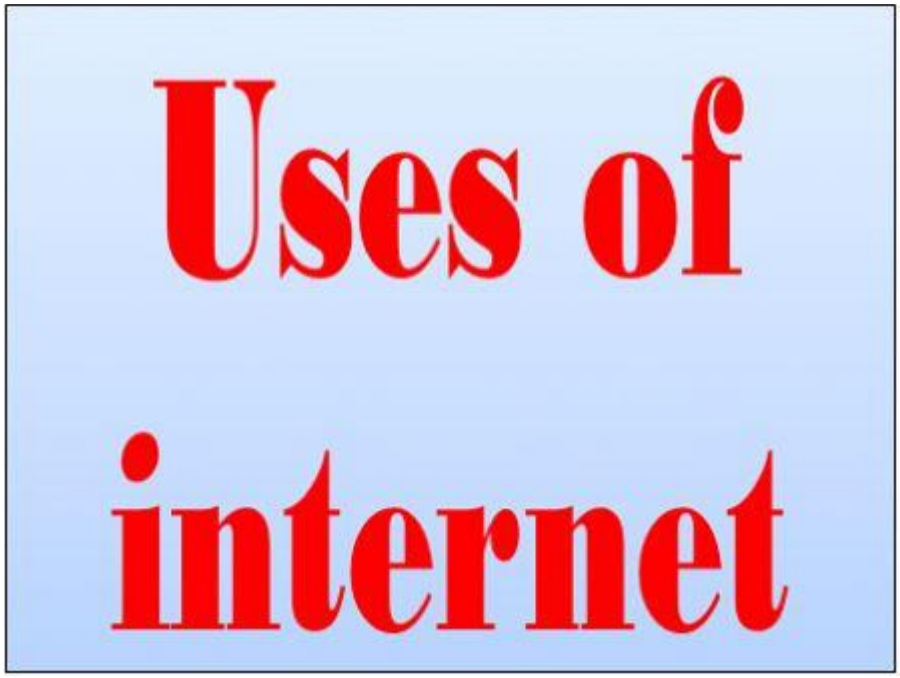

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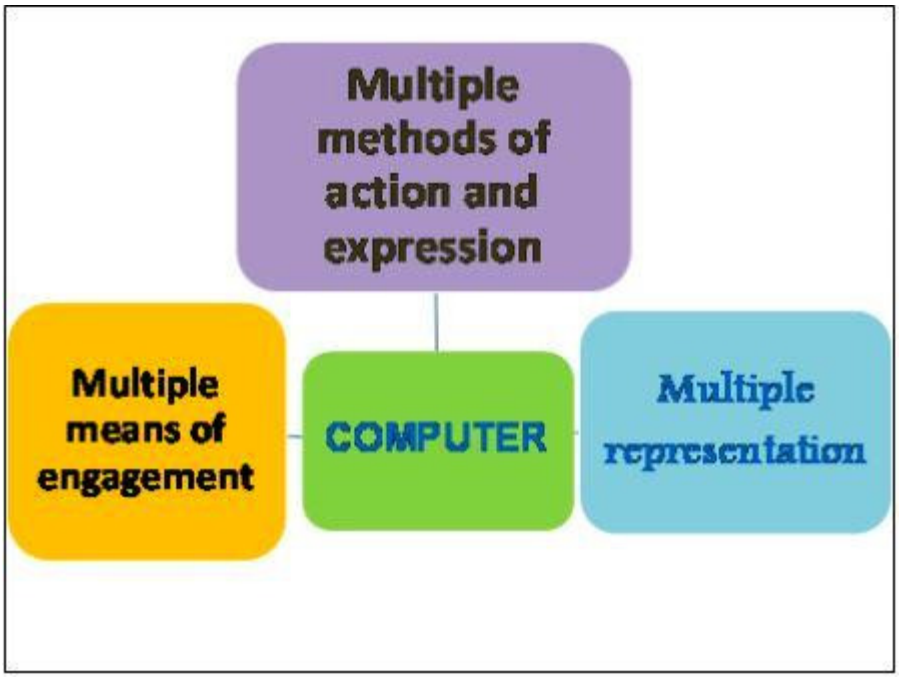

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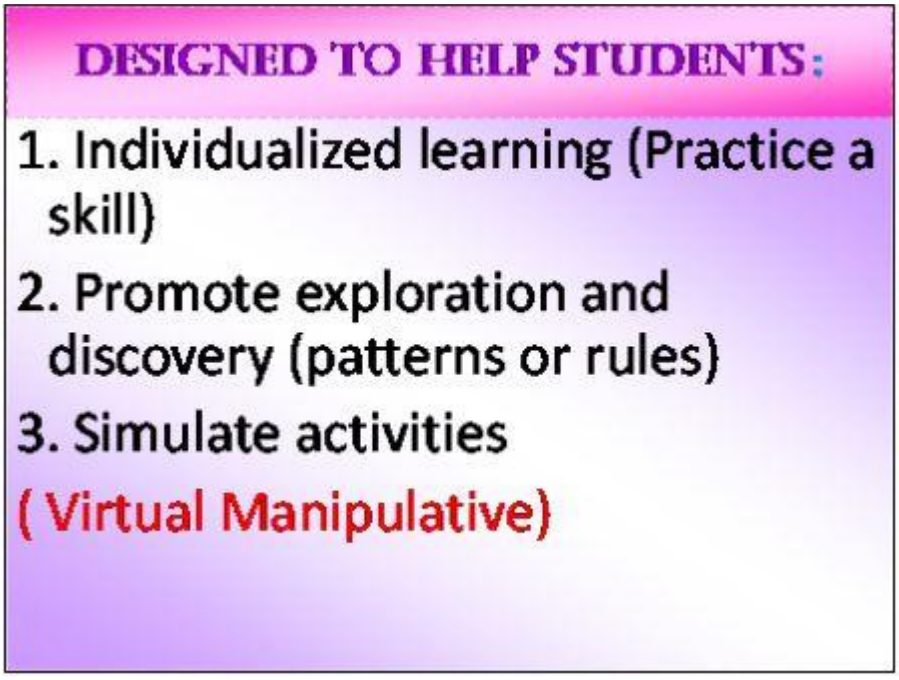

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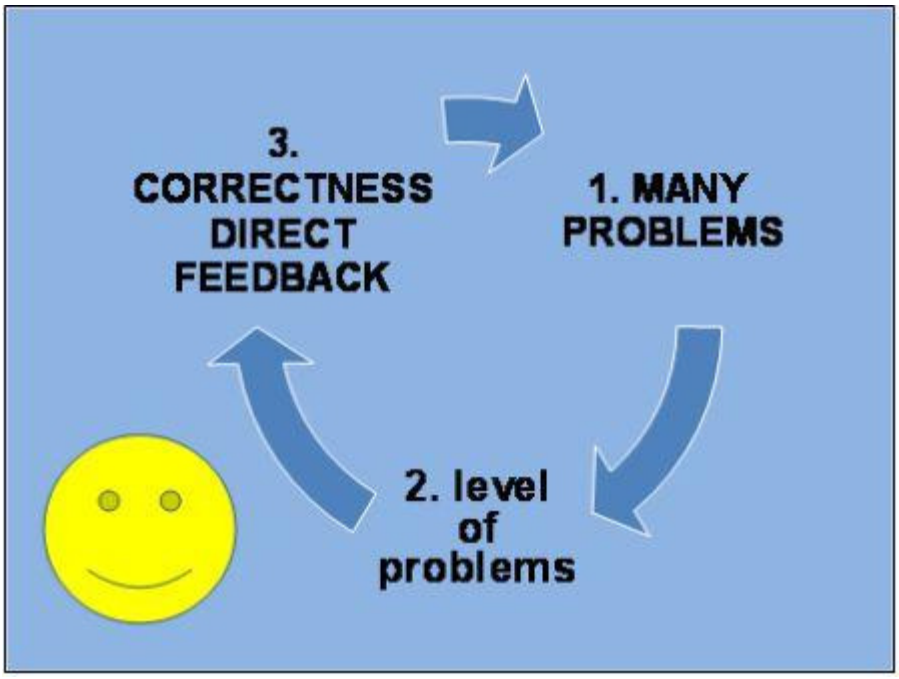

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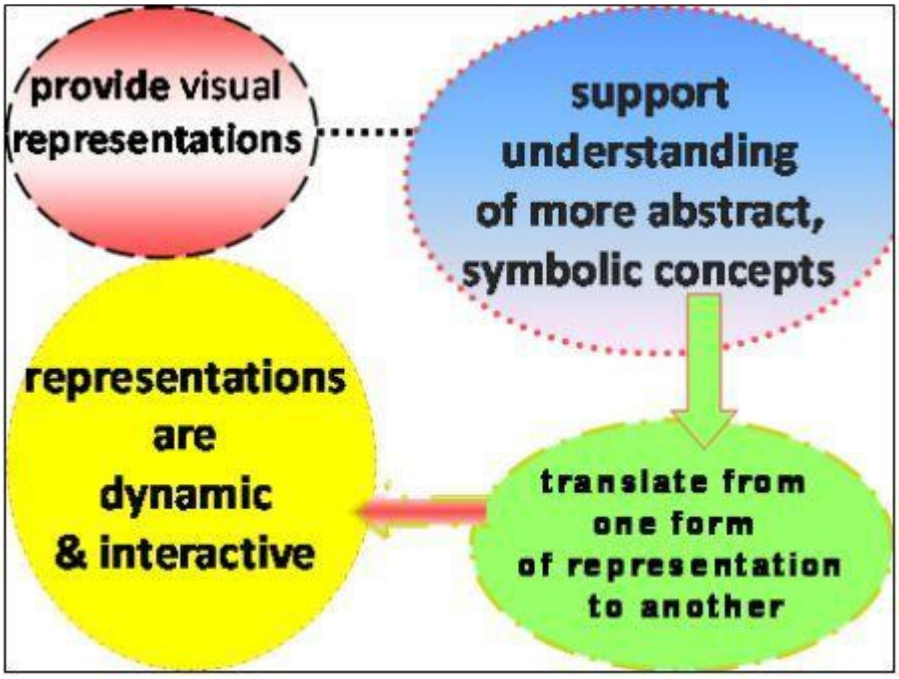

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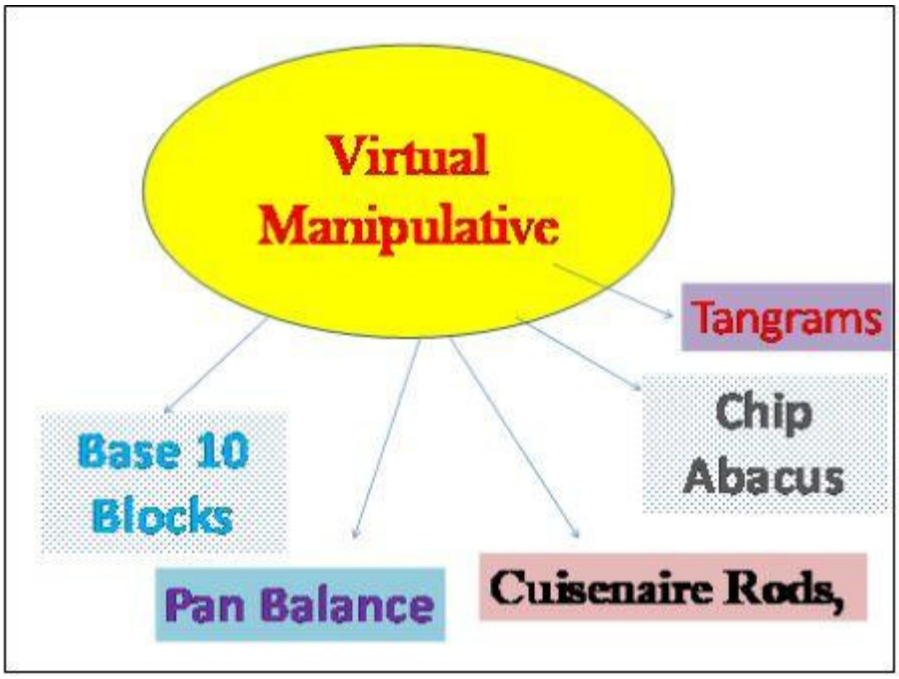

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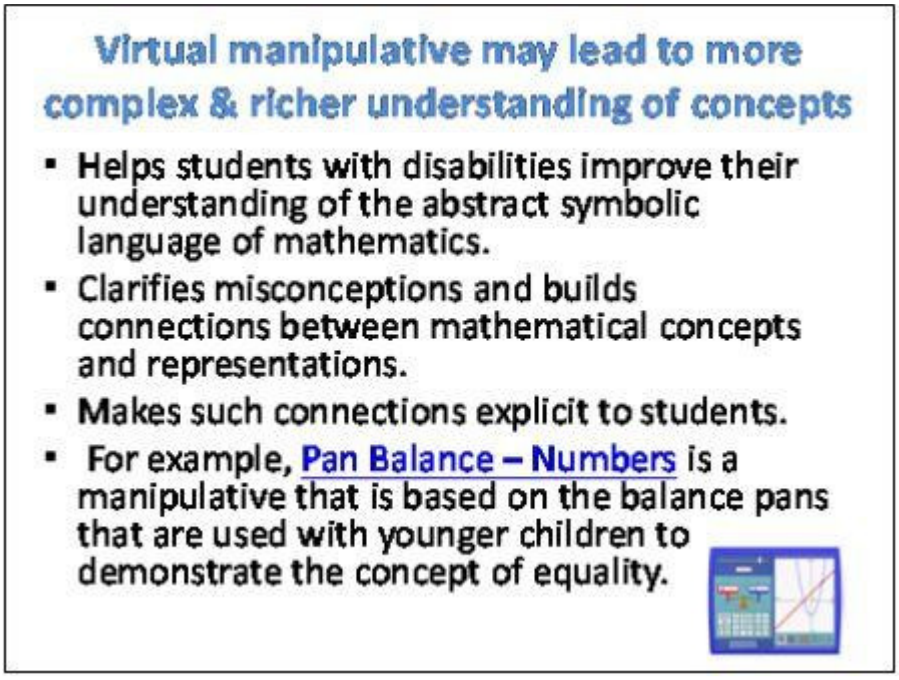

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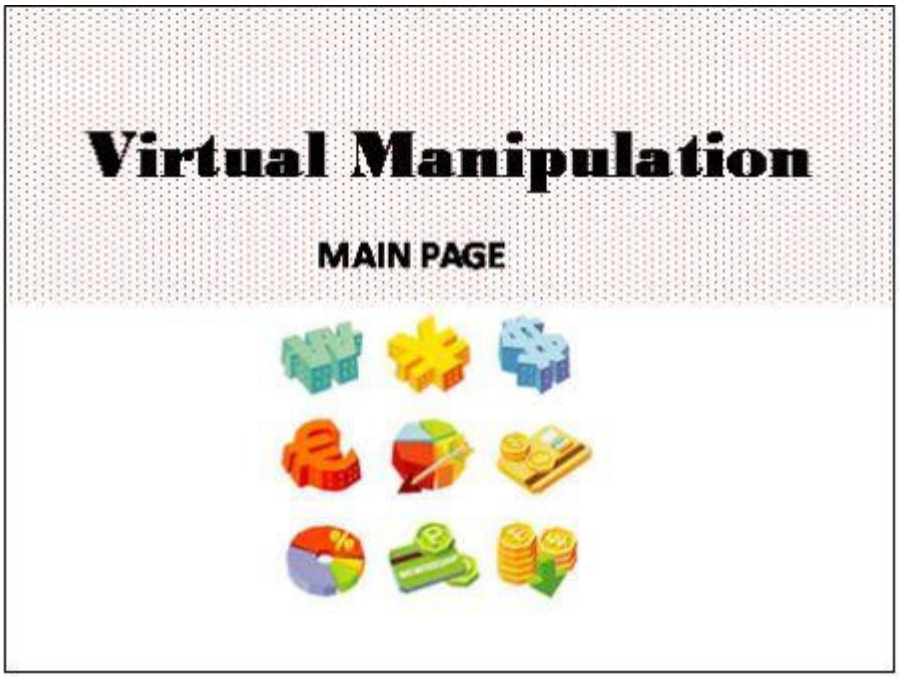

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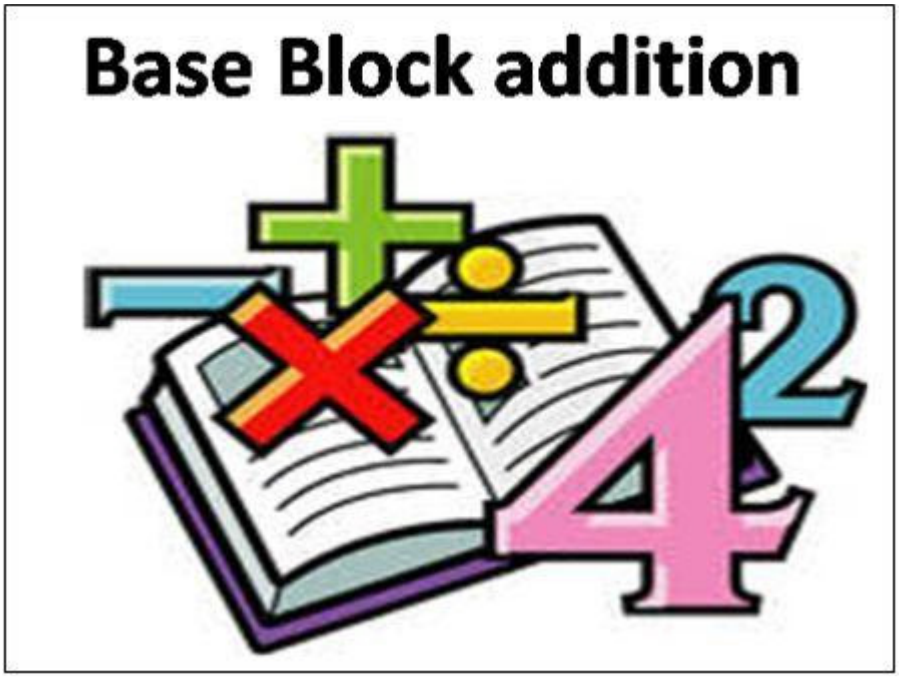

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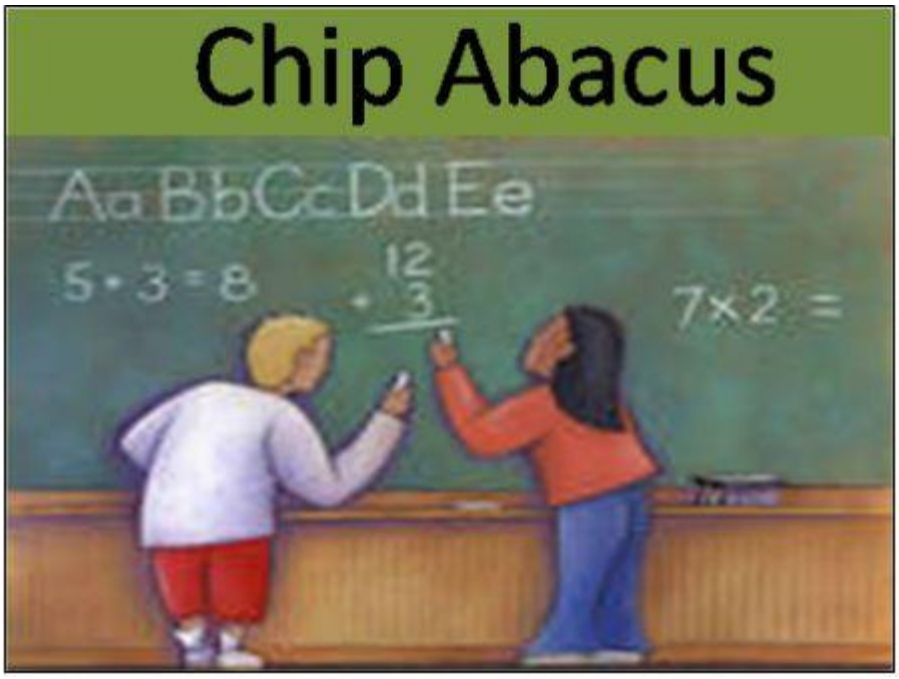

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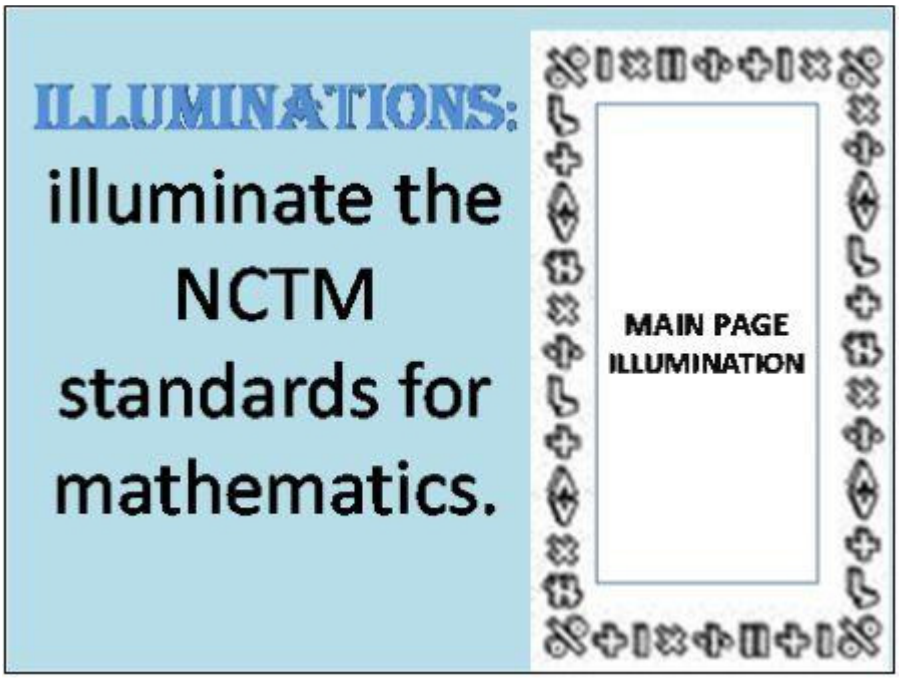

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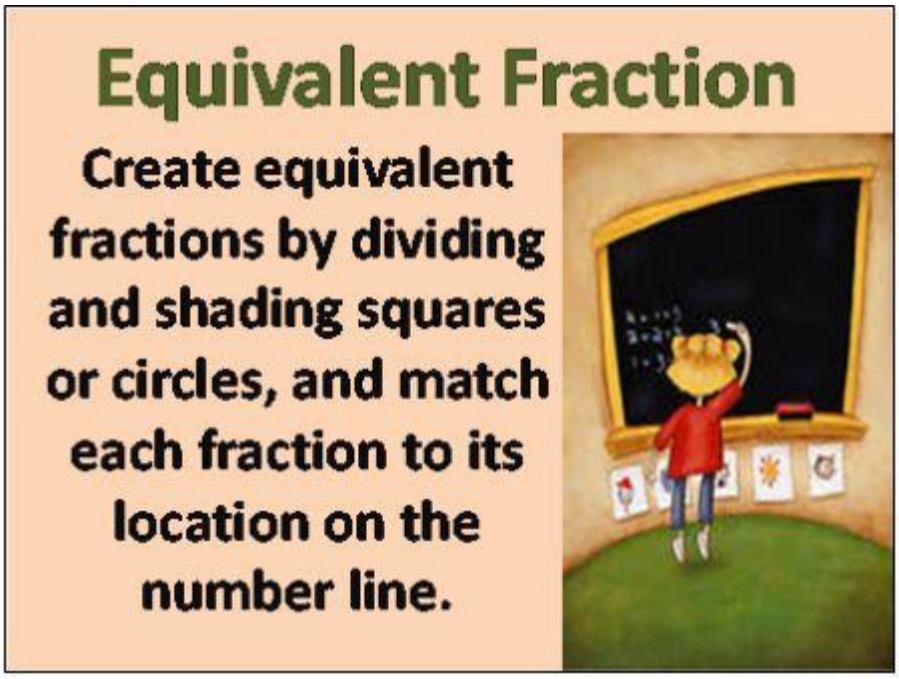

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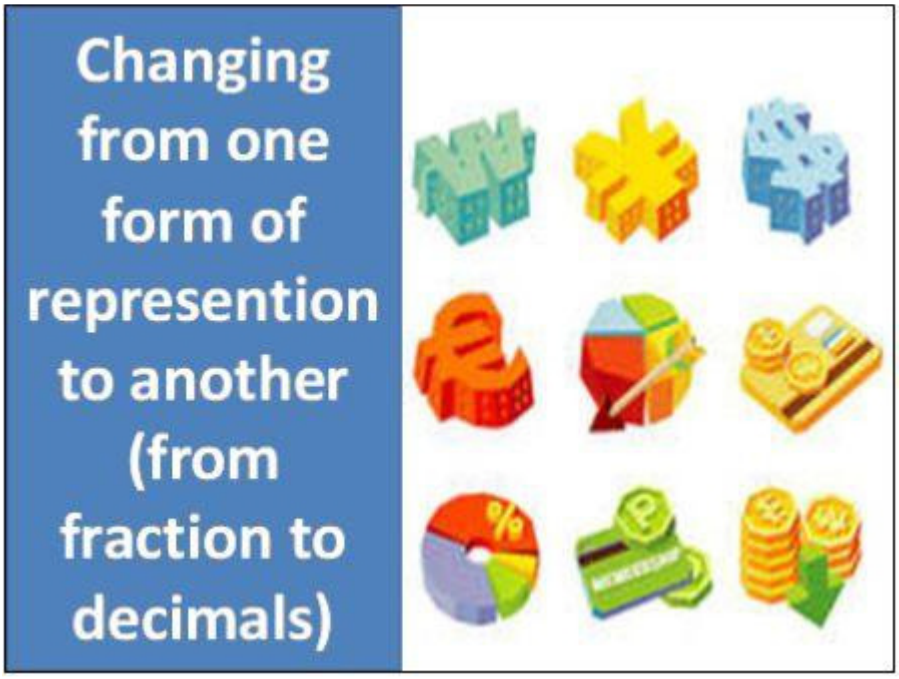

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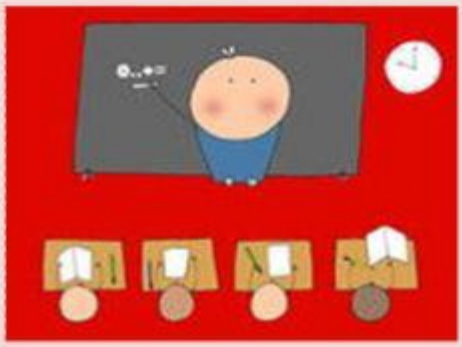
FACTOR TREE: Exercising Your Factoring Ability Against a Human or the Computer



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Bobbie Bear is planning a vacation and wants to know how many outfits can be made using different colored shirts and pants.

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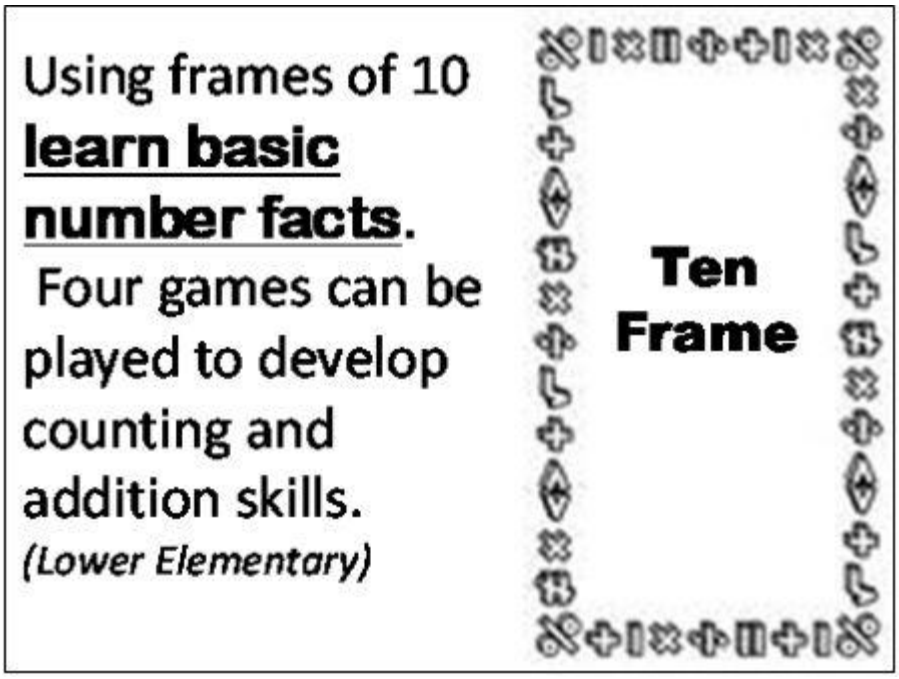

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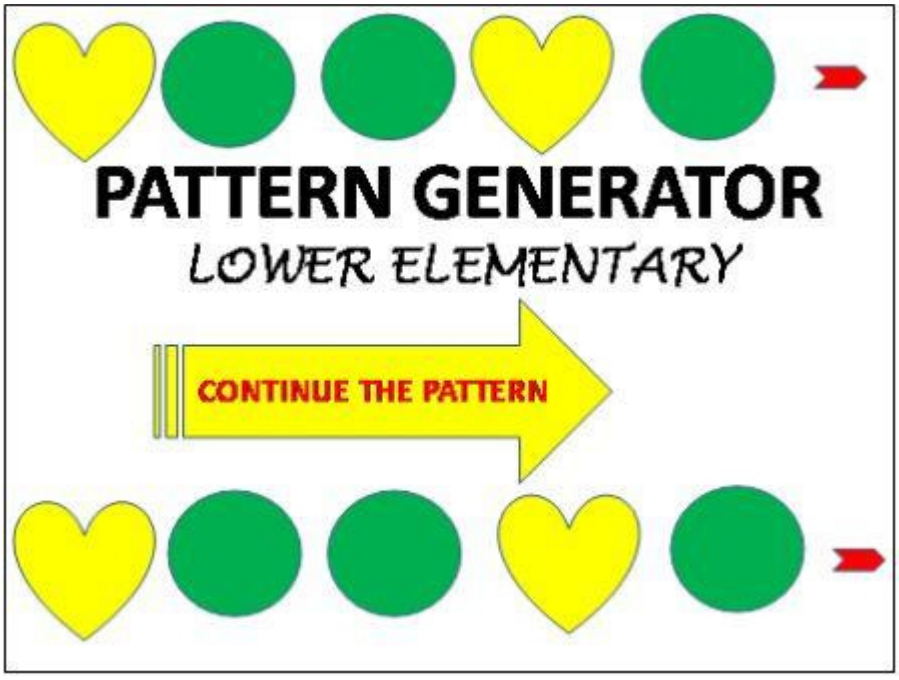

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Please answer the following questions based on what you do in your class:

1. How do you introduce the concept of "equality" or "equation"?

2. Write a list of at least 3 manipulative that you use in your classroom.

3. Do you think that the use of internet will be a waste of time and the math concepts can be learned in the concrete manipulative? Explain

4. What do you think about teaching math through games?

5. For what purposes do you use the internet in your math class and how do you use?

6. Do you think that after attending this workshop, you will use the internet as a means to introduce, explain, practice and visualize math concepts in your class?

List of websites:

A. Activities and Lesson Plans

1. National Library of Virtual Manipulatives for Interactive Mathematics: is a library of web-based interactive virtual manipulatives and concept tutorials. (all Grade levels) http://matti.usu.edu/nlvm/nav/index.html
2. Illuminations: It illuminates the NCTM standards for mathematics. It includes lessons and activities. An additional feature is *Web Resources*. http://illuminations.nctm.org/
3. MathTools: A major feature is its catalog of technology resources for math on the web. http://www.mathforum.org/mathtools/

4. AAA Math: This site has practice activities for many math topics for grades kindergarten through 8. For each topic, it gives an explanation and a timed practice activity. http://www.aaamath.com/
5. Arcytech – Educational Java Programs: This website includes interactive tools for several manipulatives commonly used in the elementary grades – Cuisenaire rods, base 10 blocks, pattern blocks, and fraction bars. http://arcytech.org/java/
6. Cyberchase for Parents and Teachers: This website is designed to teach math concepts to students ages 8 to 12 in an engaging way. The website for parents and teachers includes online games, lesson plans, and print-based activities http://pbskids.org/cyberchase/parentsteachers/index.html
7. Figure This! Math Challenges for Families: This website is designed for middle school students in becoming engaged with and learning math. http://www.figurethis.org/index.html
8. Graph Paper Printer: Graph Paper Printer is a software that create different kinds of graph such as musical notation, elementary handwriting paper, and customizable tables. http://software.techrepublic.com.com/download.aspx?docid=281128
9. PlaneMath: This site addresses students with physical disabilities are at a disadvantage in mathematics because of the inability to manipulate objects effectively. http://www.planemath.com/
10. Project Interactivate: includes over 100 interactive tools and activities that allow students to explore mathematics. http://www.shodor.org/master/interactivate/
11. Talking Calculator: Talking Calculator is a full functioning on-screen calculator that speaks the names of the buttons and can "read" whatever it displays. http://www.premierathome.com/products/TalkingCalculator.php
12. WisWeb: This website contains over 70 applets, categorized by topic and grade level. Many of them have been designed to complement the *Math in Context* series. http://www.fi.uu.nl/wisweb/welcome_en.html
13. Adding integers: http://students.washington.edu/smithr3/integers/learning.html http://oregonstate.edu/~niessm/
14. Developing Mathematical Thinking with Effective Questioning: http://teacherline.pbs.org/teacherline/resources/questionsheet_vma.pdf
15. MathVIDS: http://coe.jmu.edu/mathvidsr/Default.htm
16. Multisensory Teaching: Positive and Negative Numbers: http://www.resourceroom.net/math/integers.asp
17. Visual Fractions: http://www.visualfractions.com/

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Butler , F.M., Miller, S.P., Crehan, K., Babbitt, B., & Pierce, T. (2003). Fraction instruction for students with mathematics disabilities: Comparing two teaching sequences. *Learning Disabilities Research & Practice*, *18(2),* 99-111.

Cass, M., Cates, D., Smith, M., & Jackson, C. (2003). Effects of manipulative instruction on solving area and perimeter problems by students with learning disabilities. *Learning Disabilities Research & Practice, 18(2),* 112-120.

Gagatsis, A., & Shiakalli, M. (2004). Ability to translate from one representation of the concept of function to another and mathematical problem solving. *Educational Psychology, 24(5),* 645-657.

Math Out Loud

Tharwat Baasiri

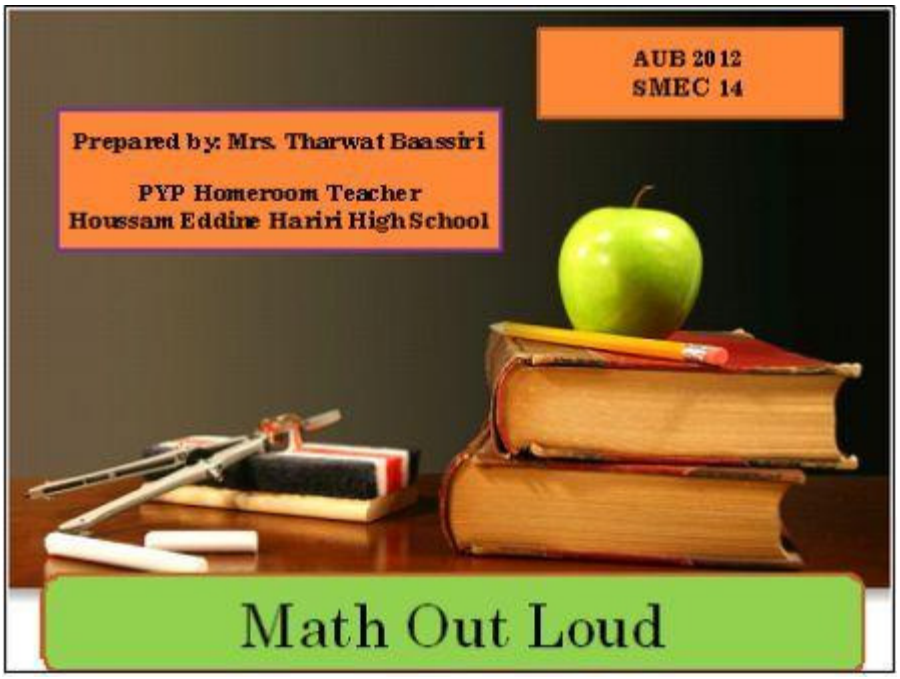
Introduction

Engaging learners in the excitement of math and teaching them to be more risk-takers was the workshop's aim. There are wonderful teaching strategies that excite learners and foster their critical thinking. In addition, session participants viewed multiple videos regarding technological practices and the means of using them in their math classes. Thus, attendees viewed math in new perspectives. This workshop primarily aimed at increasing the participants' understanding of how to implement mental math strategies in classroom through the implementation of real-life Math activities. This session included authentic and easily applicable mental math strategies for Math teachers to use and consequently achieve profound student development in elementary mathematics classrooms. In this workshop, participants enjoyed various innovative activities taking on the role of the learner in some particular instances and that of the teacher at others. From the beginning till the end of the session, participants were actively involved in interesting hands-on activities that enriched their understanding of different strategies that excite the learners and foster their critical thinking. Computational mental Math instruction was implanted in the core of the students' daily and future lives; it's the unforgettable practical Math which all learners enjoy and feel motivated to learn and practice.

Description of the Session

The session was planned as follows:

(a) Brief introduction of what mental math is and the objective of the workshop;
(b) To break the ice, attendees searched their pockets as a "scavenger hunt" process. In fact, items included Math concepts, so teachers may take advantage of the engagement to warm their students up with an interesting environment;
(c) Participants were asked about where they use math, then a slide show was introduced showing the usage of math in our daily life;
(d) Attendees warmed up their mental thinking with challenging computational mental operations;
(e) Mathematical magic tricks and magical calculator widened the teachers' thinking and taught them tricks;
(f) Number detective activity was introduced as another interactive strategy;
(g) Differentiated group activity was held out to engage participants who took on the roles of learners and got introduced to different "experiences" as a provocation for their thinking.
(h) This activity was followed by mini videos showing different mental strategies, and making thinking visible.
(i) Participants had a gallery walk around the various strategies and used their sticky notes to confirm their agreement with some of them. At last, participants wrote two stars or positive points about what they've learned during the workshop and one suggestion for improvement in their classrooms.



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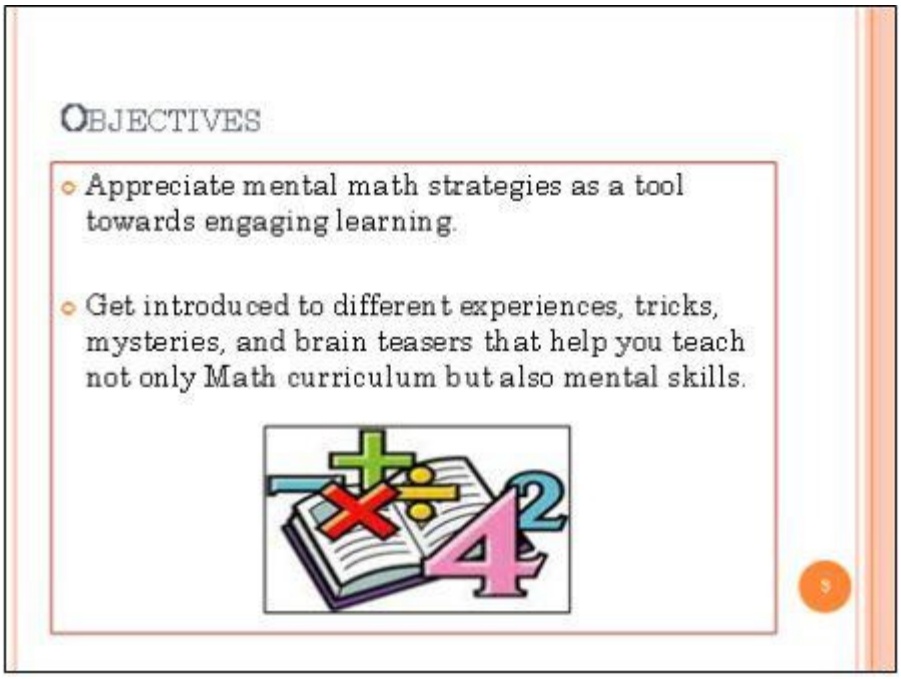

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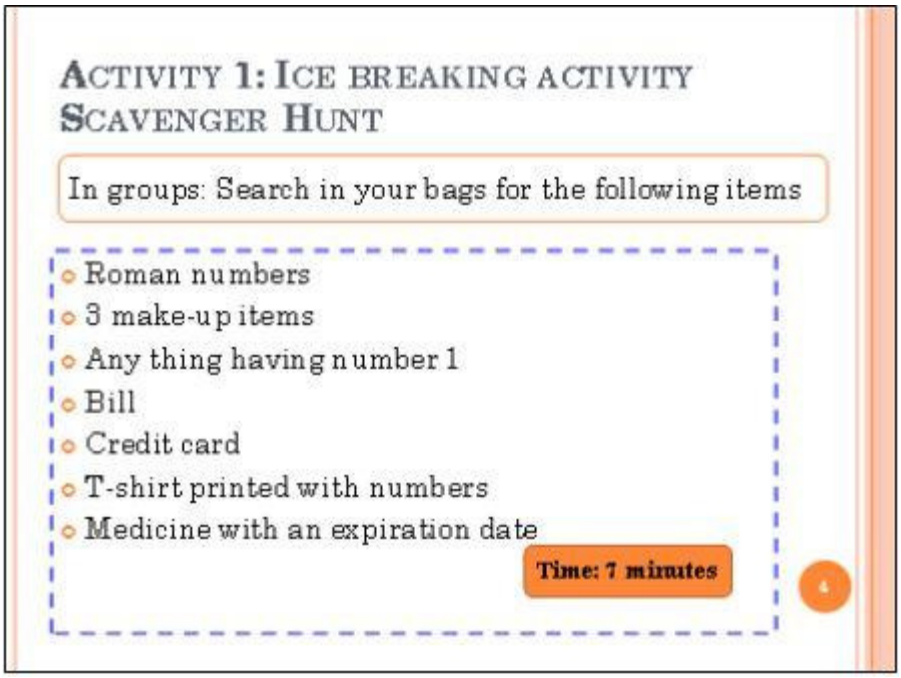

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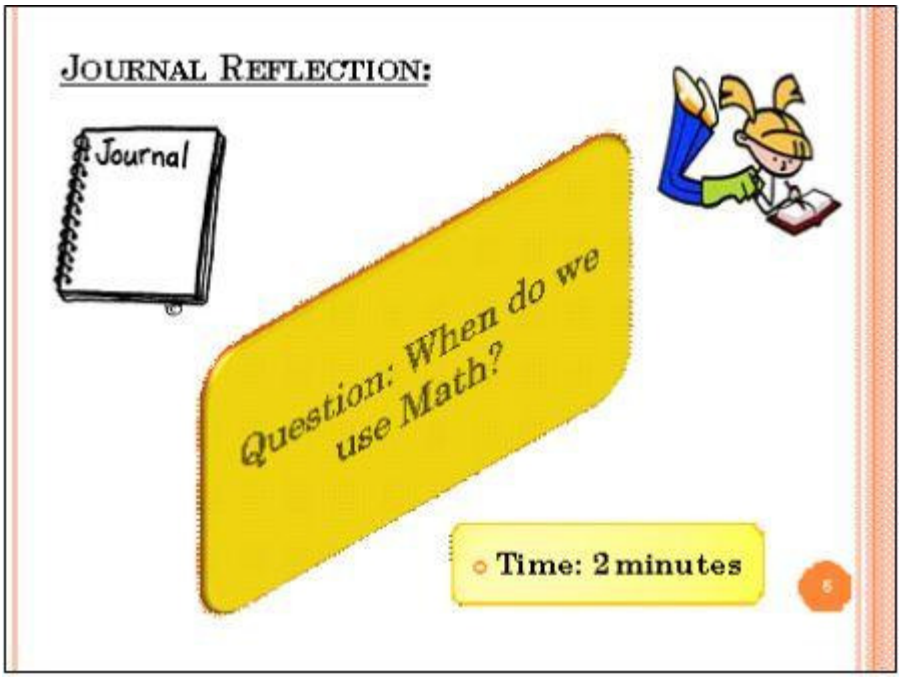

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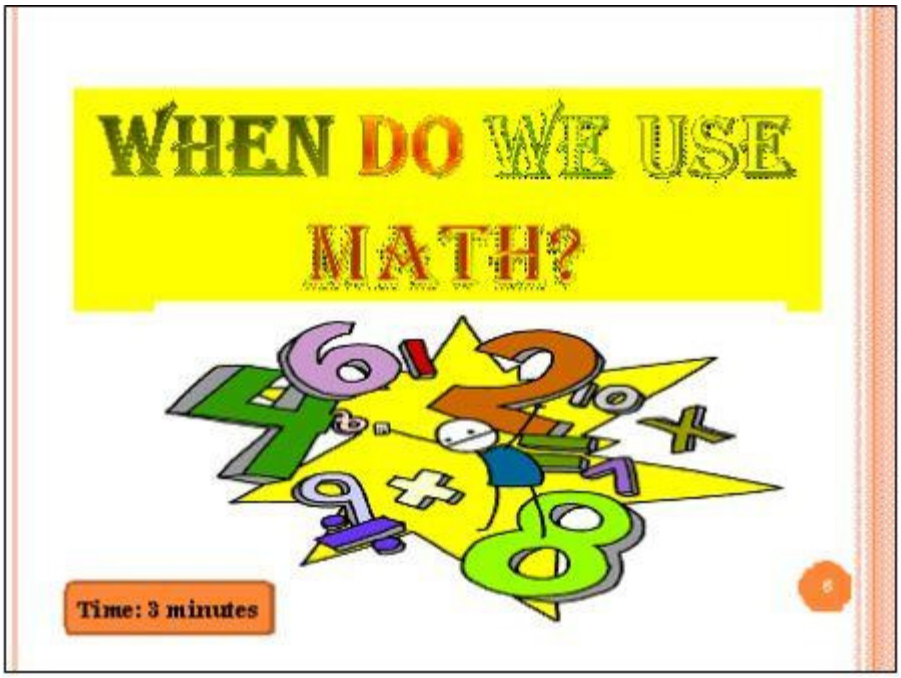

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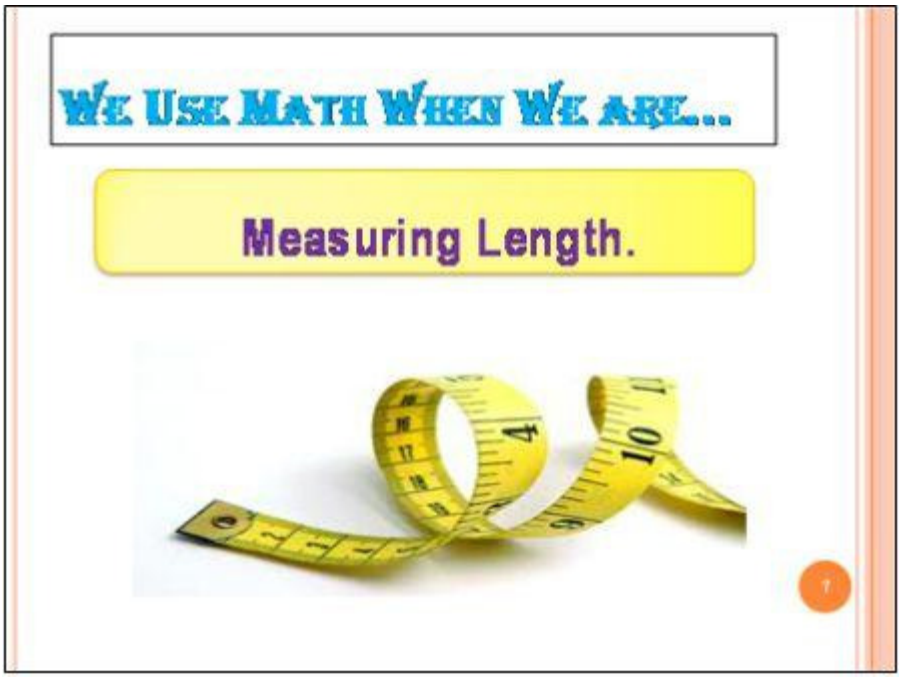

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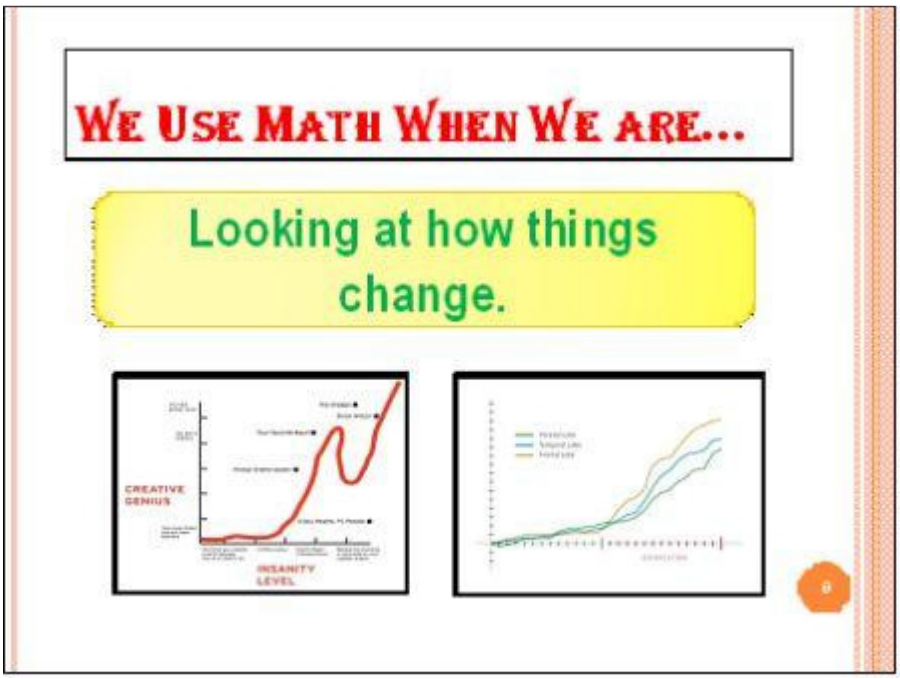

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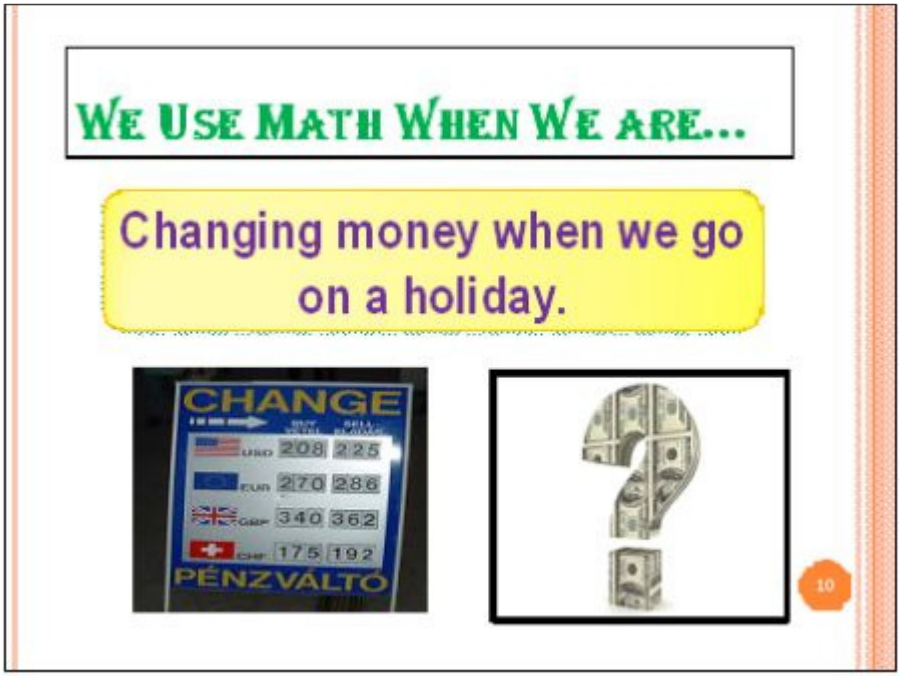

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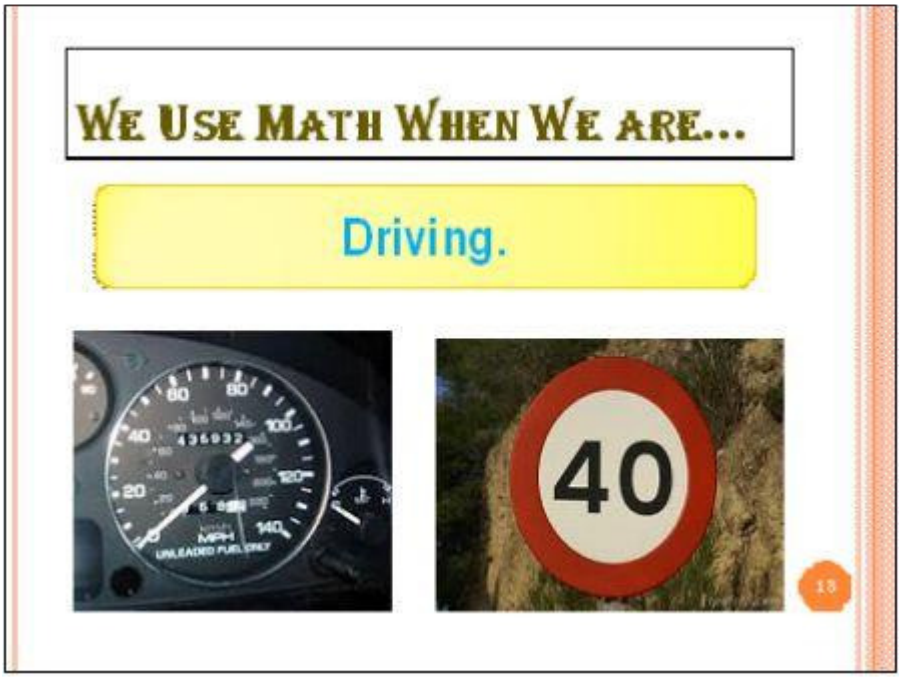

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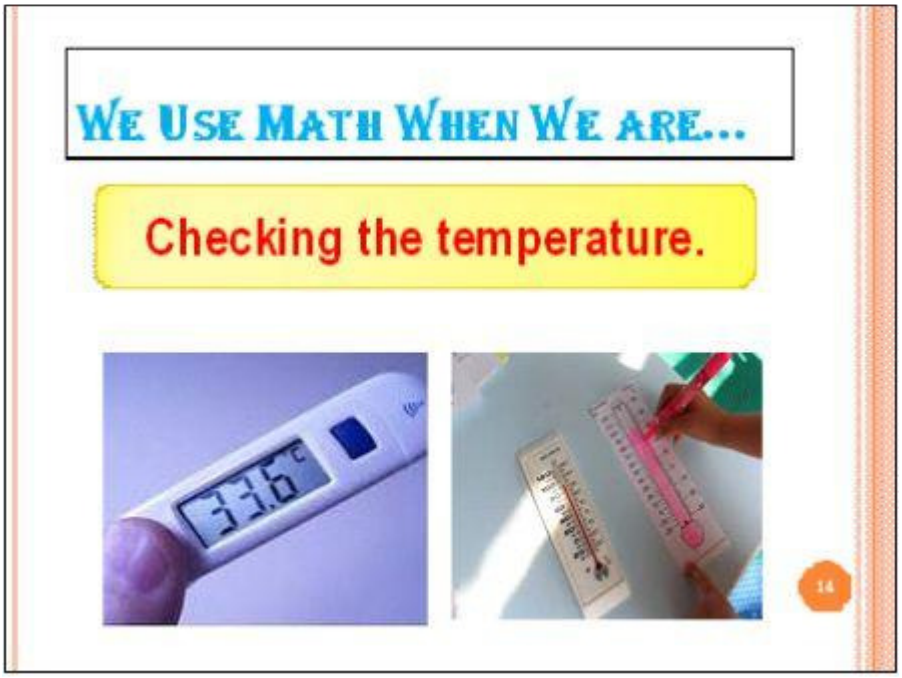

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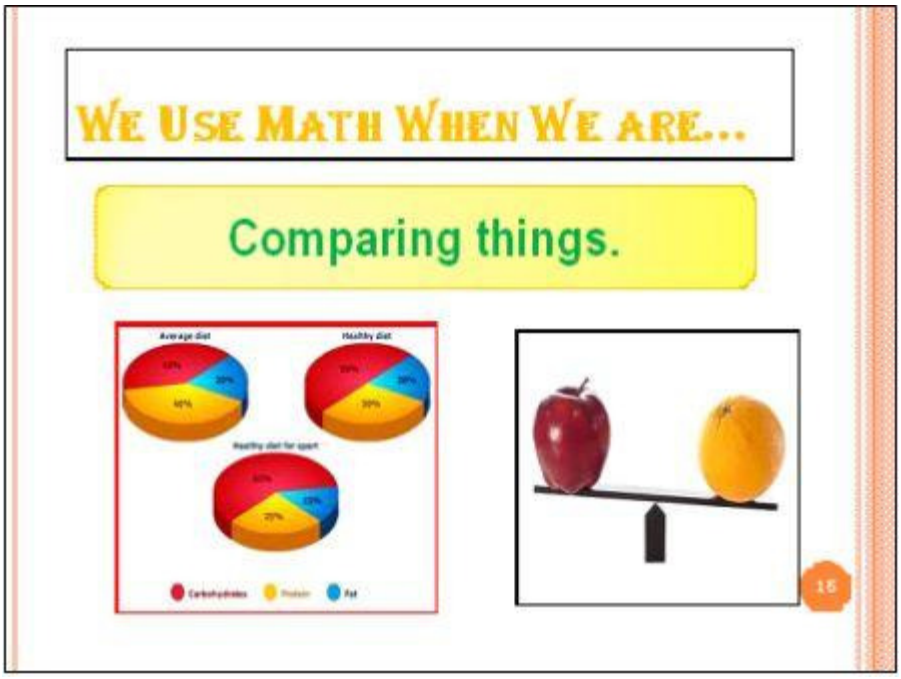

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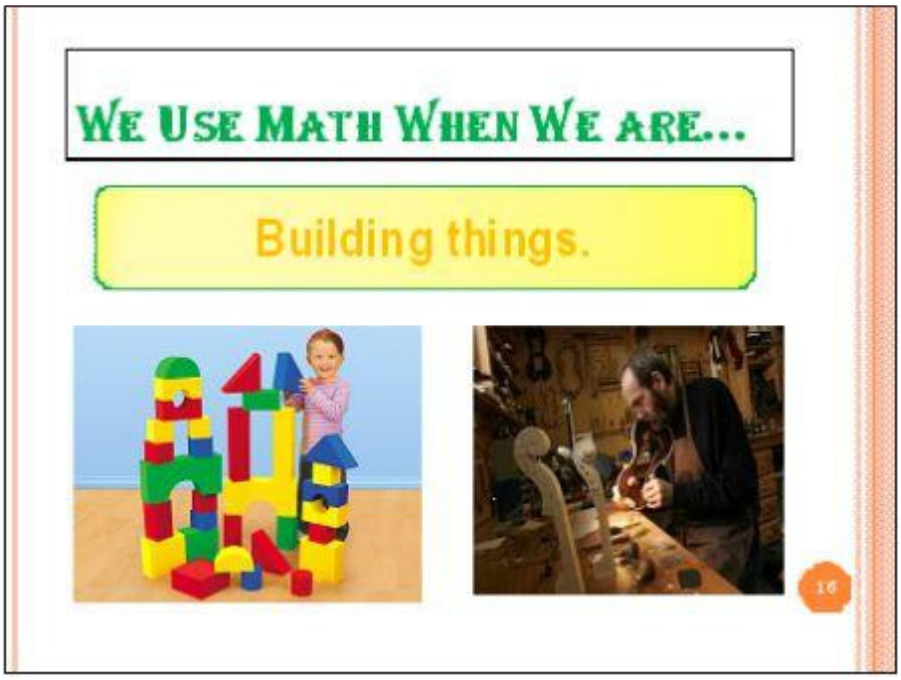

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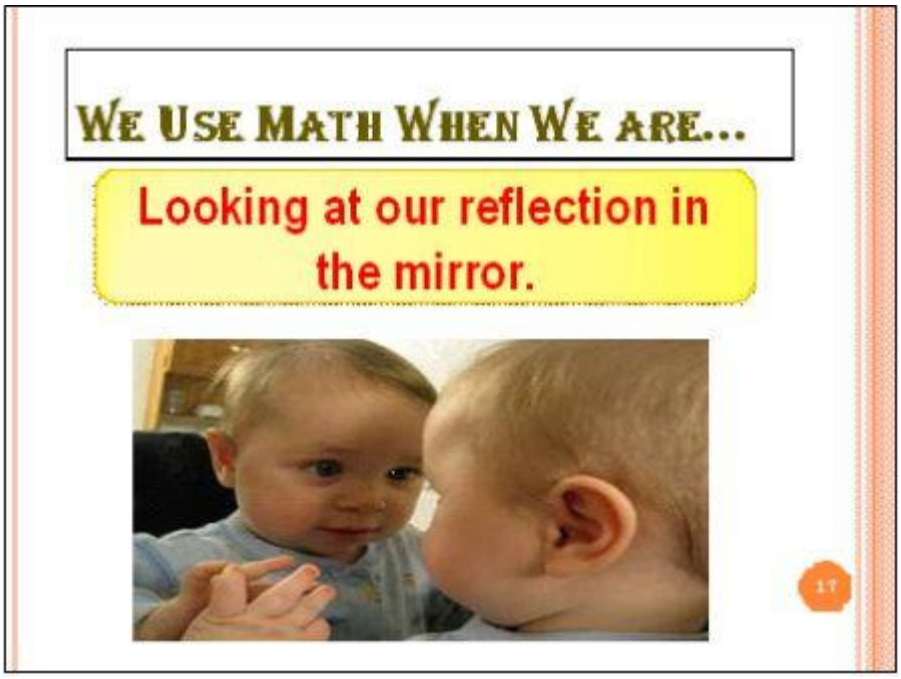

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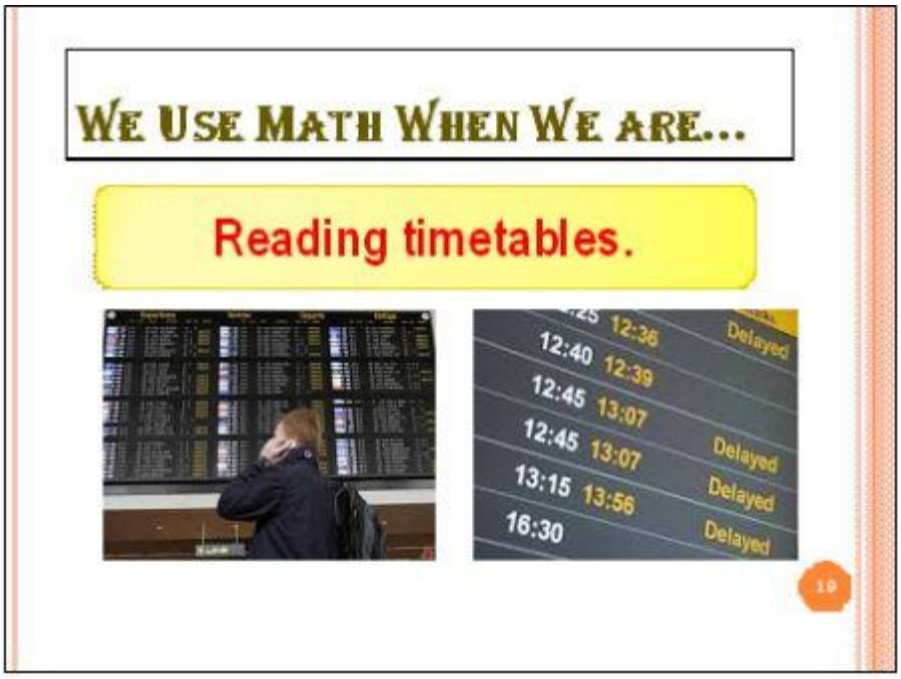

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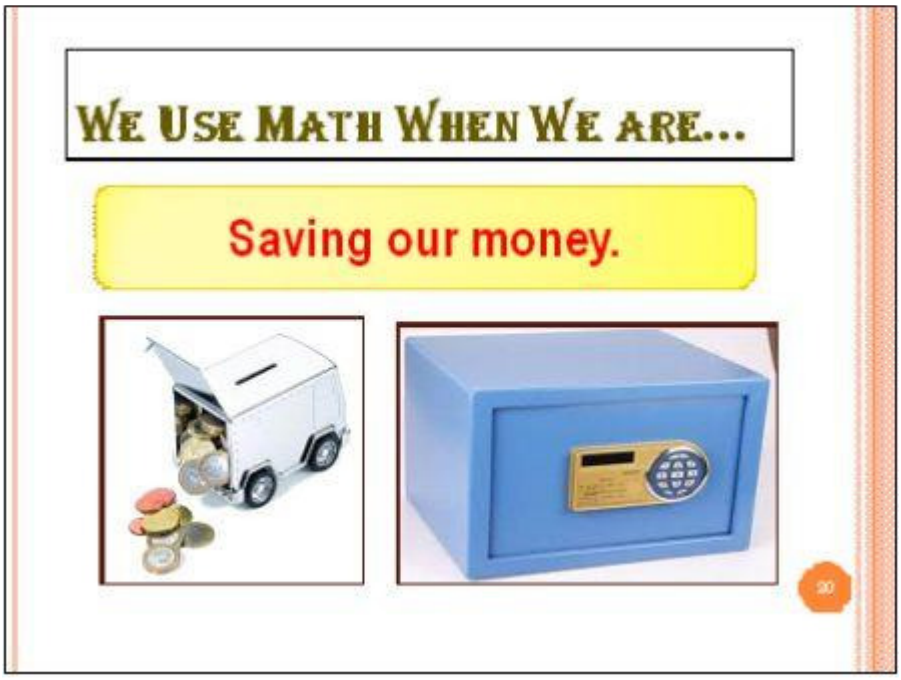

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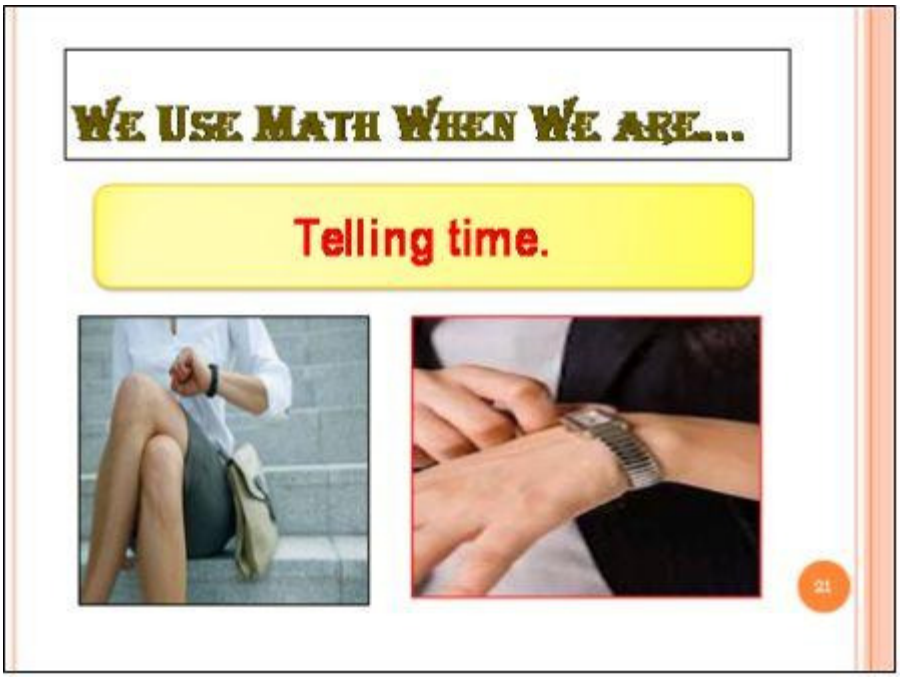

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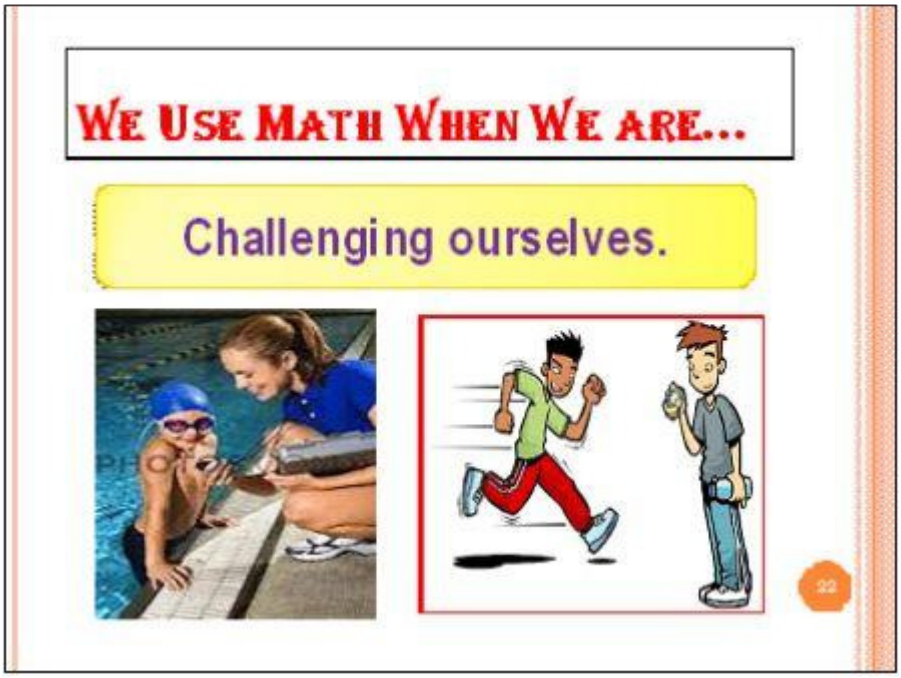

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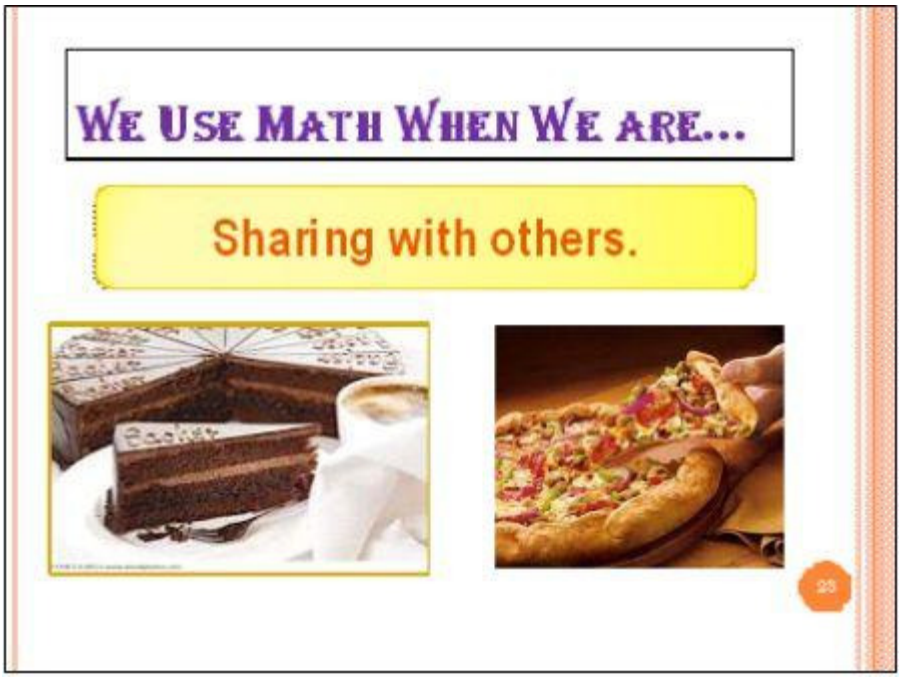

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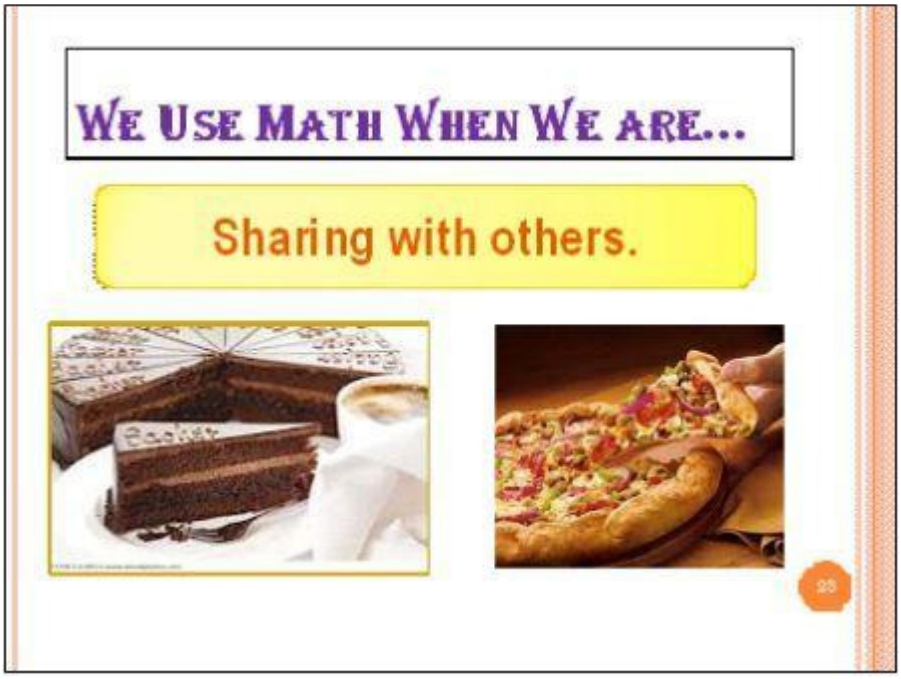

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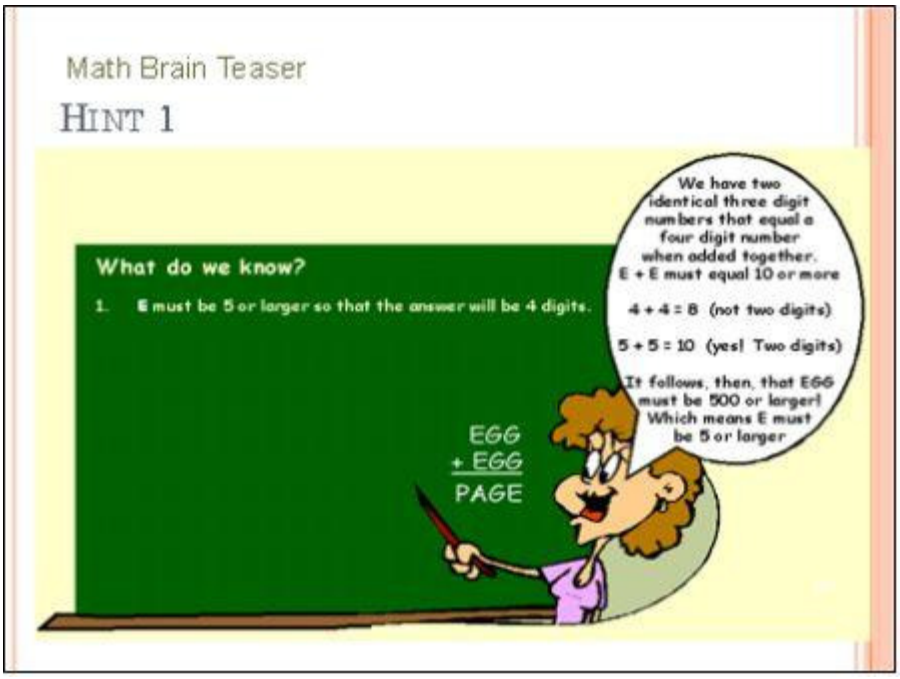

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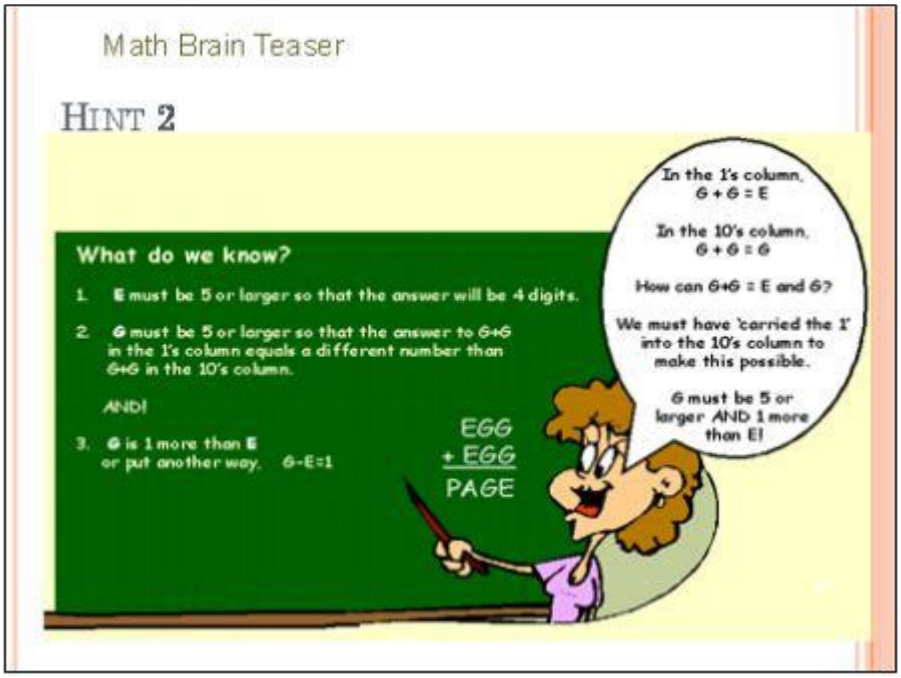

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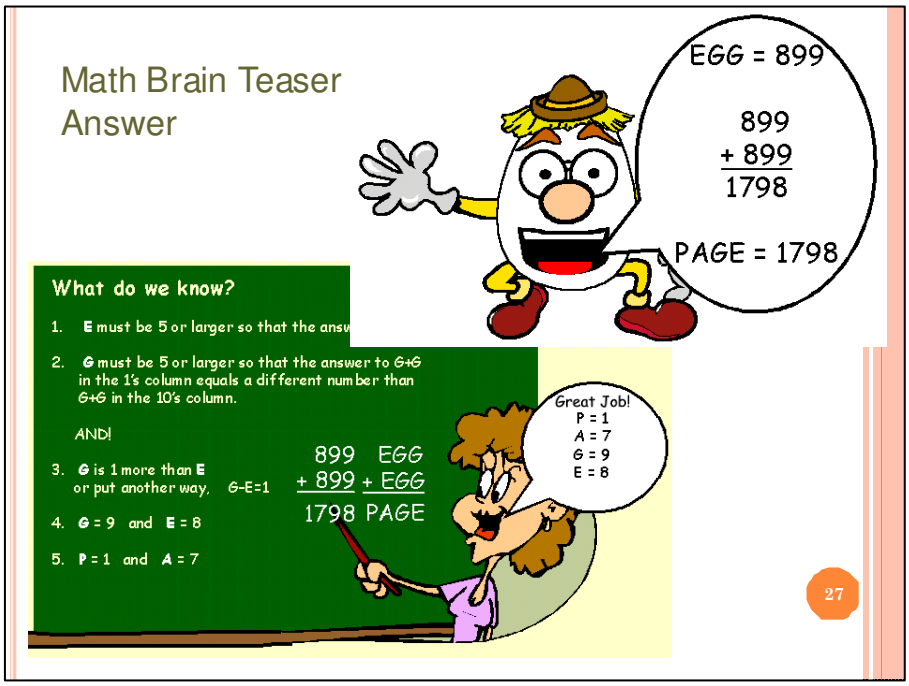


SLIDE 27

ACTIVITY: 4

MATHEMATICAL MAGIC TRICK

- Pick your favorite number between 1 and 100, but don't tell what it is!

- Multiply your number by 2.
- Multiply the product by 5.
- Tell me the answer you've come up with.
- Drop the zero from the answer you gave and tell them what their number was!

Time: 5 minutes

28

SLIDE 28

MAGIC TRICK-EXAMPLE

- **Example 1:**

Favorite number = 5
5 x 2 = 10
10 x 5 = 50
50 --- drop the zero = 5!

- **Example 2:**

Favorite number = 32
32 x 2 = 64
64 x 5 = 320
320 --- drop the zero =32!

29

SLIDE 29

MY MAGIC CALCULATOR!

- Using a calculator with this mathematical magic trick., pick your favorite number between 1 and 9, but don't tell what it is!
- multiply the number by 9.
- Now multiply that number by 12,345,679.

(1 thru 9, skipping the 8)

- TAH DAH... The calculator shows them their number -- 9 times!

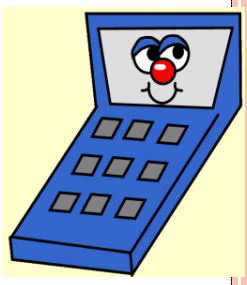
30

SLIDE 30

MY MAGIC CALCULATOR!-EXAMPLE

Example 1:
Favorite number = 5
5 x 9 = 45
45 x 12345679 = 555,555,555

Example 2:
Favorite number = 9
9 x 9 = 81
81 x 12345679 = 999,999,999



31

SLIDE 31

ACTIVITY: 5 NUMBER DETECTIVE

Number Detective

Clues

-How many degrees are in a right angle?
-How many years are in a century?
-How many days are in the month of March?
-How many days are in a leap year?
-Add the answers to all of these questions. The sum is the secret number.
-What is the secret number?

Time: 5 minutes

SLIDE 32

NUMBER DETECTIVE-ANSWER

- How many degrees are in a right angle? (90°)
- How many years are in a century? (100 years)
- How many days are in the month of March? (31 days)
- How many days are in a leap year? (366 days)
- Add the answers to all of these questions. The sum is the secret number.
- What is the secret number? (587)

33

SLIDE 33

ACTIVITY: 7

VIDEO: FAST MATH TRICKS

- How fast can you multiply 2 digit numbers:
- Let's multiply
- 41 x 31= ??????

Time: 4 minutes

34

SLIDE 34

ACTIVITY 8: *PAUSE AND REFLECT*

-What are the skills that this movie teach?

-How engaging and relevant is it to students' learning and application?

"We learn by doing if we reflect on what we do" "John Dewey"

Time: 5 minutes

35

SLIDE 35

ACTIVITY 8:
BRAIN EXERCISE

Time: 7 minutes

- **Exercise of the brain is as important as exercise of the muscles. As we grow older, it's important that we keep mentally alert. The saying; "If you don't use it, you will lose it" also applies to the brain, so……..**
- **Here is a very private way to gauge your loss or non-loss of intelligence.**
- **So take the following test presented here**

- **OK, relax, clear your mind and……. begin.**

36

SLIDE 36

What do you put in a toaster?
The answer is bread.

If you said "toast", then give up now and go do something else. Try not to hurt yourself.

If you said, "bread", go to question 2.

37

SLIDE 37

- Say "silk" five times. Now spell "silk". What do cows drink?
- Answer: Cows drink water.

- If you said "milk", please do not attempt the next question. Your brain is obviously overstressed and may even overheat.
- If you said, "water" then proceed to question three.

38

SLIDE 38

- If a red house is made from red bricks and a blue house is made from blue bricks and a pink house is made from pink bricks and a black house is made from black bricks, what is a greenhouse made from?
- Answer: Greenhouses are made from glass.
- If you said "green bricks", what the devil are you still doing here reading these questions????? .. If you said "glass", then go on to question four.

39

SLIDE 39

- Twenty years ago, a plane is flying at 20,000 feet over Germany. If you will recall, Germany at the time was politically divided into West Germany and East Germany. Anyway, during the flight, TWO of the engines fail. The pilot, realizing that the last remaining engine is also failing, decides on a crash landing procedure. Unfortunately the engine fails before he has time and the plane crashes smack in the middle of "no man's land" between East Germany and West Germany. Where would you bury the survivors - East Germany or West Germany or in "no man's land"?

- **Answer: You don't, of course, bury survivors.**
- If you said ANYTHING else, you are a real _____ and you must NEVER try to rescue anyone from a plane crash. Your efforts would not be appreciated. If you said, "Don't bury the survivors" then proceed to the next question.

40

SLIDE 40

Without using a calculator:

You are driving a bus from London to Milford Haven in Wales. In London, 17 people get on the bus. In Reading, six people get off the bus and nine people get on. In Swindon, two people get off and four get on. In Cardiff, 11 people get off and 16 people get on. In Swansea, three people get off and five people get on. In Carmathen, six people get off and three get on. You then arrive at Milford Haven. What was the name of the bus driver?

Answer: Oh for goodness sake!
It was you.
Read the first line!!!

41

SLIDE 41

ACTIVITY: 9

VIDEO: SECRET TRICK: LONG MATH DIVISION

Can you divide
221013 ÷ 9=
In 6 seconds

- **Time: 5 minutes**

42

SLIDE 42

ACTIVITY: 10

MATH MYSTERY EXPERIENCES

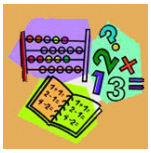
Each group will read one experience out of five to discuss afterwards:
-the use of this experience
-the relevance of this experience to real life

Time: 12 minutes

43

SLIDE 43

EARLY FINISHERS' READINGS:



Mathematics is built around and focused on:

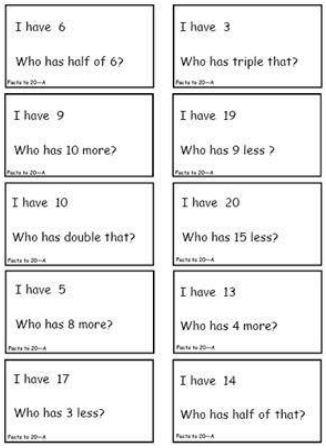
- Teaching for Understanding
- Problem-based instructional tasks
- Distributed practice that is meaningful and purposeful
- Mathematical modeling
- Deep conceptual and procedural knowledge
- Effective use of technology
- Integrated content

44

SLIDE 44

ACTIVITY: 11 I HAVE

"I have, who has" is a game that reinforces math skills. Hand out the 20 cards to children. If there are less than 20 children, give more cards to the children. The first child reads one of their cards i.e., 'I have 15, who has 7+3, the child who has 10 then continues until the circle is complete. It is a fun game that keeps everyone engaged trying to figure out the answers.



45

Time: 3 minutes

SLIDE 45

VIDEO: MATH TIMES TABLES

- Let's teach our students easier ways to know multiplication tables:
- This video will show Math Times Tables for 3, 6, 9 multiplication

46

Time: 5 minutes

SLIDE 46

REFLECTION TIME:

TWO STARS AND ONE WISH

Two stars	One wish

47

SLIDE 47

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- www.glad2teach.co.uk
- http://www.kidzone.ws
- *www.superteacherworksheets.com*
- www.authorstream.com/
- *http://www.mathnstuff.com/papers/games/whohas/whointr.htm*

48

SLIDE 48

Handouts

Math Mystery Experiences

Experience 1: MULTIPLICATION

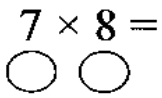
How well do you know your basic multiplication tables?

What would you think if I told you that you could master your tables up to the ten times table in less than 15 minutes? And your tables up to the twenty times table in less than half an hour? You can, using the methods we explain in this chapter. We only assume you know the two times table reasonably well, and that you can add and subtract simple numbers.

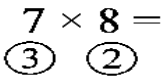
Let's go straight to the method. Here is how you multiply numbers up to ten times ten.

We'll take 7 X 8 as an example.

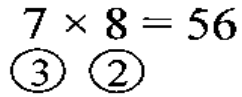
Write 7 X 8 = down on a piece of paper and draw a circle below each number to be multiplied.



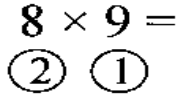
Now go to the first number to be multiplied, 7. How many more do you need to make 10? the answer is three. Write 3 in the circle below the 7. Now go to the eight. What do we write in the circle below the eight? How many more to make 10? The answer is two. Write 2 in the circle below the eight. Your work should look like this.



We now take away diagonally. Take either one of the circled numbers (3 or 2) away from the number, not directly above, but diagonally above, or crossways. In other words, you either take 3 from 8 or 2 from 7. Either way, the answer is the same, 5. This is the first digit of your answer. You only take away one time, so choose the subtraction you find easier. Now you multiply the numbers in the circles. 3 times 2 is 6. This is the last digit of your answer. The answer is 56. This is how the completed sum looks.



Let's try another, 8 times 9.



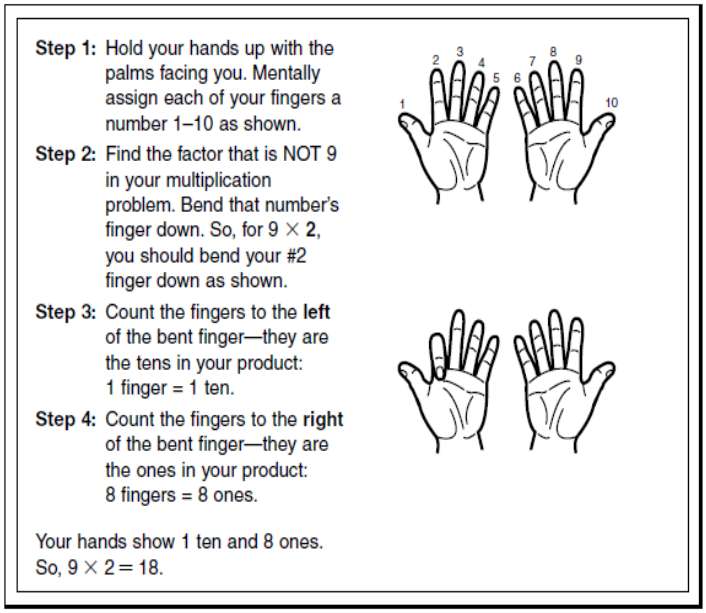
How many more to make ten? The answer is 2 and 1. We write 2 and 1 in the circles below the numbers. What do we do now? We take away diagonally. 8 - 1 = 7 or 9 - 2 = 7. 7 is the first

digit of your answer. Write it down. Now multiply the two circled numbers together. 2 X 1 = 2, the last digit of the answer. The answer is 72. Isn't that easy?

Experience 2: MULTIPLICATION TABLE 9

Finger Products

Chisenbop is an ancient method using your fingers. You can use Chisenbop to multiply when 9 is a factor. The product 9 x 2 is shown below as an example.



9x1=	**0**	**9**
9x2=	**1**	**8**
9x3=	**2**	**7**
9x4=	**3**	**6**
9x5=	**4**	**5**
9x6=	**5**	**4**
9x7=	**6**	**3**
9x8=	**7**	**2**
9x9=	**8**	**1**
9x10=	**9**	**0**

The trick is: all the product are organized from (0 to 9)

The sum of each product is 9

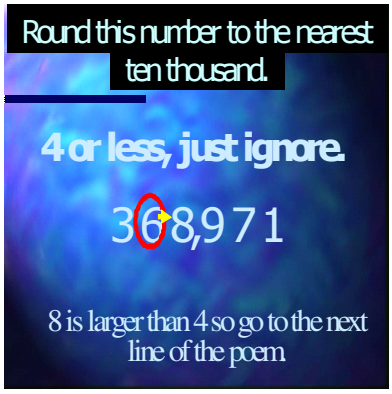
Ex: 9x5=45 → 4+5=9

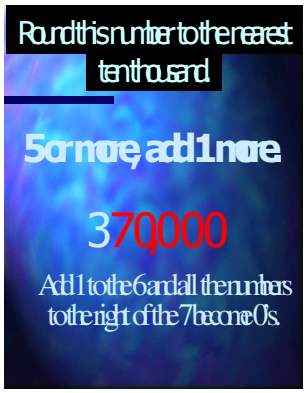
Experience 3:

Rounding poem

Find your number.
Look right next door.
4 or less just ignore.
5 or more, add 1 more.

Example:





Experience 4:

The first, middle, and last names of a number. Toward the beginning of second grade, Laura was trying to figure out 28 – 8. To her, at that point, 28 – 8 was just as arbitrary a problem as 24 – 7. The approach that she took was to count backwards. The teacher wanted her to see how the number *names* could help. Here is an excerpt from their conversation.
Tchr: *playfully* "Hi there, Laura G——! What's *your* name?"
LG: *amused* "Laura!"
Tchr: "Your first and last name."
LG: "Laura G——"
Tchr: "Hmm, Laura G——... What if I take away the Laura? What's left?"
LG: *hesitantly* "G——?"
Tchr: "Sure! Would you say your name again?"
LG: "Laura G——"
Tchr: "So what was 'Laura G——' minus 'Laura'?
LG: *more confidently* "G——."
Tchr: "Yup! Say your name again!"
LG: *amused again* "Laura G——!"
Tchr: "What's 'Laura G——' minus 'G——'?"
LG: "Laura?"
Tchr: "And what's 'Laura G——' minus 'Laura'?"
LG: "G——?"
Tchr: "Yay. Ok, we're going to pretend your name is twenty-eight! *playfully* So, what's your name?"
LG: "Twenty-eight."
Tchr: "Hi! Nice to meet you, Twenty Eight! What's your first name?"
LG: *hesitantly* "Twenty?"
Tchr: "Hi, twenty! And what's your last name?"
LG: *less hesitantly, but still with the questioning tone* "Eight?"
Tchr: "And... your whole name is...?"
LG: *confidently* "Twenty-eight!"

Tchr: "Ah, and what if I take away the Twenty? What's left?"
LG: "Eight?"
Tchr: "Yes! Say your name again?"
LG: "Twenty eight!"
Tchr: "And what's 'Twenty Eight' minus 'Eight'?"
LG: *with real confidence* "Twenty!"

This is *not* a mathematical idea, but it is also not a trick. It is a linguistic idea. The name 'twenty-eight' evolved to make this computation easy! Many languages insert "and" in the number name (for example, "eight and twenty" rather than "twenty eight"), making it even clearer that "twenty-eight" is "twenty" and "eight." We could have called that number fourweek (suggesting multiplication/division), but instead chose a name that suggests addition/subtraction and lets us understand 28 – 8 through *language alone*. Of course, language alone does not solve all problems -- for problems like 24 – 7 we need mathematical ideas, too -- but even for 24 – 7 the linguistic idea is valuable, because we want *24 – 4* to feel so trivial that we can *use* it in the solution of 24 – 7.

Base 10 blocks help, of course, but take advantage of the language, too!

Experience 5: ACTIVE PARTICIPATION STRATEGIES IN MATH CLASS

1-White Boards: ask all students to write answers to questions in the mental math section of the Everyday Math lesson so that you are able to quickly assess the proficiency of each student. Write on your own white board.

2- Thumbs up/thumbs down: use this strategy to encourage students to listen to other students in the class. Students must learn to evaluate both the solutions and the explanations of other students in the class.

3-Show me the answer: use a variety of strategies to involve all students
• Ask students to show the answer by holding up that many fingers.
• Give each student numeral cards and use these with or without a place value mat for place value practice.
• Make the number twenty-four.
• Make the number that is one more than 78
• Make the number that is one less than 46.
• If you count by 5s, what number comes after 55?
• Give students small response cards:
• Even/odd cards: hold up the correct card as I say a number
• Shape cards: I have four sides and all right angles. All of my sides are the same size. What shape am I? Hold it up.

4-Think-Pair-Share:
• Ask the question and allow quiet "think "time. This wait time encourages each student to be actively involved in the question.

• Ask students to tell their partner the answer or explain or…. This allows students the chance to practice on one person before talking before the whole class. This practice helps reluctant students as they can always use some or all of their partner's words.
• Ask a couple of students to share with the class, especially those you have overheard who have different ways of explaining or different answers or different methods of solving a problem, etc.

5- "Let go and let students":
• Expect students to do some or all of the Math Boxes independently. Quickly spin off students who are capable of independent work.
• Give students the chalk/marker and ask them to write on board, chart or OH rather than having them explain while you write
• Ask another student to repeat what ___ said rather than repeating or summarizing yourself
• Post student definitions or particularly well-done solutions in a prominent place in classroom to encourage students to think independently
• Ask students to read directions and problems or have students buddy read the directions or problems

Mental Math

1-Critical to Conceptual Understanding

By Shannon Dipple

Mental math is a critical component to a balanced math program. Sadly, many teachers are leaving this crucial piece out or are not using it to maximize student learning potential. Most educators associate mental math with basic fact memorization and practice. This is not what it is. Mental mathematics is an outcome of being able to manipulate numbers by finding patterns and using strategies to make a process easier and quicker. Therefore, teachers must teach strategies to aid mental math.

Importance of Mental Math

Knowing how to correctly manipulate numbers in our head reinforces number sense. Without a strong foundation in number sense, students will be at a disadvantage in all areas of mathematics. Number sense incorporates the themes of place value, measurement, estimation, and the ability to understand how numbers work. When this foundation is in place, all math processes become much more simple and then the "speed factor" of mental math begins to make sense. Also, when we teach our students how to do math in their heads, we are reinforcing concepts of patterns, which is how our brains learn best. This is turn will lead to connections between numbers, which will then lead to easier memorization of math facts. We want our students to be "nimble with numbers."

So how should you teach it?

How to Teach Mental Math

Teaching mental math is more than simply stringing together a random group of numbers and asking students to come up with the correct answer. It is also more than simple fact memorization. To correctly teach these processes, teachers need to focus on teaching conceptual understanding of mathematical processes. Just because we use the word "mental" does not mean this is going to be quick. The speed comes later as a by-product of being able to do "math in your head." There should be about five minutes of practice every day, but mental math can also be done anywhere, anytime. Look for ways to incorporate mental Base Ten strategies into your daily math routine: skip counting backwards and forwards by 2s, 5s, and 10s, subtracting the same number multiple times, making a 10 for addition facts (13 + 9 can be thought of as (9 + 1) + 12 = 22. You can also teach the use of doubles plus one or more, such as 7 + 6 = 6 + 6 + 1.

These lessons can be brought forward into higher math skills. For example, 238 + 644. Make both numbers a multiple of 10. Round the numbers to multiples of 10, which makes them easy to work with, such as 240 + 650. (Note: You are not teaching rounding here - you are teaching a mental math strategy!) Add them together for a sum of 890. Then compute what you added: 2 + 6, subtract that from 890, and you are left with the answer: 882.

While this may seem long to you, many students grasp this way of doing maths very quickly in their heads. However, this is not possible without that strong conceptual foundation of what number sense is. Remember as well that it is the frequency of practice that strengthens retention, not the length of the practice session. Brief daily practicing of skills lead to success. Teaching students to use a variety of strategies is pointless if teachers do not provide enough opportunity for students to practice with integrity, repetition and experience success.

What about Timed Tests?

There is nothing inherently wrong with timed tests if your students feel confident in working with numbers. If this is the case, timed tests serve their purpose which is to increase the speed with which we perform mental calculations. If your students cannot quickly solve their facts, then they are missing a conceptual piece and no amount of timed tests is going to change that. Teachers must intervene and teach different strategies, get out the manipulatives, and talk to their students about their mathematical thinking and reasoning. There is no point to doing timed tests at this stage, other than to reinforce to some children that they hate math and cannot ever be good enough to pass a timed test. That is exactly what we do not want to happen. Try to incorporate daily mental math. When done correctly, the growth in number sense and understanding of how numbers work is phenomenal.

2- Mental Math

The ability to calculate mentally with efficiency is a very important skill for all students, but especially for visually impaired and blind students. Using the braillewriter, and the abacus can be very labor intensive and time consuming, and calculators have their own limitations (see the discussion on calculators). The more efficiently students can estimate, calculate, and check the reasonableness of answers using mental math techniques, the more facile they will be at using

numbers, in both schoolwork and independent living skills. These strategies should be taught to students as soon as they begin to count and work with simple numbers.

In order to manipulate numbers and calculate mentally, students must understand the concept of "complements" or "partners" of numbers. For example, in addition and subtraction, the student needs to know that the number 5 is made up of addends of 2 and 3, or 1 and 4 (complements, partners). Likewise, the number 12 is made up of 3 and 9, or 6 and 6, or 10 and 2. In multiplication and division, the student must know that the number 24 is made up of factors of 2 and 12, or 6 and 4, or 8 and 3.

Teaching approaches

While there are many individual techniques for estimating and calculating mentally, most strategies involve one of the following four basic approaches:

a. decomposing numbers — breaking apart numbers into meaningful and useful units or groups that can be easily recomposed
b. making easier numbers to work with — putting numbers together that are easier to use, often by changing the order of numbers
c. substituting numbers — replacing values with equal values that are easier to manipulate
d. compensating — rearranging numbers so they are easier to work with, either by changing a number and then adjusting the answer, or by adjusting both numbers so there is no need to change the answers

Strategies for developing mental math skills

Following are several examples of strategies which may help students develop skills in counting and using the basic operations.

Addition

- Using the idea of complements, the student can adjust numbers to make adding a lot easier.
- Students can handle larger, more complicated numbers by starting their addition by adding the largest place values first, then next largest, etc.
- Students could also simplify their addition by adding the tens or hundreds together first, and then adding the units. (The student could write down subtotals of 120,15,135 as needed as he or she calculated mentally.)
- Students who have difficulty remembering many of the facts, can use the additive principle, doubles (2+2, 3+3) or facts or "partners" for numbers up to 10 (7+3, 6+4), and derive other facts from these (4+3=1 less than 4+4).
- For the addition of nines, the student can keep in mind that the one's digit in the sum is always one less than the number added to the nine.

Subtraction

- The ability to understand the concept of partners or complements comes in handy in mental subtraction, as with other operations.
    1. Start by practicing subtracting partners from numbers up to 10.
    2. Continue the process by subtracting partners from numbers 20, 30, 40, etc.

3. Continue practicing subtracting two digit numbers from 100, and then numbers larger than 100.

- Another approach involves subtracting numbers from smaller units which are closer to the actual subtrahend, and then adding the remaining portion. Always start by subtracting digits from the same number of digits immediately above it, then deal with the remaining amounts.
- When subtracting a number from a number that is a power of 10, use the complements that make up the numbers 9 and 10.
- Students can also "balance" numbers by adding the "same difference" to both to make them easier to work with.
- "Balancing" can also be done with decimals.

Multiplication

- Students can learn to think in patterns or arrays by using a "thinking model" with naturally occurring arrangements like those occurring in egg cartons, pop bottle cases, buttons on cards, cookies or candies packaged in rows, etc; then children can develop their own arrays. This approach can also be used with auditory cues; for example, how many times do you hear 2 taps, 3 rings, etc.?
- Emphasize the associative properties of the factors in multiplication. For example, remind the student that 3 fours is the same as 4 threes, 2 sixes is the same as 6 twos (rotate an egg carton 90 degrees to illustrate).
- Multiplication is repeated addition—if the child knows that 2 fours is 8, then 3 fours is 8 plus another 4, or 12.
- Use the concept of doubles—if the child knows that 2 sixes are twelve, then 4 sixes is twice as much, or 24.
- When multiplying by multiples of 10, students can just remember to add zeros.

List of Online resources for Teachers

www.glad2teach.co.uk
http://www.kidzone.ws
www.superteacherworksheets.com
www.authorstream.com/
http://www.mathnstuff.com/papers/games/whohas/whointr.htm
http://ezinearticles.com/?Mental-Math---Critical-to-Conceptual-Understanding&id=3864702
http://www.primary-education-oasis.com
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http://s22318.tsbvi.edu/mathproject/ch5-sec5.asp
http://www.virtual.net.au/~bhandley/lua2.htm
http://mathwire.com/strategies/apstrategies.pdf

Math Concepts versus Math Procedures
Houssam Kasti

Introduction

Teaching mathematical concepts versus teaching mathematical procedures, what kind of math are we teaching?! To many teachers, mathematics is strictly a set of rules applied in a certain order and therefore students need to be given enough practice to master them. Only when teachers (or students) are faced with a simple conceptual question do they realize that they didn't teach/study real mathematics. Teaching mathematical concepts is not related to teaching certain curriculum or using certain book, it is about knowing the essence of mathematics. In this session, some questions concerning mathematical concepts in various levels and mathematical domains were tackled. The main purpose of this session was to raise the awareness among teachers of what our main role, as mathematics teachers, is by solving together some conceptual questions concerning mathematical concepts in various cycle 4 levels (Grades 10, 11 and 12) and domains. After the workshop teachers were expected to start using more conceptual questions along with other kinds of questions (knowledge, procedural and problem solving) in their teaching practices.

Description of the session

The flow of the session was as follows: **First,** a discussion of the differences among procedural (or knowledge) questions, conceptual questions and problem solving questions was carried out **(15 mins)**. For this purpose, teachers were given a list of questions that they had to categorize between knowledge, problem solving and conceptual. (Conceptual questions were straight forward questions but not as easy as knowledge questions and they were short unlike problem solving questions) (see paper 1). **Next,** teachers in groups were given paper 2 (grade 10 level) to write what concept each item was testing. Discussion and feedback was given by the presenter. **(15 mins) The same** was repeated with paper 3 (grade 11 level) but only the first two questions were thoroughly discussed **(20 mins). At the end,** paper 4 (grade 12 level) was distributed.

Notes:

- The session could have been repeated as a two hour workshop because teachers showed interest in solving items in details.
- No PowerPoint presentation was used in this session.

Paper 1

What do you think the characteristics of a concept question are?

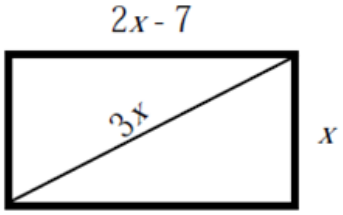
- ✓ **Directly related to concept;**
- ✓ **Simple;**
- ✓ **not many steps;**

(Not so direct as knowledge not so complicated as PS)

Categorize each of the following questions into one of the following categories: knowledge, procedural, problem solving and conceptual.

1. A solution of an equation is the number that _____. **K**
2. Solve the equation: $2 + 3x = 4 - 2x$. **P**
3. Which of the following is a solution for the equality $\sqrt{x^5 + 1} = x + 1$? **C**
   a. -1 only.
   b. 0 only.
   c. -1 and 0.
   d. -1, 2 and 0.

4. Find x such that the perimeter of the rectangle is equal to 16 cm.



PS

In Exercises 5 and 6, explain why the limits do not exist.

5. $\lim_{x \to 0} \frac{x}{|x|}$ **P (C)**

6. $\lim_{x \to 1} \frac{1}{x - 1}$ **K**

7. Suppose that a function f is defined for all x in $[-1, 1]$. Can anything be said about the existence of $\lim_{x \to 0} f(x)$? Give reasons for your answer.

8. If $\lim_{x \to 1} f(x) = 5$, must f be defined at $x = 1$? If it is, must $f(1) = 5$? Can we conclude *anything* about the values of f at $x = 1$? Explain. **C** **C**

9. Consider the two vectors $\vec{U}$ and $\vec{V}$ such that $\|\vec{U}\| = 3$, $\|\vec{V}\| = 26$ and $\|\vec{U} \times \vec{V}\| = 72$. Calculate $\vec{U} \cdot \vec{V}$ **P**

10. Calculate $\int_0^{\frac{\pi}{2}} sin^2(x)cos^2(x)dx$. **P**

11. If $x^4 = 16$ and $y^2 = 36$, then the greatest possible value for $x - y$ is:
    a) 10 b) 20 c) - 4 d) 6 e) 8
    C

12. State the fundamental theorem of calculus. **K**

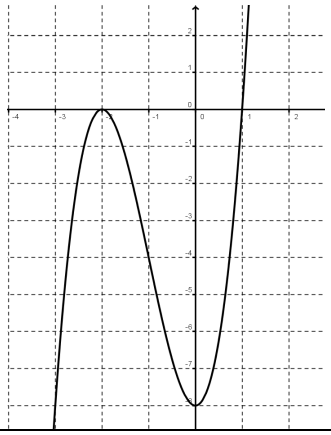
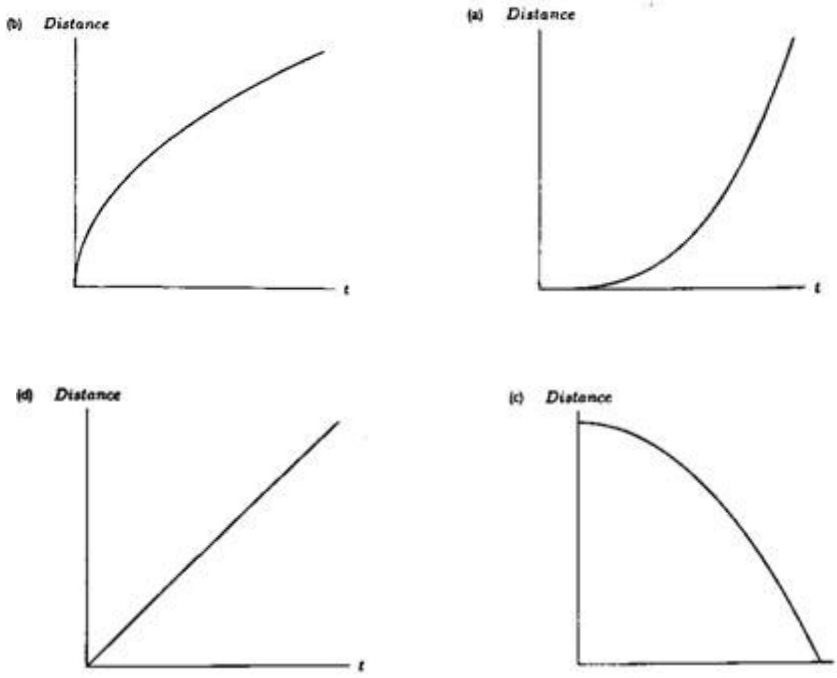
Paper 2
(Grade 10 Level)

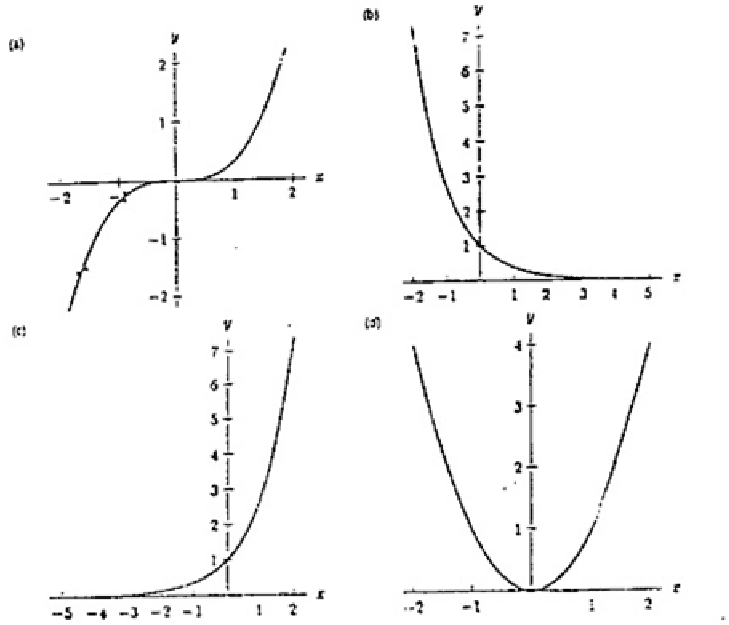
Solve each of the following questions.

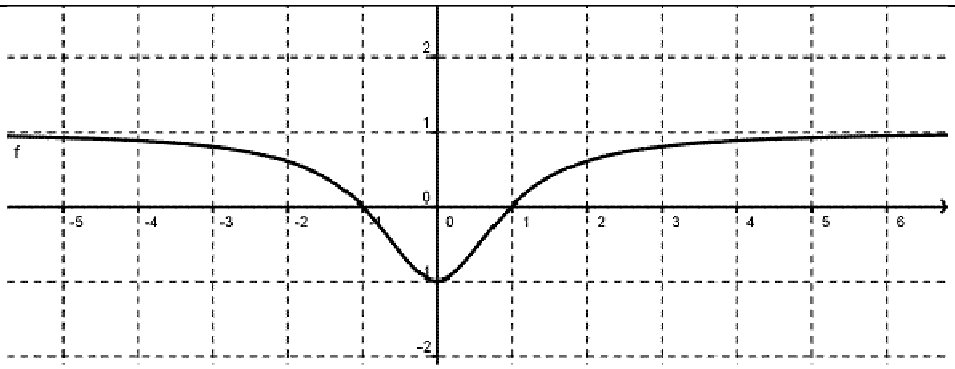
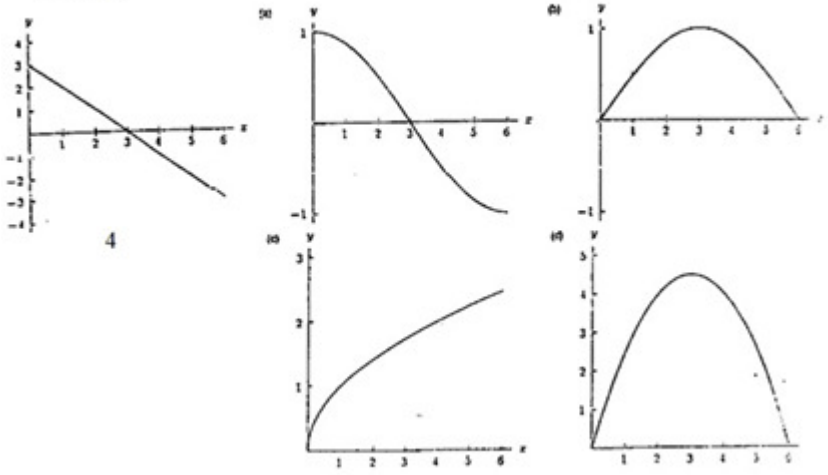
		Concept of
1	The equation $(x+1)(x+2)=(2x-1)(x+1)$ is equivalent to the equation $(x+2)=(2x-1)$	Divide by zero factor
2	In how many ***rad*** angles can we divide a circle?	radians
3	If $\sqrt{a^2}>\sqrt{b^2}$, then $a>b$.	Inequality or and function
4	If f is an odd function and $f(3)=-4$ then $f(-3)=4$.	Odd function
5	If $f(x)\geq 0$ for every x in IR, then $f(x-2)\geq -2$.	Translation & Inequation
6	If $f(x)\geq 0$ for every x in IR, then $f(x+2)\geq 2$.	Translation & Inequality
7	$(5^3-3^3)^{\frac{1}{3}}=5-3$	Distribution of power over subtraction
8	The equation $\frac{x(x+2)}{x^3+8}=0$ admits 0 and -2 as solutions.	domain
9	If $(x-2)(3-x)(2x-3)>0$, then the sign of $\frac{(x-2)(x-3)}{(2x-3)}$ (A) is positive (B) is negative (C) cannot be determined from the given information	Sign of a rational expression
10	The solution to the inequation $(2-\sqrt{5})x+1<0$ is: a) $x<\frac{-1}{2-\sqrt{5}}$ b) $x<\frac{1}{2-\sqrt{5}}$ c) $x>\frac{-1}{2-\sqrt{5}}$ d) $x>\frac{1}{2-\sqrt{5}}$	Dividing by a negative number in inequation
11	For what values of x these functions are equal ? $f(x)=\sqrt{\frac{-x-1}{-x+2}}$ and $g(x)=\frac{\sqrt{-x-1}}{\sqrt{-x+2}}$	Equal functions
12	What happens to the components of vector $\vec{u}(1,-2)$ when it is translated?	Vector components

Paper 3
(Grade 11 level)

Solve each of the following questions.

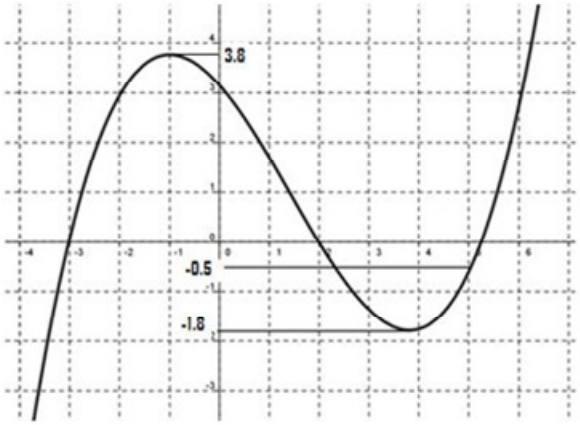
		Concept
1	Consider the number E defined by $E = n^2 - n + 41$. Is E a prime number for any n in N?	Induction Concept
2	 Find the expression of the curve at the left if it is a cubic polynomial function.	Double root + coefficient concepts
3	Which of the graphs represents the position of an object that is slowing down? 	Slope as rate of change concept
4	If two straight lines are perpendicular to the same plane then they are coplanar.	Coplanar concept

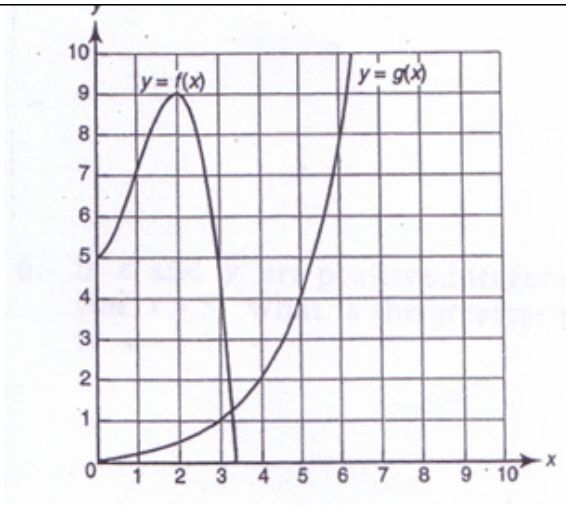
5	Fill in the blanks with the cross product" $\wedge$ " or the scalar product". " 1) $(\vec{a}-\vec{b})\_\_\_(\vec{a}+\vec{b})=\vec{a}^2-\vec{b}^2$ 2) $(\vec{a}-\vec{b})\_\_(\vec{a}-\vec{b})=\vec{0}$ 3) If $\vec{u}\perp\vec{v}$ then $\|\vec{u}\_\_\vec{v}\|=\|\vec{u}\|\cdot\|\vec{v}\|$ 4) $\vec{u}\_\_(\vec{v}\_\_\vec{u})=0$	Scalar and cross concepts
6	Which of the following is a graph of a function that is equal to its own derivative $f'(x)=f(x)$? 	Derivative function and sign of a function concepts
7	Let f be a function defined for all real numbers x. If $f'(x)=\frac{\lvert 4-x^2\rvert}{x-2}$, ther f is decreasing on the interval 1) $]-\infty,2[$ 2) $]-\infty,+\infty[$ 3) $]-2,4[$ 4) $]-2,+\infty[$ 5) $]2,+\infty[$	Sign of derivative and absolute function concepts
8	The curve (C) of a function f , defined over IR, is shown below.	Composite function

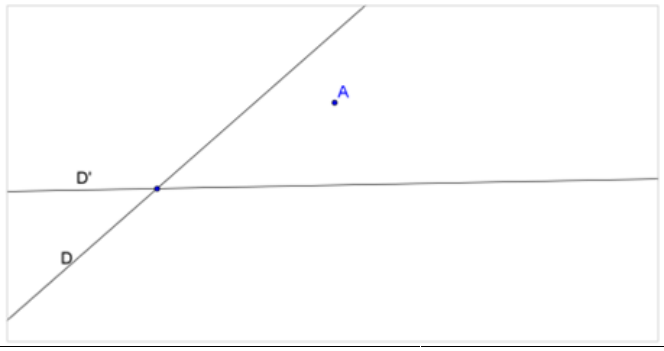
	 Let g be the function defined by: $g(x) = \frac{-3}{f(x)}$. 1. Determine the domain of definition of g. 2. Does g admit a horizontal asymptote? Explain.	and asymptote concepts
9	Given: $p(x) = ax^2 + bx + c$ If the equation $p(x) = 0$ admits two opposite real roots, then $a \neq 0$ and $b = 0$.	Sum of roots concepts
10	If A and B are two mutually exclusive events in Ω then $P(A) = 1 - P(B)$. If A and B are two events such that $P(A) = P(B)$ then A = B.	Sets and Probability concepts
11	Which of the graphs (a)-(d) represents an antiderivative function of the function in Figure 4 ?  4	Derivative function and reading graphs concepts

Paper 4
(Grade 12 level)

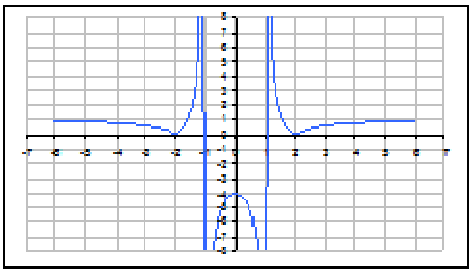
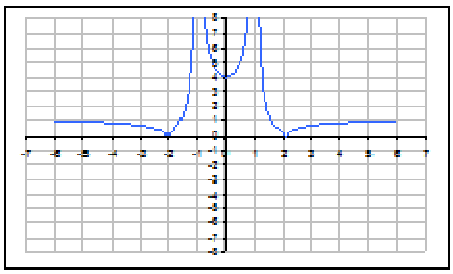
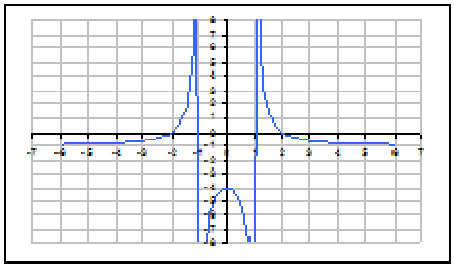
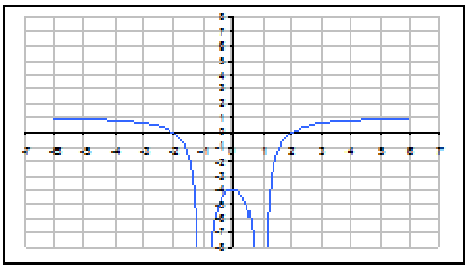
Solve each of the following questions.

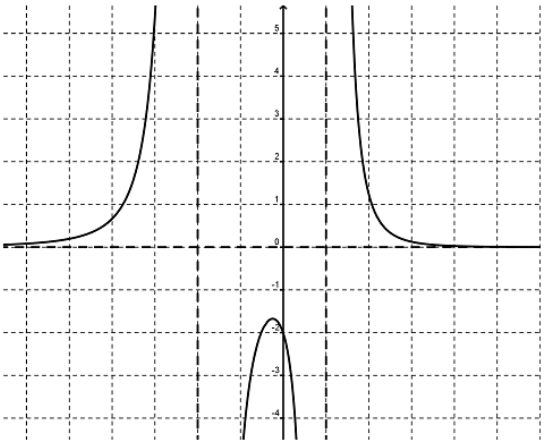
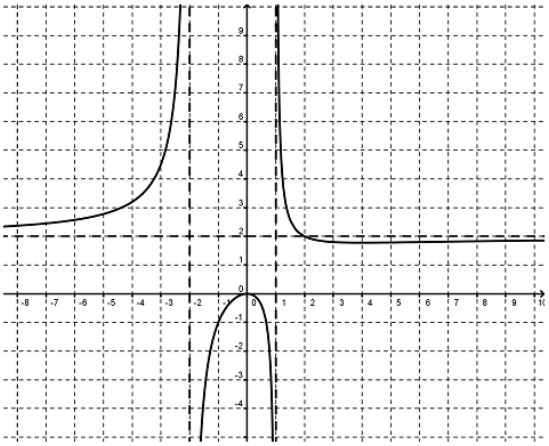
		Concept
1	Consider the curve (G) the representative curve of F. F is the antiderivative of f.  A. Calculate $\int_0^5 f(x)dx$. B. Calculate the area between C_f, the x-axis and the two vertical lines: 1. $x = 0$ *and* $x = 5$.	Antiderivative
2	Prove, for every point in (P), $h \circ h' = h' \circ h$ if and only if h or h' is the identity mapping.	Id mapping
3	Consider the functions f and g such that; $f(x) = \begin{cases} 0 & ;x \in [0,\frac{1}{2}[\\ x-\frac{1}{2} & ; x \in [\frac{1}{2},1] \end{cases}$ $g(x) - \begin{cases} -x+\frac{1}{2} & ;x \in [0,\frac{1}{2}[\\ 0 & ; x \in [\frac{1}{2},1] \end{cases}$ Define the functions $f \circ g$ and $g \circ f$ over their domain of definition.	Composite function
4	Knowing that a poly with real coefficients admits conjugate complex roots, explain the number of intersection points between cubic functions and x-axis; similarly fourth deg functions.	Real coefficient and roots of poly equations

5	**The function *f* defined on IR* by:** $x \to xe^{\frac{1}{x}}$. **Find** $\lim\limits_{\substack{x\to 0\\ x>0}} f(x)$ **and** $\lim\limits_{\substack{x\to 0\\ x<0}} f(x)$ **what can you conclude?**	Vertical asymptote
6	How can we find the algebraic form of z such that $z=\left(\frac{-1}{2}-i\frac{\sqrt{3}}{2}\right)^{12}$?	Complex number forms
7	A computer program is designed so that, when a number is entered, the computer output is obtained by multiplying the number by 3 and then subtracting 4 from the product. If the output that results from entering a number x **is then entered**, which expression represents, in terms of x, the final output? (A) 3x-8 (B) 3x-12 (C) 9x-8 (D) 9x- 16 (E) 6x+9	Comp functions
8	a) What is the value of $f(g(3))$? b) What is the value of $g^{-1}(4)$? 	Composite and inverse functions
9	In a recursive sequence if the curve of f defined by: $f(U_n) = U_{n+1}$ intersects the first bisector, then the sequence is convergent.	Recursive sequences and limit
10	If a sequence is convergent to a limit L then the sequence is bounded by L.	Recursive sequence and limit
11	The first term of a recursive sequence could change the convergence of a sequence.	Recursive sequence and limit
12	In the plane (P) , consider the two translations $t_{\vec{u}}$ and $t_{\vec{v}}$. What does this $t_{\vec{u}} \circ t_{\vec{v}}$ represent?	Comp mapping

	What is the inverse of $t_{\vec{u}}$ and why?	
13	Construct right isosceles triangle ABC of vertex A such that B is on (D) and C on (D'). 	Rotation
14	A) If functions f and g are defined by the following table, then which of the following is true: a. $f(g(0)) = 1$ b. $g^{-1}(f^{-1}(-1)) = -1$ c. $f^{-1}(g(0)) = 3$ 1) a only? 2) b only? 3) a and c only? 4) b and c only? 5) a, b, and c? B) Given: $f(5) = 2, g(2) = 3, g'(2) = 6, f'(5) = 3$, and $f'(3) = -4$. If $h = g \circ f$, then $h'(5) =$ 1) 36 2) 18 3) 6 4) 12	Inverse and composite functions
15	Consider the two functions f and h defined by: $f(x) = \frac{6x-3}{5x+1}$; $h(x) = \frac{6\ln x - 3}{5\ln x + 1}$. Find the derivative of f; then **deduce** the derivative of h.	Derivative of Comp

x	$f(x)$	$g(x)$
-1	0	1
0	-1	2
2	1	3
3	2	0

16	1. Given (C) the graph of *h* of equation $h(x)=\frac{x^2-4}{x^2-1}$  Which of the following graphs is that of the function *g* of equation $g(x)=\frac{\lvert x^2-4\rvert}{x^2-1}$?   	Absolute value of a function

17	Given the graphs of three functions defined over IR-{-2,1}. Tell which of them is the graph of f, that of f' and that of f''. Explain your answer. 1)  2)  3) 	First and second derive plus asymptote

SCIENCE

How Do You Make Life Science a More Interesting Course in the First Secondary?
Zarifeh Jarjour

Introduction

The curriculum of the first year of the secondary cycle in Life Science focuses on the study of functional organization in a living organism. The first part includes nutrition and organization in Chlorophyllic plants and communication and organization in animals. The second part focuses on plant production and the influence of environmental factors on their production. What is common between these topics? Why did the curriculum designers tackle these objectives? Due to time limits of our academic year and due to the fact that many teachers find it is a waste of time to teach about plants, teachers start with the nervous system. They believe it is more important because it will be required as a prerequisite in the third year secondary, and thus they neglect the second part. On the other hand, some students find that they are wasting their time studying about plants. They don't understand their role in our environment although, without them, life on earth would be impossible. Plants are a very important part of our environment as they change inorganic matter to organic matter by producing food for all living things, both animals and plants (heterotrophs). They are also the only source of oxygen, thus they keep equilibrium in nature. Therefore, it is necessary for teachers to stress and clarify the need to save our environment and reduce pollution by increasing and encouraging students' environmental awareness. This session presented a number of hands-on activities that can be easily demonstrated in class to make teaching about plants livelier. Students can be involved by asking them to prepare them in class beforehand.

Description of the Session

The session was planned as follows:

- **a)** A brief introduction of the content of the curriculum. **(10 mins)**
- **b)** What is the relation behind including the two parts of the matter? Communication, in particular, is the reaction of green plants, autotrophs, to sunlight. **(10 mins)**
- **c)** Photosynthesis is the process by which green plants change carbon dioxide and water into organic food and oxygen in the presence of sunlight. **(5 mins)**
- **d)** Participants were divided into groups and worked on some activities that were setup beforehand using very simple and "easy to find material". **(30 mins)**
- **e)** Discussion of the different experiments, setups, and suggestions as well as summing up. **(10 mins)**

Setups

1- Observation of onion cells and chloroplasts under an optic microscope. Compare with cheek (buccal) cells. (p22)
2- Slide on microscope showing the chloroplasts in leaves of an aquatic plant. (p22)
3- Testing for a-starch, b-proteins, c-glucose and fructose and d-lipids. (p19; 52)

4- Addition of iodine water to a multi-colored leaf, decolorizing it to prove that only green areas manufacture starch (refer to #22 below). (p20)
5- Soaked seeds (grains) for three days form a white layer of carbon dioxide gas on the surface.
6- Beans germinating for different periods of time (5 days, 10 days) showing roots, root hairs, and embryo. (p52)
7- A germinating potato with a number of buds. As potatoes start to germinate they lose starch, which is used by the embryo that is using it, so this explains that the embryo is a heterotroph. (p53)
8- Using sodium bicarbonate $NaHCO_3$ or baking soda, Na_2CO_3 or baking powder with a drop of water to show liberation of carbon dioxide. Enriching the medium with CO_2.

(p30) **$2NaHCO_3 \longrightarrow Na_2CO_3 + H_2O + CO_2$**

9- Show roots and root hairs (gardenia plant). (pp. 33, 34)
10- Two long blown balloons tied together showing the open stomata, when deflated the stomata closes. (The balloons represent the guard cells.) (p41)
11- Soaked stems of carnation flowers, plants in water colored with red or blue ink to show position of xylem with respect to the phloem in stems. (p36, 38)
12- Blowing i.e. Exhaling in Lime water $Ca(OH)_2$ turns milky or turbid because of the formation of calcium carbonate $CaCO_3$ or limestone which is insoluble in water. (p19, 30)

$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$ depriving the medium of carbon dioxide (p30)

$KOH + CO_2 \rightarrow CaCO_3 + H_2O$ (pp. 21, 30). Explain the setup in doc. d (p. 21) to show the importance of CO_2 in photosynthesis. Air is circulated in potassium hydroxide first and then in calcium hydroxide which doesn't turn turbid and thus proves that the air is impoverished with carbon dioxide.

13- Carbon dioxide makes the medium acidic: **$H_2O + CO2 \longrightarrow H_2CO3$** carbonic acid. This turns litmus paper red.
14- In Lebanon, kettles used for boiling water form a layer of calcium carbonate on with walls and bottom ,this can only be removed by using an acid or vinegar.
15- Spilling water on the glass window, some water droplets stick to the wall showing adhesive and cohesive forces. This explains how a column of water rises in narrow tubes. The meniscus also explains the rise of water, capillarity. Water rise in a wall of building that has a water source at its base. (p 37)
16- Dipping the edge of a paper towel in water. Water rises in tiny empty spaces. (p37)
17- Put a plant pot in a plate filled with water in the beginning of the session. Record observations by the end. (p37)
18- Transpiration: as the sun goes down, dried clothes will become wet again. Why?
19- After a hot shower, water vapor condenses on mirrors and bathroom walls.
20- In summer as you go up to the mountains, a fog forms because as hot air rises up to colder layers in the atmosphere it cannot hold all the water vapor and change into tiny water drops that we call fog. (How many teaspoons of sugar do you put in a tea cup of tea?)

21- A plant pot full with dry soil placed in a plate containing water. Observe what happens after half an hour. Why?
22- Decolorizing leaves in boiling alcohol or acetone before testing for starch.
23- When burning organic matter such as paper, meat or a nut (oil) a black powder forms, this residue is carbon. Oxidation**:** $\mathbf{C_6H_{12}O_6 + O_2 \longrightarrow H_2O + CO_2}$
24- As butane gas burns (in the oven) in your kitchen, a red flame forms sometimes, and a black layer forms on pots; because some holes are blocked. Why? Incomplete combustion occurs, not enough oxygen is present: $\mathbf{C_4H_{10} + O_2 \rightarrow H2O + C}$ (soot). This proves the presence of carbon in organic matter.
25- Chain of vertebra to show the function of protection of the spinal cord. (Additional).

Suggestions

Below are several suggestions in order to increase interest in the importance of plants to our environment. Students show no interest in the course, especially when you start talking about autotrophs, and the function of nutrition and organization in chlorophyllic, vascular plants. There are too many difficult words in a topic in one sentence and each word requires a lot of explanation.

1- Plants change inorganic matter to organic matter by using solar energy. They are autotrophs, manufacturing their own food, and oxygen by the process of photosynthesis. They are called producers. Without them life would be impossible.
2- What are the factors that we need to survive on earth: water, sunlight, and nutrients. What are our nutrients? Name some of plant origin, or meat of herbivores…
3- You can begin the semester, by starting to germinate some seeds in some corner in the classroom. Soak them in water and ask students to observe and record their observations, daily or weekly in their note books.
4- Take pictures of planted wheat or lentils at different levels or stages of growth, avocado seeds would be great. Cracking of the seed, formation of the embryo.
5- Observe what happens on the surface of the water after two or three days. The formation of carbon dioxide liberated by the soaked beans
6- Testing for the different organic foods (students like this because they have memorized it from grade 9 last year).
7- Observation of onion cells, and chloroplasts under an optic microscope. Compare with cheek cells, which don't have a cell wall.
8- Spilling water on a glass window, some water droplets stick to the wall showing adhesive and cohesive forces. This explains how a column of water rises in narrow tubes. The meniscus also explains the rise of water, capillarity.
9- Diffusion and osmosis are two phenomena that will be used to explain many activities especially in transpiration, movement of crude sap up in xylem tubes, absorption of water by grains to start a new life cycle.
10- Cohesive forces, and adhesive forces allow the upward pull of water in narrow tubes (Capillarity)
11- The position of xylem tubes with respect to the phloem tubes are alternating in the root while they are superposed in the stem.

12- Plastids are irregular shaped bodies that in plant cells. Chloroplasts contain Chlorophyll and are the sight of photosynthesis. Some contain starch and are called leucoplasts in potatoes, oramyloplasts in bananas (containing amylose), or chromoplasts (colored in red tomatoes, carrots, red pepper). Potatoes placed in the sun, show green areas, leucoplasts change to chloroplasts. When put in the dark they start to germinate.

Reference

Life Science Secondary Education, First year NCERD, National Text Book

Integrating the Nature, Connections and Applications of Science in the Teaching Process
George Rizkallah

Introduction

Many of our high school students graduate from school without the full awarness of the nature of science and how it is made. Loaded curricula, science projects, and other activities whether organized or not may not help the students fully understand how science is made nowdays and what is the scope of the work of scientists. Moreover, teachers rush through their programs and therefore end up focusing on content and chanel their efforts toward official exams, disregarding the basics aspects of science and the work of scientists. Also, powerful and advanced means of communication impose a new component that scientist are currently using to promote science in the scientific world, a fact that students ought to be exposed to in their overall science education. This session shed light on these matters by making educators aware of the range of their work which has widened and consequently they must vary their teaching learning science activites furthermore.

Both theory and experiments in science should be undertaken by all students. They should complement one another naturally as they do in the wider scientific community. Science in the Secondary Cycle course allows students to develop traditional practical skills and techniques and to increase facility in the use of mathematics, which is the language of science in most situations. However, it may not emphasize the development of the understanding of the nature of science, of interpersonal skills, and information & communication technology skills, which are essential in modern scientific endeavors and are important life-enhancing, transferable skills in their own right.

In other words, through studying of any science, students should become aware of how scientists work and communicate with each other. While the "scientific method" may take on a wide variety of forms, it is the emphasis on a practical approach through experimental work that distinguishes science from other disciplines. Hence the aim of science ought to be to demonstrate, apply, use, construct, analyze and evaluate: a) scientific facts and concepts; b) scientific methods and techniques; c) scientific terminology; and d) methods of presenting scientific information. ***However, is this actually happening?***

Description of the Session

The session was like a circle of learning where twelve educators discussed the following four questions in hopes of coming up with useful tips and recommendations:

1- To what extent do high school students graduate with an awareness of the nature of science? What can be done about this?
2- What should be done to improve the experimental approaches in science laboratories?
3- Should students be trained to start science research in high school?
4- How can students develop the skills to communicate scientific information?

The session was planned as follows: a) setting the framework of the discussions **(15 mins);** b) discussing the above proposed four questions **(45 mins);** and c) summing up and generating recommendations **(15 mins).**

SLIDE 1

THE NATURE OF SCIENCE

THE SCIENTIFIC WORLD VIEW

These ways represent a fundamental aspect of the nature of science and reflect how science tends to differ from other modes of knowing.

The world is understandable.

Scientists believe that through the use of intellect, and with the aid of instruments that extend the senses, people can discover patterns in all of nature.

Scientific ideas are subject to change.

Change in knowledge is inevitable because new observations may challenge prevailing theories. (Geocentric Vs Heliocentric theories)

SLIDE 2

THE NATURE OF SCIENCE

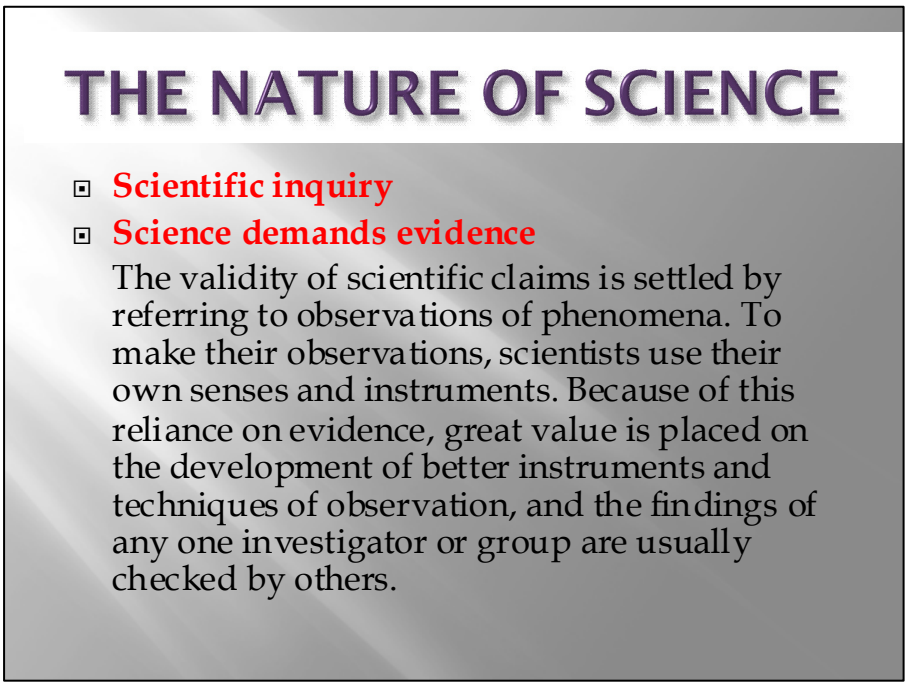
Scientific knowledge is durable.

Albert Einstein did not discard the Newtonian laws of motion but rather showed them to be only an approximation of limited application within a more general concept.

Science cannot provide complete answers to all questions.

There are, for instance, beliefs that—by their very nature—cannot be proved or disproved (such as the existence of supernatural powers and beings, or the true purposes of life).

SLIDE 3



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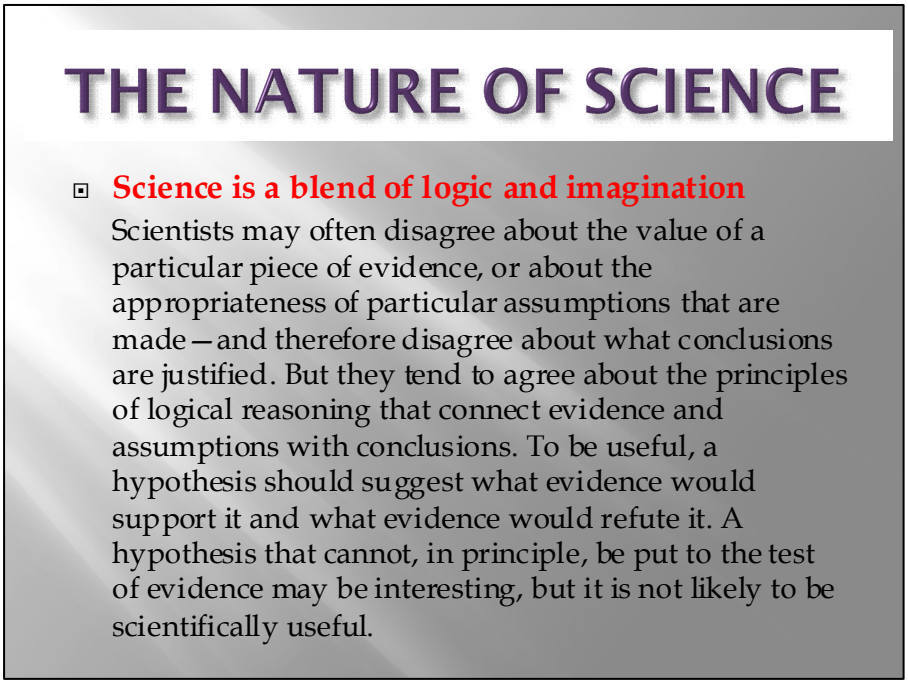


SLIDE 5

THE NATURE OF SCIENCE

- **Science explains and predicts**

  Scientists strive to make sense of observations of phenomena by constructing explanations for them that use, or are consistent with, currently accepted scientific principles. The credibility of scientific theories often comes from their ability to show relationships among phenomena that previously seemed unrelated. The theory of moving continents, for example, has grown in credibility as it has shown relationships among such diverse phenomena as earthquakes, volcanoes…

SLIDE 6

THE NATURE OF SCIENCE

- **Scientists try to identify and avoid bias**

  - Scientific evidence can be biased in how the data is interpreted, in the recording or reporting of the data, or even in the choice of what data to consider in the first place. Scientists' nationality, sex, ethnic origin, age, political convictions, and so on may incline them to look for or emphasize one or another kind of evidence or interpretation.

  - One safeguard against undetected bias in an area of study is to have many different investigators or groups of investigators working on it.

SLIDE 7

THE NATURE OF SCIENCE

- **Science is not authoritarian**

  Usually, new ideas that do not mesh well with mainstream ideas may encounter vigorous criticism, and scientists investigating such ideas may have difficulty obtaining support for their research. Indeed, challenges to new ideas are the legitimate business of science in building valid knowledge. Even the most prestigious scientists have occasionally refused to accept new theories despite there being enough accumulated evidence to convince others. In the long run, however, theories are judged by their results: When someone comes up with a new or improved version that explains more phenomena or answers more important questions than the previous version, the new one eventually takes its place.

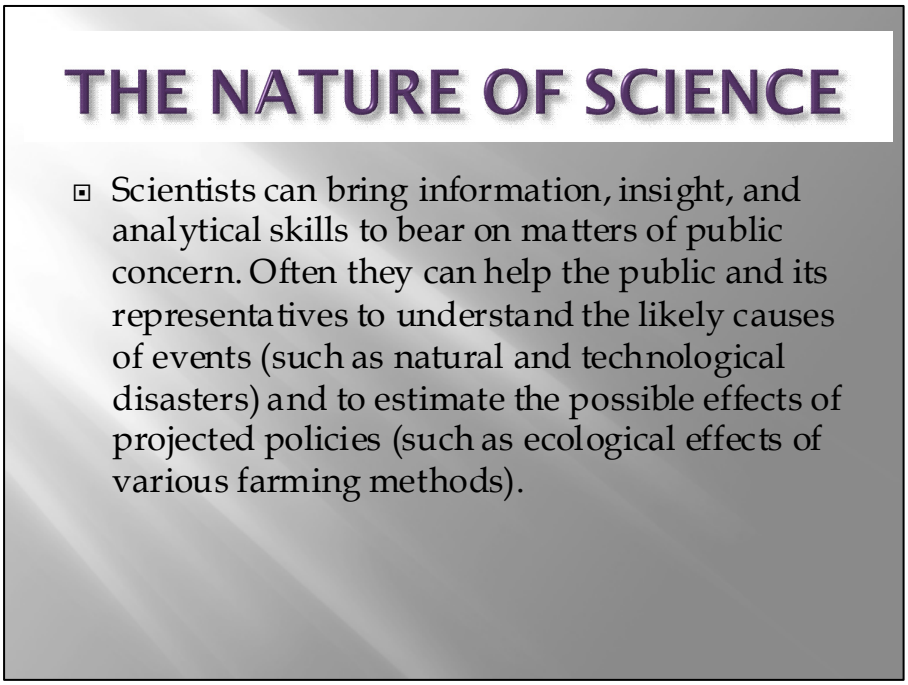
SLIDE 8

THE NATURE OF SCIENCE

- **The scientific enterprise**
- **Scientists participate in public affairs both as specialists and as citizens**

  In their work, scientists go to great lengths to avoid bias—their own as well as that of others. But in matters of public interest, scientists, like other people, can be expected to be biased where their own personal, corporate, institutional, or community interests are at stake. For example, because of their commitment to science, many scientists may understandably be less than objective in their beliefs on how science is to be funded in comparison to other social needs. Because of the social nature of science, the dissemination of scientific information is crucial to its progress.

SLIDE 9



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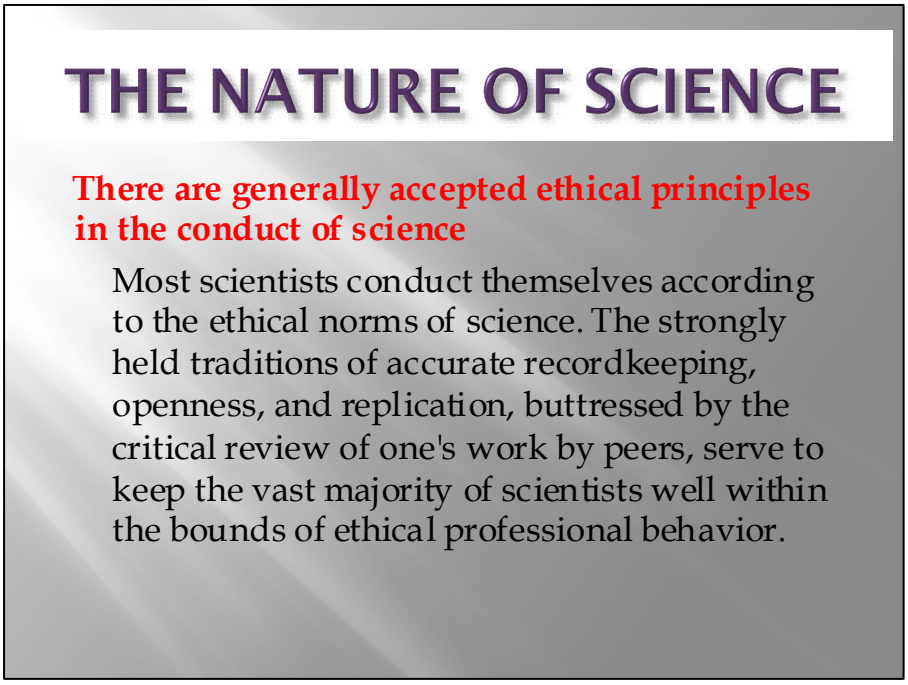

SLIDE 11

THE NATURE OF SCIENCE

- Another domain of scientific ethics relates to possible harm that could result from scientific experiments. One aspect is the treatment of live experimental subjects. Modern scientific ethics require that due regard must be given to the health, comfort, and well-being of animal subjects. Moreover, research involving human subjects may be conducted only with the informed consent of the subjects, even if this constraint limits some kinds of potentially important research or influences the results.

SLIDE 12

QUESTIONS FOR DISCUSSION

- To what extent do high school students graduate with an awareness of the nature of science? What can be done about that?
- What should be done to improve the experimental approaches in science laboratories?
- Should students be trained to start science research in high school?
- How can students develop the skills to communicate scientific information?

SLIDE 13

- By graduation students must:
  1. Design experiments.
  2. Reflect on their interdisciplinary learning (narrative inquiry, journals, group discussions).
  3. Develop a sense of research (performance tasks).
  4. Exhibit their research and share information.
  5. Participate in science fair and so on…

SLIDE 14

- John Dewey has stated, "We do not learn from experience…we learn from reflecting on experience".
- Zull points out, "Even if we experience something that has happened to us before, it is hard to make meaning of it unless it engages our emotions." He also states that reflection is a search for connections "and suggests that we have to seriously consider the role of emotion if we want to foster deep learning

SLIDE 15

Science and Literacy in the Elementary Classroom: Making Connections

Hala Al-Kotob

Introduction

There are meaningful ways in which science and language can meet for the purpose of developing elementary students' understanding of science concepts and enhancing their perception and use of language as well. It is an innovative idea that can be applied across different school levels to find ways in which science and language meet. Since language, spoken and written, is the means through which all learning takes place, it is important for teachers to understand that science and language are interdependent. The primary purpose of this workshop was to shed light on the meaningful ways in which science and language can be integrated. Participants took on the role of the learner during the session by actually reading through short texts and finding ways in which science and language meet. A variety of text forms including informative, explanatory, procedural…etc, which tackled scientific concepts and also encompassed a range of scientific terminology, originating from certain root words, prefixes, and suffixes were used. For instance, an explanatory text about the phases of the moon was structured in away to have all the details related to this natural phenomena mentioned. At the same The text also utilized the simple present tense of verbs as factual information was presented, appropriate punctuation, spelling, and capitalization, and cause-effect signal words have to be used effectively to show the causes behind the occurrence of the phenomena.

Description of the Session

The session was planned as follows:

(a) Participants filled in the 1st two parts of a K-W-L chart on how they see the connection between science and literacy, placing their questions on sticky notes. **(10 mins)**
(b) Participants posted their questions on the "Questions Wall" and read the questions posed by other participants. **(5 mins)**
(c) Participants were divided into five groups and each group read a different text type tackling a scientific topic. **(5 mins)**
(d) Participants used different graphic organizers in which they mapped the science content presented and possible meaningful language connections. **(20 mins)**
(e) Each group presented their work. **(10 mins)**
(f) Participants wrote their responses to the questions they posed at the beginning of the session. **(5 mins)**
(g) Participants discussed the questions that were not answered. **(10 mins)**
(h) Participants filled in the "L" part of their K-W-L chart. **(5 mins)**

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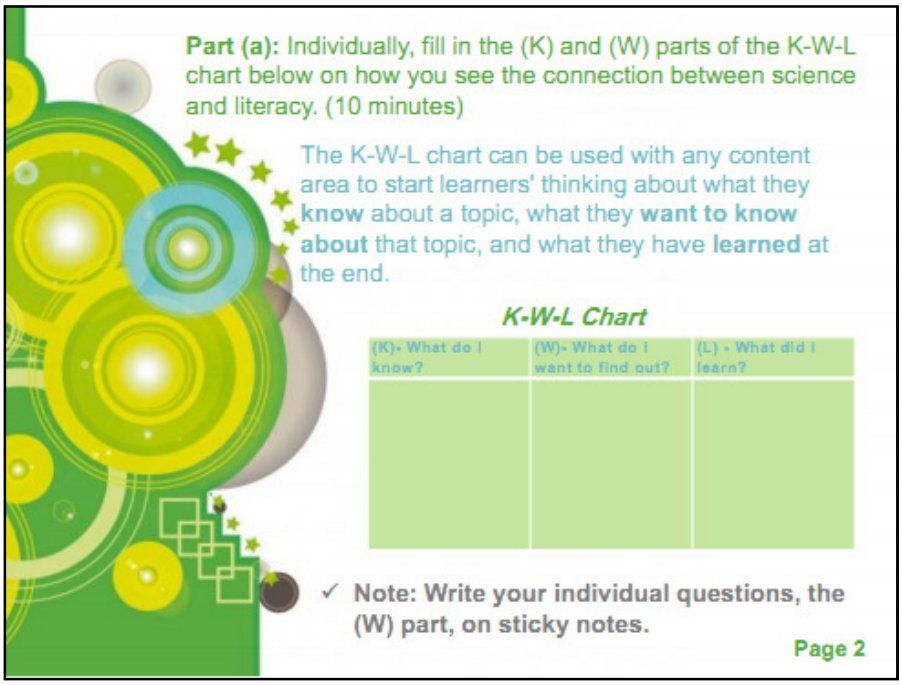

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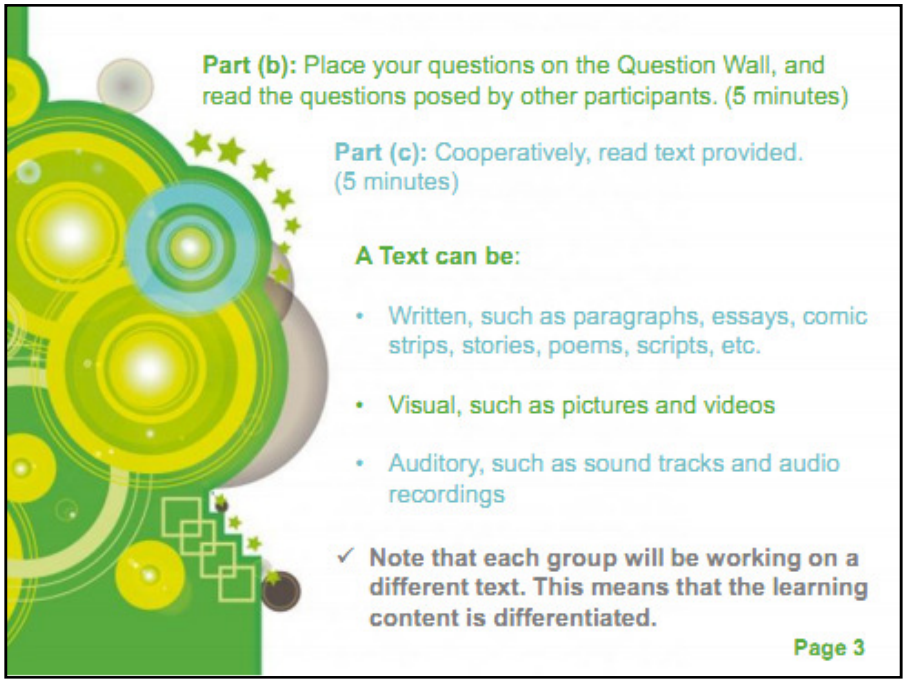

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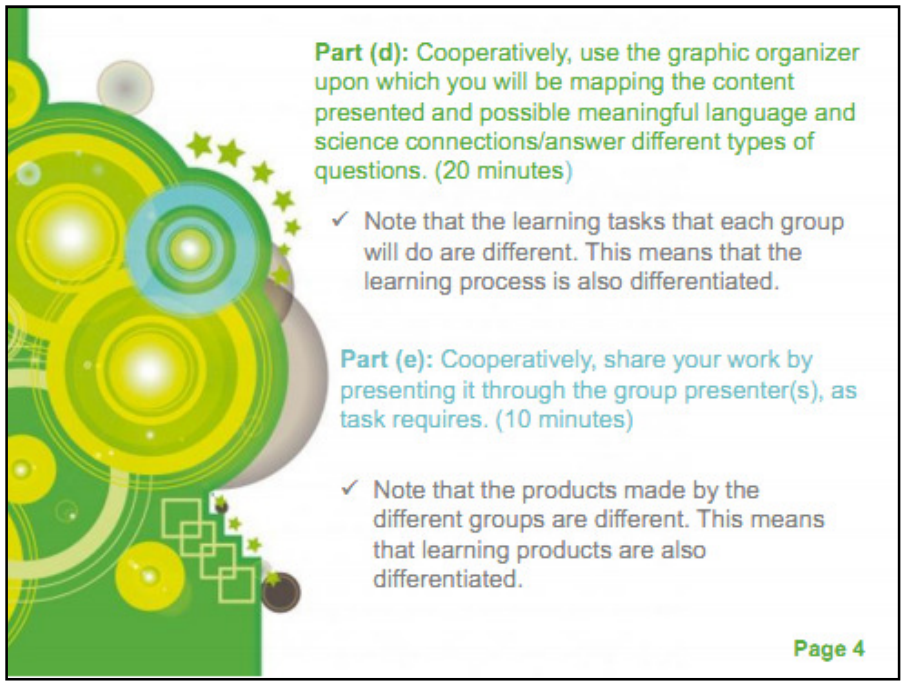

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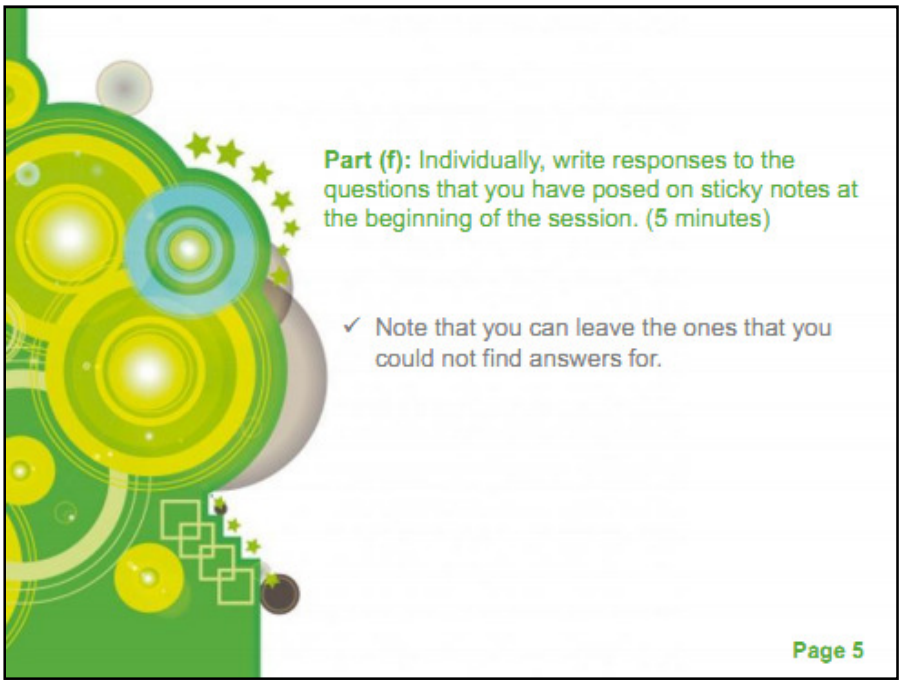

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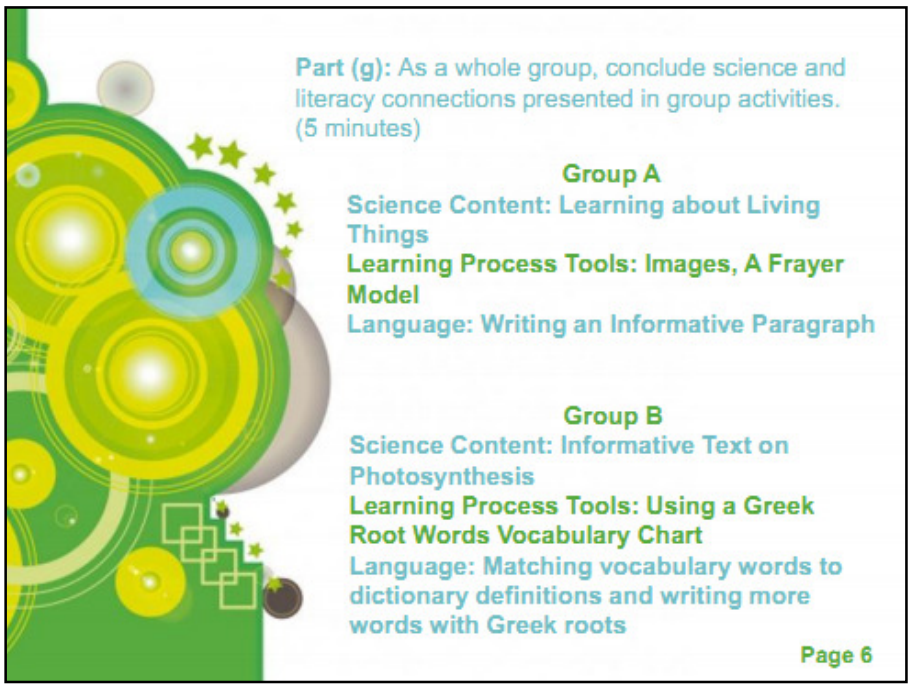

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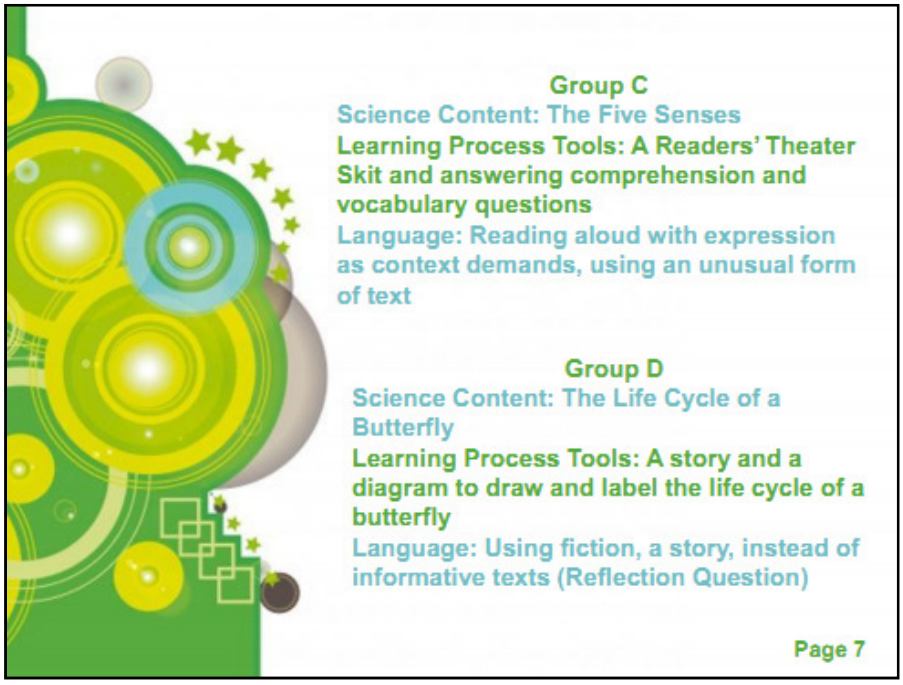

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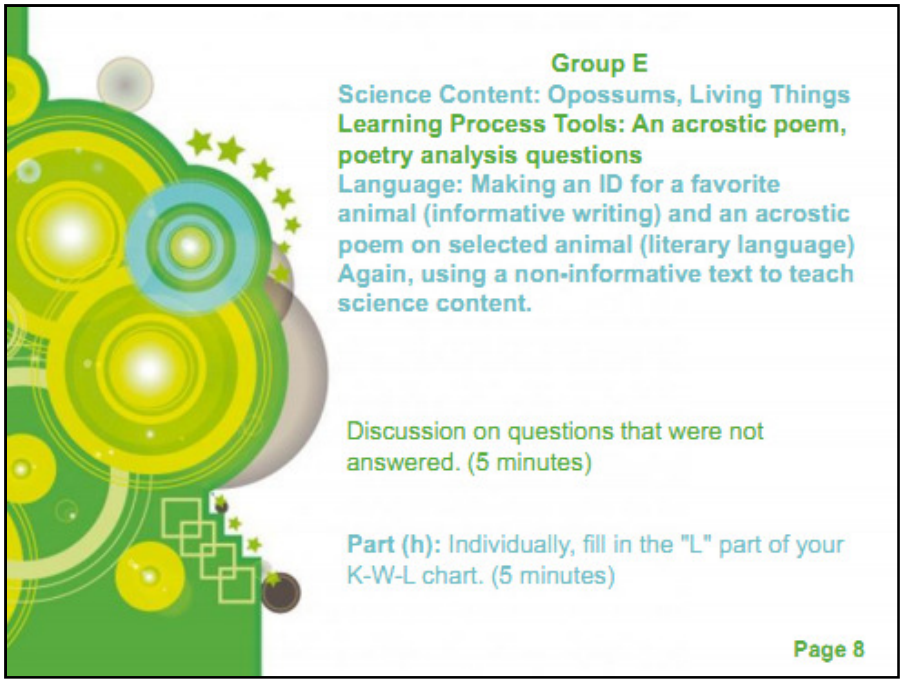

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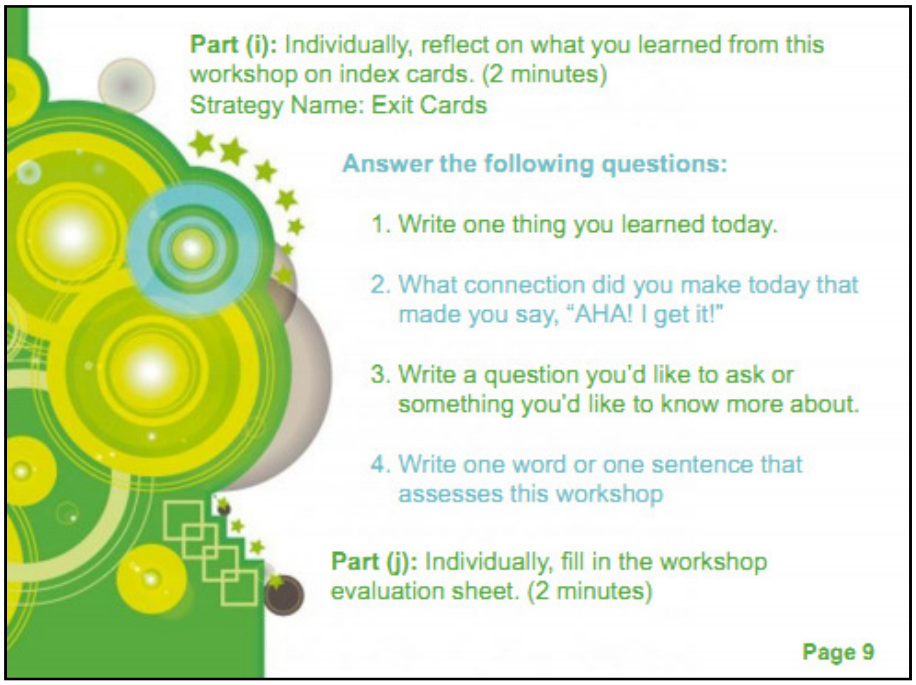


SLIDE 9

SLIDE 10

SLIDE 11

SLIDE 12

American University of Beirut

The Fourteenth Annual Science and Math Educators Conference (SMEC 14)

March 31, 2012

Science and Literacy in the Elementary Classroom: Making Connections

Trainer: Hala Al Kotob

Makassed Houssam Eddine Hariri High School

Name: _____

Part (a): Individually, fill in the (K) and (W) parts of the K-W-L chart below on how you see the connection between science and literacy. (10 minutes)

The K-W-L chart can be used with any content area to start learners' thinking about what they **know** about a topic, what they **want to know** about that topic, and what they have **learned** at the end.

K-W-L Chart

(K)- What do I know?	*(W)- What do I want to find out?*	*(L) - What did I learn?*

Note: Write your individual questions, the (W) part, on stickynotes.

Part (b): Place your questions on the Question Wall, and read the questions posed by other participants. (5 minutes)

Setting the Stage for a Cooperative Learning Engagement

After sitting in assigned group, choose:

- **an organizer**: in charge of managing the group, asks questions, makes sure that everyone contributes, and keeps the group on task
- **a reader**: responsible for reading the papers, texts, and paragraphs needed
- **a writer**: responsible for recording the results, keeping notes of inportant thoughts expressed in the group
- **a time-keeper**: keeps track of time and reminds the group how much time is left
- **a presenter**: speaks for the group, presenting conclusions reached within the group, not personal ones

Part (c): Cooperatively read text provided. (5 minutes)

Part (d): Cooperatively use the graphic organizer upon which you will be mapping the science content presented and possible meaningful language connections (20 minutes)

Part (e): Coopertaively, share your work by presenting it through the group presenter. (10 minutes)

Part (f): Individually, write responses to the questions that you have posed at the beginning of the session. Leave the ones that you could not find answers for. (5 minutes)

Part (g): As a whole group, conclude science and literacy connections presented in group activities, then discuss questions that were not answered. (10 minutes)

Part (h): Individually, fill in the "L" part of your K-W-L chart. (5 minutes)

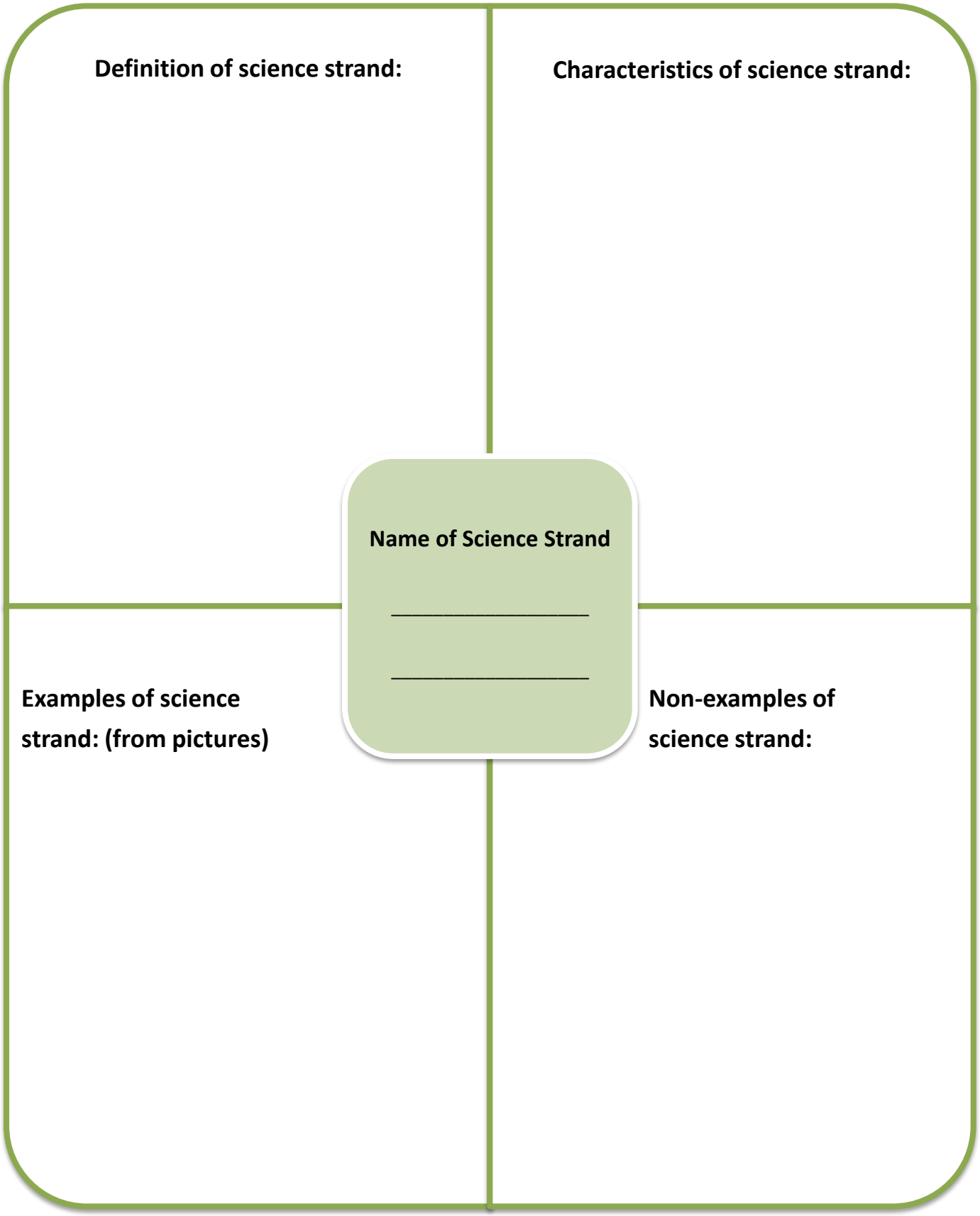
Part (i): Individually, reflect on what you learned from this workshop on the index cards. (2 minutes)

Part (j): Individually, fill in the workshop evaluation sheet. (2 minutes)

Group (A) Members: _____

1. Observe the following pictures.

2. **Complete the Frayer Model below.** The Frayer Model is a word categorization activity that helps learners to develop their understanding of concepts.



3. **Now use the information you listed in the Frayer Model to write an informative paragraph.**

What are the characteristics of an informative paragraph? Put a √ to make sure that you met all requirements in your writing.

An informative paragraph:

- Has a suitable title _____
- Starts with a topic sentence that states what the paragraph is about (main idea) ____
- Has details related directly to what is being informed about. ____
- Does not include any irrelevant details _____
- Ends with a concluding sentence _____
- Is written in the simple present tense as it states facts _____
- Is characterized by making correct subject-verb agreement _____
- Is appropriately punctuated _____
- Has words spelled and capitalized correctly _____

_____

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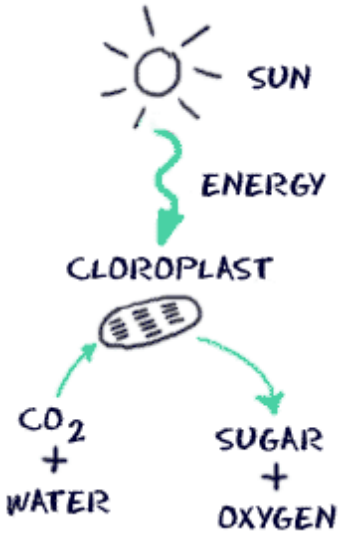
Group (B) Members: _____

1. Read the following text.

PHOTOSYNTHESIS

Photosynthesis is the process of converting light energy to chemical energy and storing it in the bonds of sugar. This process occurs in plants and some algae. Plants need only light energy, CO_2, and H_2O to make sugar. The process of photosynthesis takes place in the **chloroplasts**, specifically using **chlorophyll**, the green pigment involved in photosynthesis.

Photosynthesis takes place primarily in plant leaves, and little to none occurs in stems, etc. The parts of a typical leaf include the upper and lower **epidermis**, the **mesophyll**, the vascular bundle(s) (veins), and the **stomata**. The upper and lower epidermal cells do not have chloroplasts, thus photosynthesis does not occur there. They serve primarily as protection for the rest of the leaf. The stomata are holes that occur primarily in the lower epidermis and are for air exchange: they let CO_2 in and O_2 out. The vascular bundles or veins in a leaf are part of the plant's transportation system, moving water and nutrients around the plant as needed. The mesophyll cells have chloroplasts, and this is where photosynthesis occurs.



As you hopefully recall, the parts of a chloroplast include the outer and inner membranes, inter membrane space, **stoma**, and thylakoids stacked in **grana**. The chlorophyll is built into the membranes of the thylakoids.

Chlorophyll looks green because it absorbs red and blue light, making these colors unavailable to be seen by our eyes. It is the green light, which is NOT absorbed that finally reaches our eyes, making chlorophyll appear green. However, it is the energy from the red and blue light that are absorbed that is, thereby, able to be used to do photosynthesis. The green light we can see is not/cannot be absorbed by the plant, and thus cannot be used to do photosynthesis.

The overall chemical reaction involved in photosynthesis is: $6CO_2 + 6H_2O$ (+ light energy) $C_6H_{12}O_6 + 6O_2$. This is the source of the O_2 we breathe, and thus, a significant factor in the concerns about deforestation.

2. **Observe the vocabulary chart to play a match making game.** Vocabulary charts can be very useful in helping learners widen their passive and active vocabulary based on related word group areas. Unlike rote memorization of new vocabulary, which provides few contextual clues and helps "short term" learning for exams, providing no real "hook" with which to remember new vocabulary, vocabulary charts, on the other hand, provide this "hook" by placing vocabulary in connected categories thus helping "long term" memorization.

Below is a random list of dictionary definitions of targeted scientific vocabulary words that you will match after using the Greek Roots definition of the same vocabulary words as clues.

Greek Roots Photosynthesis Vocabulary Chart

Chlorophyll:

- **Chloro: Greek (*khlōros*), meaning green**
- Phyll: Greek (*phullon*), meaning leaf

Chloroplast:

- **Chloro: Greek (*khlōros*), meaning green**
- Plast: Greek (*plathō or plastos*), meaning mold or form

Grana, plural of granum:

- Greek (*granum*), meaning grain, or seed

Photosynthesis:

- **Greek *(phōtos*), meaning light**

Epidermis:

- Greek (derma), meaning skin

stomata, plural of stoma:

- stoma, Greek (*stoma*), meaning mouth

Mesophyll**:**

- **Mes-: Greek** (mesos), meaning middle
- Phyll: Greek (*phullon*), meaning leaf

3. Now use the vocabulary words in the box to fill in the table of dictionary definitions below.

Chloroplast – Stomata – Grana – Chlorophyll – Photosynthesis – Mesophyll – Epidermis

Vocabulary Word	Dictionary Definition
	outer cell layer of plant: the outermost layer of cells of a plant
	green plant pigment used in photosynthesis: The pigment in plants that captures the light energy required for photosynthesis.
	carbohydrate production using light and chlorophyll: A process by which green plants and other organisms turn carbon dioxide and water into carbohydrates and oxygen, using light energy trapped by chlorophyll.
	part of plant cell containing chlorophyll: A membranous sac plastid that contains chlorophyll and other pigments and is the place where photosynthesis occurs within the cells of plants and algae.
	plant pore: A tiny pore in the outer layer epidermis of a plant leaf or stem that controls the passing of water vapor and other gases into and out of the plant.
	layers containing chlorophyll: A stack of thin layers in a chloroplast in which the green pigment chlorophyll is contained.
	part of leaf: The soft tissue parenchyma containing chlorophyll between the epidermal layers of a plant leaf.

4. Write more words that you know having similar Greek Roots.

_____

_____

Group (C) Members: _____

1. Read the following text.

Pop, Poppity, Pop!

A Readers' Theater About the Senses by Donna Latham

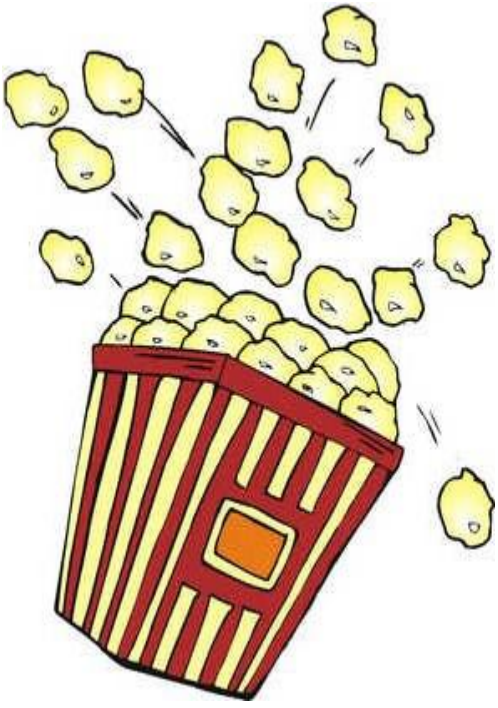
Readers' Theater is an integrated approach for involving learners in reading, writing, listening, and speaking activities. It involves children in sharing literature, reading aloud, writing scripts, performing with a purpose, and working collaboratively.

This readers' theater skit takes place in a park. There, a group of hungry friends has just wrapped up a game of kickball. Use your senses to imagine what happens when the peddler and her grandchild suddenly, um, pop in to grant a wish.
• Don't forget to read with expression and energy.

Characters: • Voice One • Voice Two • Voice Three • Peddler • Grandchild

All Voices: Woo-hoo! Great game!

Voice One: Boy, I really worked up an appetite playing kickball. I'm super-duper hungry.



Voice Two: Me, too.

Voice Three: Me three.

Voice One: I wish we had a yummy snack to share.

Voice Two: Yep, something light and fluffy. Like popcorn.

Voice Three: Yeah, something crunchy and munchy. Like popcorn.

Voice One: Right, something buttery and salty—

All Voices: Like popcorn.

Voice Two: Exactly! A snack exactly—

All Voices: Like popcorn.

Voice Three: If only your wish could come true….

Voice One: But how can we rustle up popcorn now?

Voice Two: Out here in the park?

All Voices: It's impossible, hopeless, and ridiculous.

Voice Two: You got that right.

Voice Three: It would take magic.

Voice One: Hey, do you see what I see?

Voice Two: Where?

Voice Three: There. Way, waaaay down the street.

Voice One: Is that a peddler wheeling her cart?

Voice Two: Yep. And a little girl's skipping next to her.

Voice Three: I wonder what's inside that rickety, old, red cart.

Voice One: Hey, the peddler's waving to us.

Voice Two: She's grinning ear to ear.

Voice Three: Like she has a sweet surprise.

Peddler: One and all, gather 'round. Listen to this poppin' sound.

Grandchild: Pop, poppity, pop!

Voice Two: I can hear it.

All Voices: We can hear it.

Grandchild: Pop, poppity pop!

Peddler: Shiny kernel pops up fluffy. Crispy, crunchy, plump and puffy.

Voice Two: I can see it.

All Voices: We can see it.

Grandchild: Pop, poppity pop!

Peddler: Buttery aroma drifts your way. Snag a whiff with me today.

Voice Three: I can smell it.

All Voices: We can smell it.

Grandchild: Pop, poppity pop!

Peddler: It shakes and rattles and rolls my cart. This rockin' and rollin' warms my heart.

Voice One: I can feel it.

All Voices: We can feel it. Pop, poppity pop!

Grandchild: Pop, poppity pop!

Peddler: Looks like the poppin's ready to stop.

Voice Two: Just like magic.

Voice Three: Well…

All Voices: Well…

Peddler: Well?

Voice One: Well? May we taste it?

Peddler: One and all, gather 'round. Dive into this popcorn mound.

Grandchild: Pop, poppity pop!

Voice Two: I can taste it.

All Roles: We can taste it. Yum, yummity, yum!

2. Refer to the text to:

	**Describe what popcorn LOOKS like.** _____ _____ _____ _____
	**Describe what popcorn SOUNDS like.** _____ _____ _____ _____
	**Describe what popcorn SMELLS like.** _____ _____ _____ _____
	**Describe what popcorn FEELS like.** _____ _____ _____ _____
	**Describe what popcorn TASTES like.** _____ _____ _____ _____

3. Choose the correct definition for each underlined vocabulary word.

I. Is that a peddler wheeling her cart?

a. someone who cooks **b.** someone who is very old

c. a magical person **d.** someone who sells things

II. I wonder what's inside that rickety, old, red cart.

a. falling apart **b.** rolling

c. delicious-smelling **d.** shiny

III. A buttery aroma drifts your way.

a. feeling **b.** taste

c. smell **d.** warmth

IV. Dive into this popcorn mound.

a. pile **b.** bag

c. cart **d.** box

V. I really worked up an appetite playing kickball.

a. sweat **b.** hunger

c. tired feeling **d.** energy

Group (D) Members: _____

1. Read the following story.

Scientific Story-Telling about the Birth of a Butterfly
by Chaitalie Shukla
(for 7 to 9 year old children)

Grandma's garden had rows of pretty flowers. The earth was wet, and the leaves in many shades of green. The butterfly eggs were glued to a leaf in a rosebush. Mama butterfly had laid them and had stuck their undersides with white glue. The birth of a butterfly was going to take place.

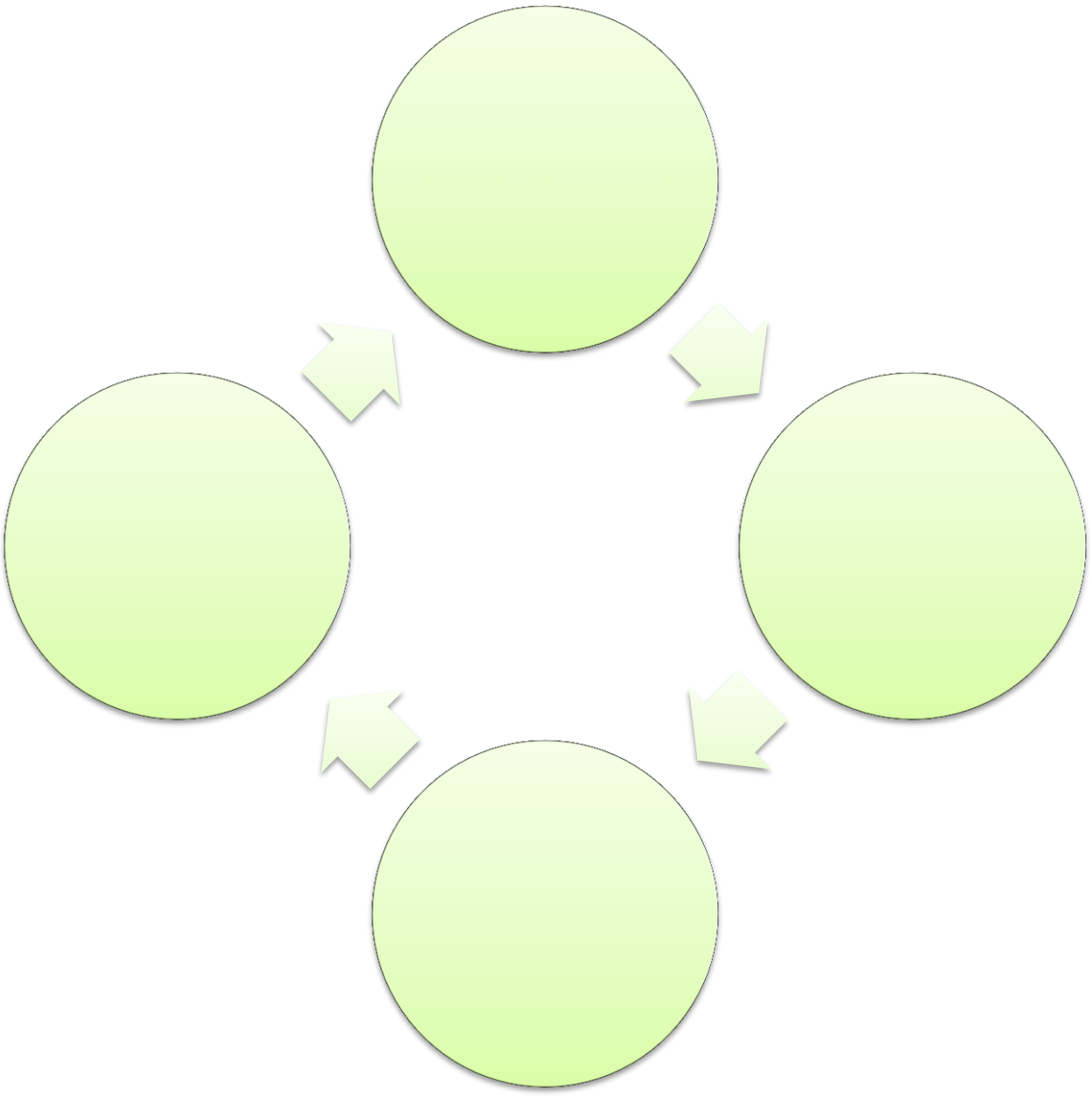
After a few weeks, they had finally hatched. This is known as the larva stage when the tiny babies or 'caterpillars' in green or yellow and red were going to be seen all over the garden and especially among the softer newer leaves that would feed them.

Soon after birth, the lazy caterpillars could be found lolling their wriggly bodies in the soft shade as they nibbled lustily on the juicy leaves till their bellies were full. They had to, since many of them would grow up to ten times larger. They would also throw off their old skins four or five times and grow new ones to accommodate their soft fluffy growing bodies. They moved on many legs all over the green patches unaware that each was about to turn into a colorful butterfly.

In less than two weeks since birth, each one of them had grown enormously and had stopped wandering about. They had attached themselves to the undersides of leaves and were preparing for the next birth stage: the pupa. They were also beginning to lose their color and had turned into darker shades of brown. What a clever way to hide from hungry birds and frogs! Besides, if someone looked carefully she would have seen the pattern of wings trapped inside a frozen motionless pupa.

What a strange birth process! More than three weeks had passed while the pupae hung inert, sometimes fluttering a little in the soft breeze. All this time the baby butterfly was developing within. Soon it was time for magic….and one day a new butterfly began to emerge from its gluey sticky cocoon. It slowly unfolded each wing and hung it out to dry. Each butterfly wing was covered with tiny colored scales. In a couple of hours, it was entirely awake and its wings had dried. Its birth was now complete and it was ready to begin its life as a fully-grown butterfly.

2. **Based on the story above, draw and label the lifecycle of a butterfly in the box below.**



3. **Reflect on how the story informed you about butterflies, but in a different way.**

_____

_____

_____

_____

_____

Group (D) Members: _____

1. Read the following acrostic poem where the first letter of each line spells out the word *opossum*.

Opossums

by Liana Mahoney

On your back, three joeys ride.

Pink-nosed babies blink, wide-eyed.

Omnivore, your appetite

Sends you stalking through the night.

Solitary, yet not alone

Until your babes have fully grown.

Meals of berries, snails galore –

Shared by moonlight, family of four.

2. Answer the following.

I. Line 1 of the poem reads: *"On your back, three joeys ride."* Define joey.

_____

II. What is this poem mostly about?

a. an opossum hunting for food
b. baby opossums growing up
c. a mother opossum taking care of her babies
d. opossums getting into trouble

III. Explain the meaning of following lines: *"Solitary, yet not alone, Until your babies have fully grown."*

_____

_____

IV. Which two lines in the poem show that opossums are active at night? _____

3. Make an identity card for your favorite animal. Then write an acrostic poem about it.

Name		Drawing
Name of Offspring		
Category		
Diet		
Taking Care of Offspring		
Habitat		
Living Habits		
Movement		

_____

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Workshop Resources

K-W-L Chart: http://wvde.state.wv.us/strategybank/KWLCharts.html

Frayer Model:

- http://www.tantasqua.org/superintendent/profdevelopment/etfrayermodel.html
- http://irondalecom.jefcoed.com/Teachers/nancymitchell/Documents/Frayer%20Model%20for%20Comprehension/Frayer%20Model%20Research.pdf

Pictures of living things: http://www.ebookdestination.com

"Photosynthesis": http://biology.clc.uc.edu/courses/bio104/photosyn.htm

Vocabulary Chart: http://esl.about.com/library/lessons/blvocabtrees.htm

Greek Roots:

- http://en.wikipedia.org/wiki/List_of_Greek_and_Latin_roots_in_English
- http://www.infoplease.com/ipa/A0907013.html

Dictionary Definitions: **Microsoft® Encarta® 2006. © 1993-2005 Microsoft Corporation. All rights reserved.**

Readers' Theatre:

- http://www.scholastic.com/librarians/programs/whatisrt.htm
- www.superteacherworksheets.com, "Pop, Poppity, Pop!" A Readers' Theater About the Senses by Donna Latham (Adapted)

Story:

- http://www.thebutterflysite.com/life-cycle.shtml
- http://en.articlesgratuits.com/scientific-story-telling-about--the-birth-of-a-butterfly-for-7-to-9-year-old-children-id2484.php

Poem:

- Acrostic Poems: http://www.readwritethink.org/files/resources/interactives/acrostic/
- www.superteacherworksheets.com, "Opossums" by Liana Mahoney
- Animal Facts: http://www.kidsbiology.com/
- http://teachers.net/lessons/posts/2833.html

MATHEMATICS AND SCIENCE

Inquiry Based Learning

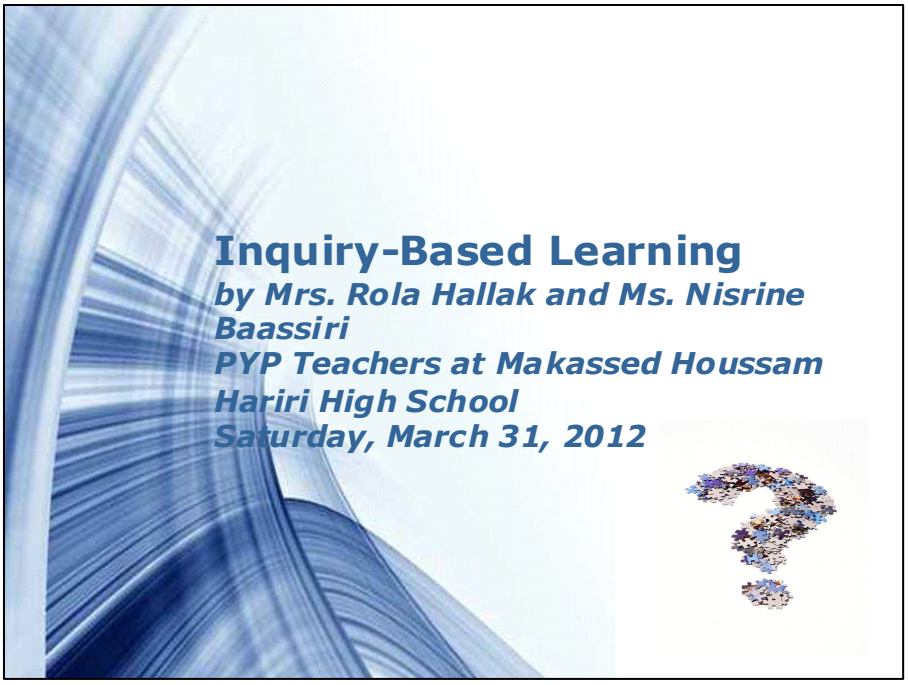
Rola Hallak and Nisrine Baasiri

Introduction

An old adage states, “Tell me and I forget, show me and I remember, involve me and I understand". The last part of this quotation is the essence of inquiry-based learning. Inquiry, which goes beyond asking questions, implies involvement that leads to understanding. It is a comprehensive strategic process. Furthermore, involvement in learning implies possessing skills and attitudes that permit learners to seek resolutions to questions and issues and construct meaning. The primary purpose of the workshop was to increase participants’ understanding of inquiry-based learning. The central idea of the workshop was that inquiry-based learning engages, challenges and develops learners to construct meaning of what they learn. The framework for inquiry used in this workshop was based on the inquiry cycle demonstrated by Kathy Short in “Creating a Classroom for Inquirers and Authors”. In this workshop, participants inquired into the concept of “inquiry” and what it looks like inside and outside the classroom. They were also provided with many opportunities to analyze what they're already doing and explore some new techniques that they can add to their repertoire. Through real-life examples of inquiry, participants gained essential theoretical knowledge about inquiry supported with applicable tools, activities, and facilitation plans for use. By the end of the workshop and after having analyzed a variety of inquiry models and having experienced one of them, they synthesized and designed their own.

Description of the Session

After welcoming the participants, the participants shared how comfortable they were with inquiry-based learning. After this ice-breaking activity, which took 5 minutes, participants read a quotation from the slide. Afterwards, as groups, participants used the Frayer Model to share their definitions of inquiry and gave its characteristics in 10 minutes. Then, a discussion about inquiry-based learning in terms of twenty-first century skills was carried out. Then, participants viewed and commented on two graphics: one for the traditional classroom and the other for the constructivist classroom which relies on inquiry. After being regrouped, participants read what inquiry looks like at school, in the curriculum, learning and nature of self. Each group represented their understanding in a snapshot, and “save the last word for me” was applied. At different instances, participants were encouraged to record new perspectives they gained. Then, they will view an inspirational movie about inquiry. After this, they viewed different inquiry cycles and ended the session by reading an article about inquiry-based science.



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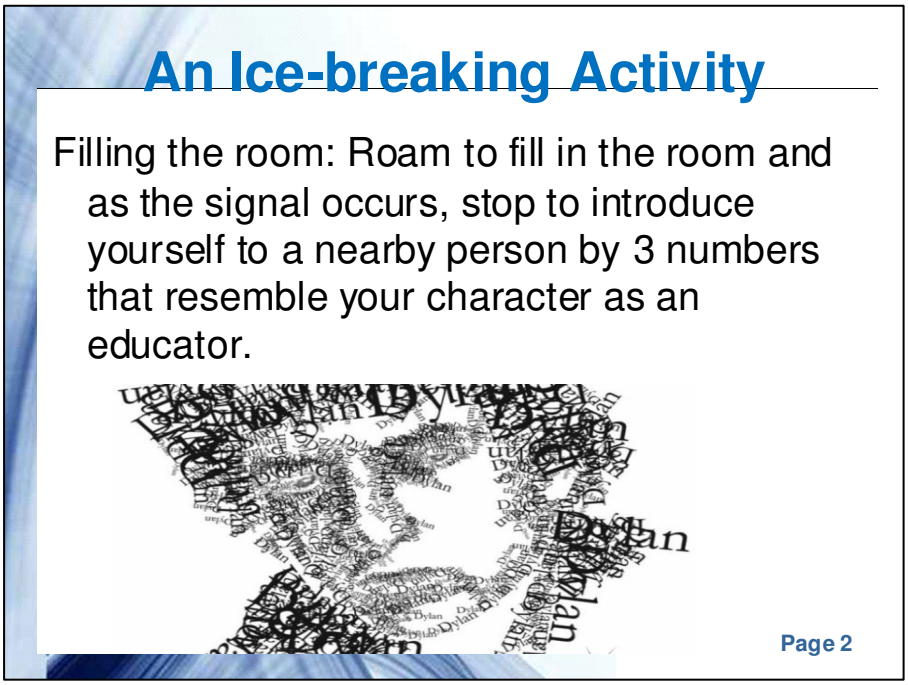

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Creating a Community of Inquirers

- Tool: T-Chart
- In groups, set agreements based on positive attitudes such as: respect, cooperation, commitment, or confidence.

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Throughout the workshop, we'll use the teacher's hat and the student's hat.

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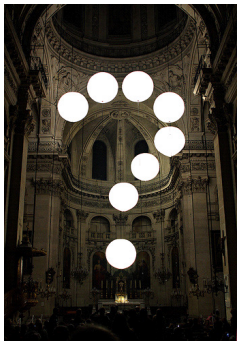
Central Idea

Inquiry-based learning engages, challenges, and develops learners to construct meaning of what they learn.



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Learning Outcomes

By the end of the workshop, participants will:

1. Understand what inquiry-based learning is
2. Understand how inquiry-based learning look like
3. Appreciate that inquirers have positive attitudes that are applied throughout the process
4. Investigate into one model of inquiry

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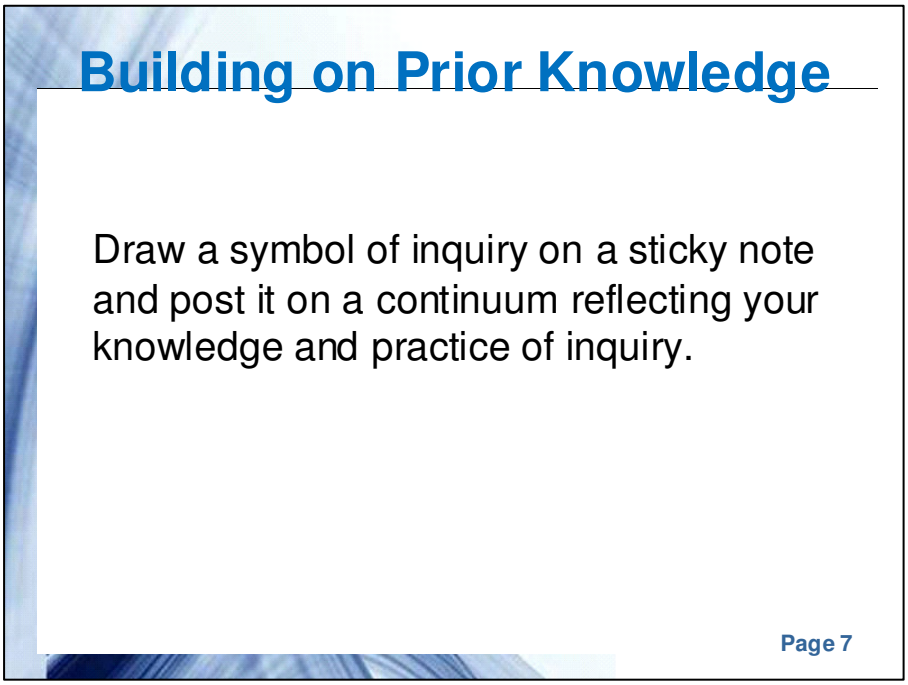

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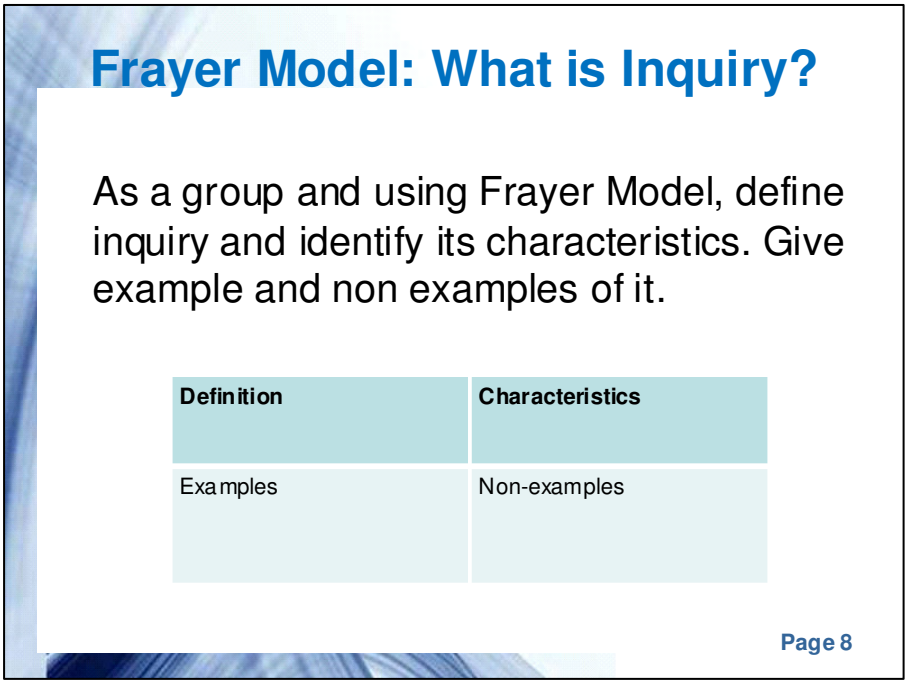

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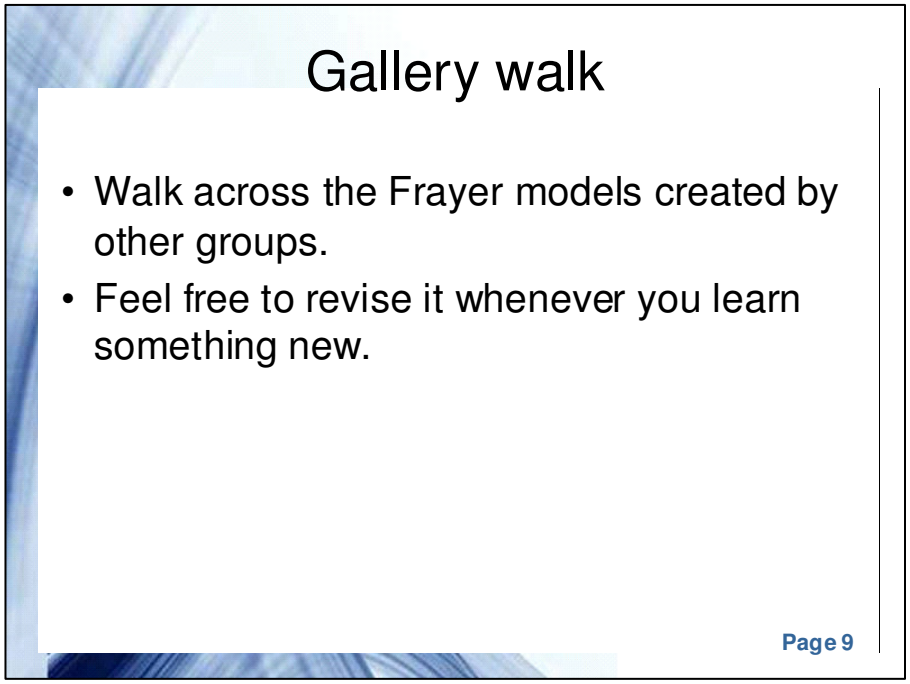

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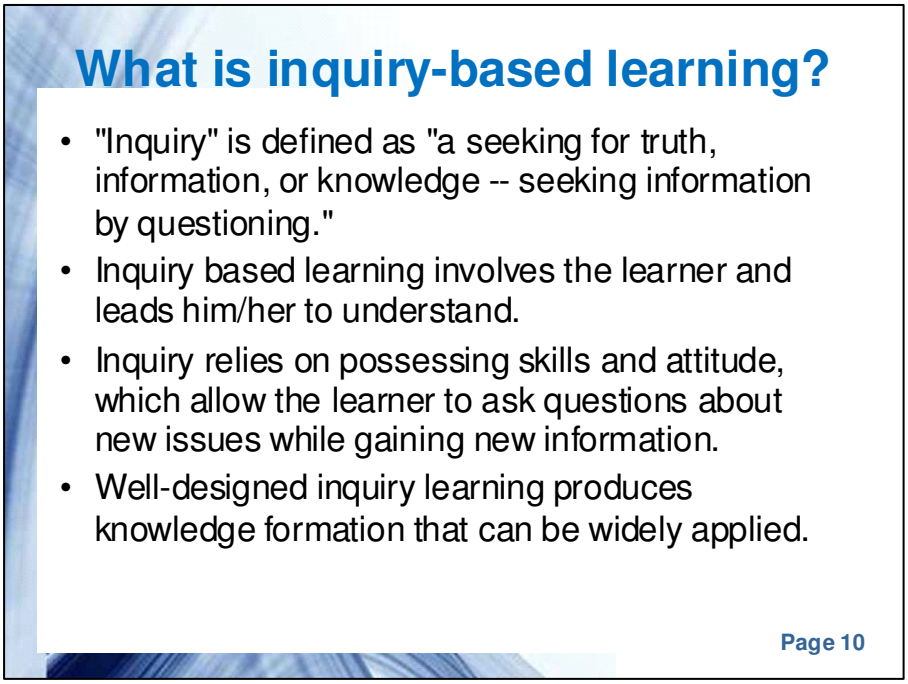

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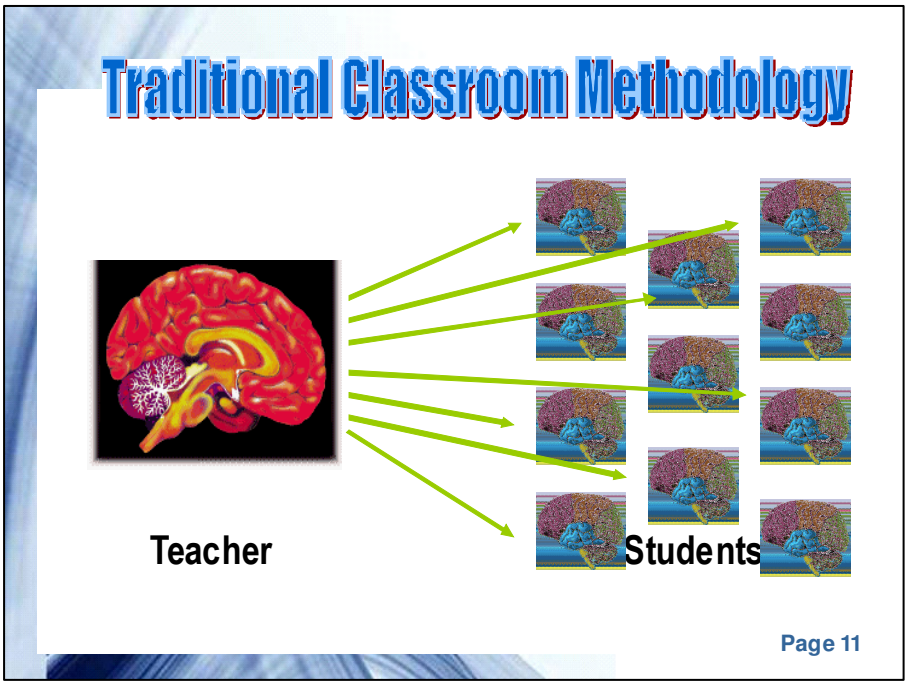

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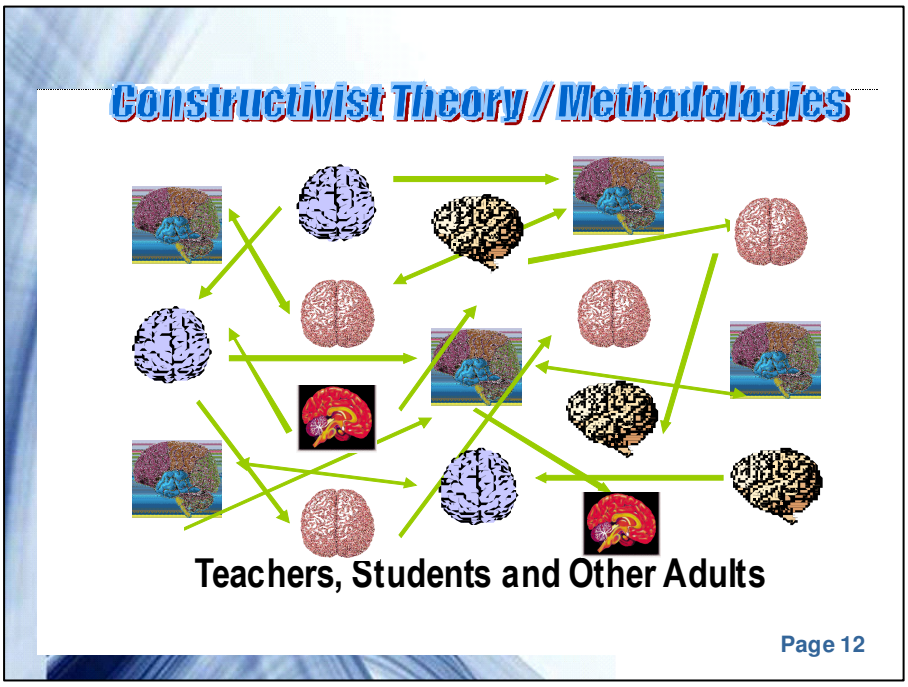

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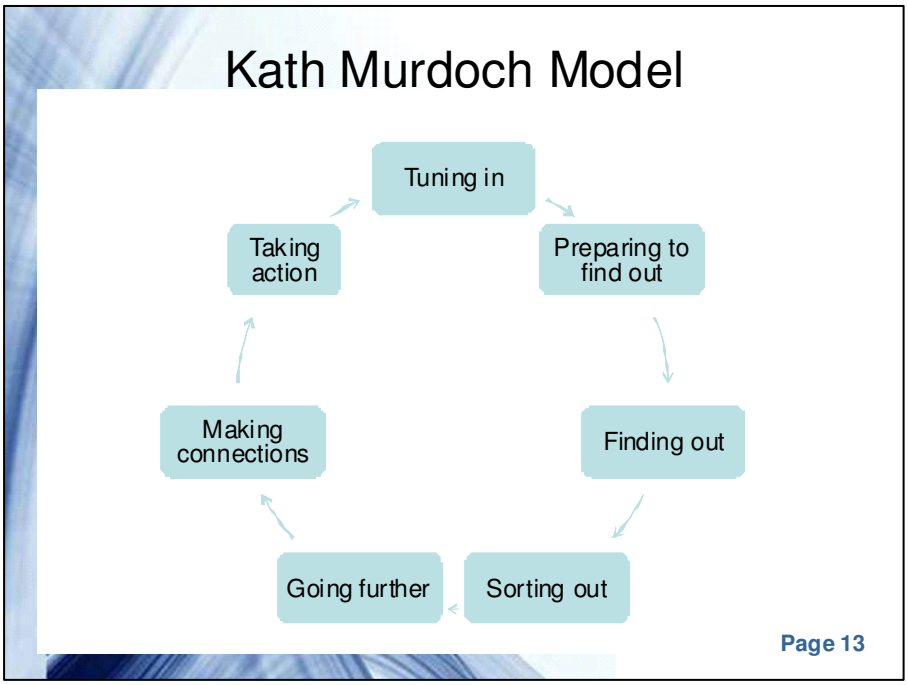

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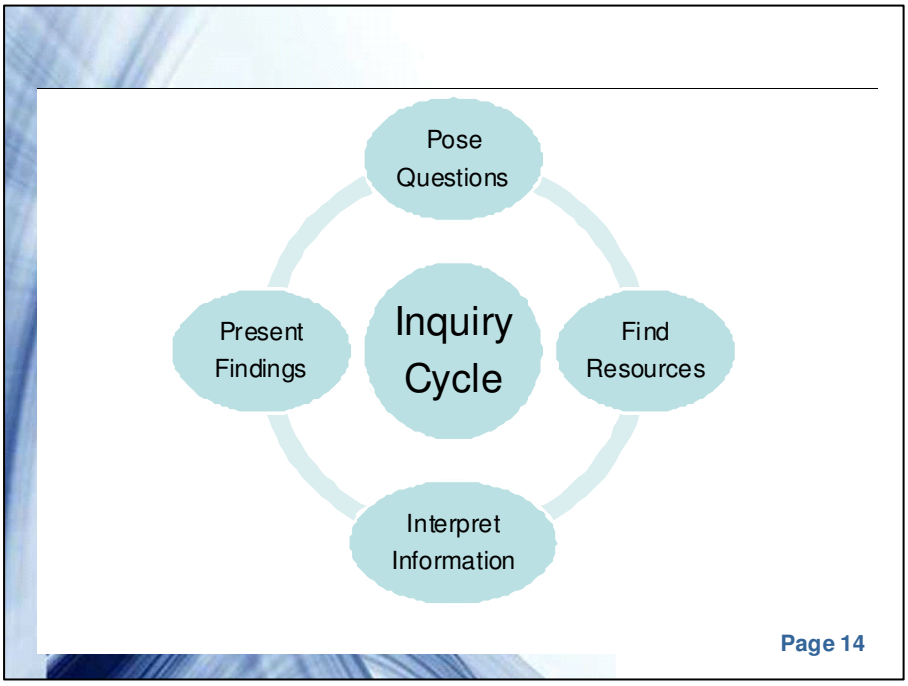

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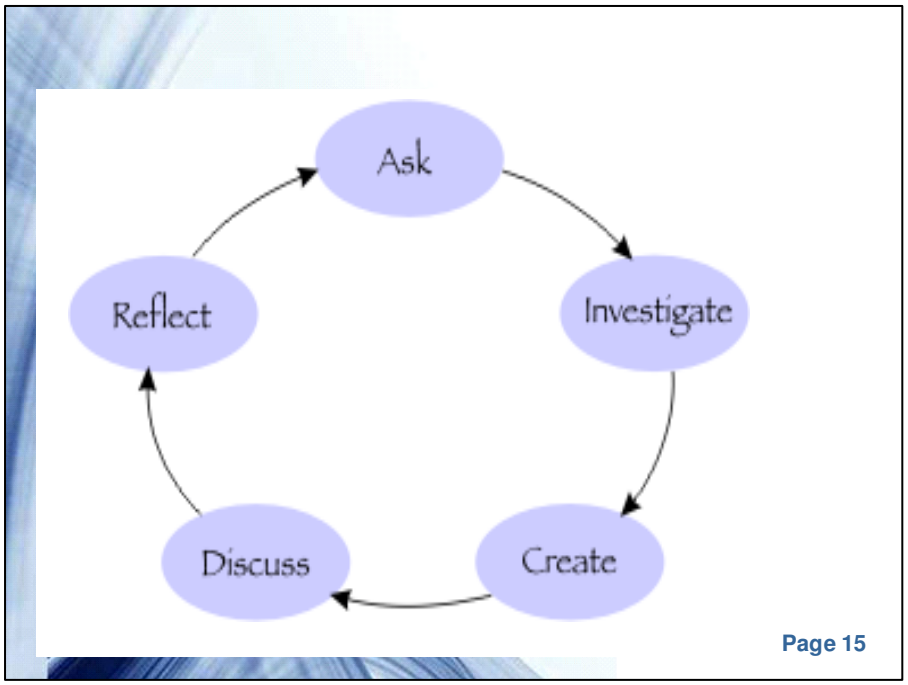

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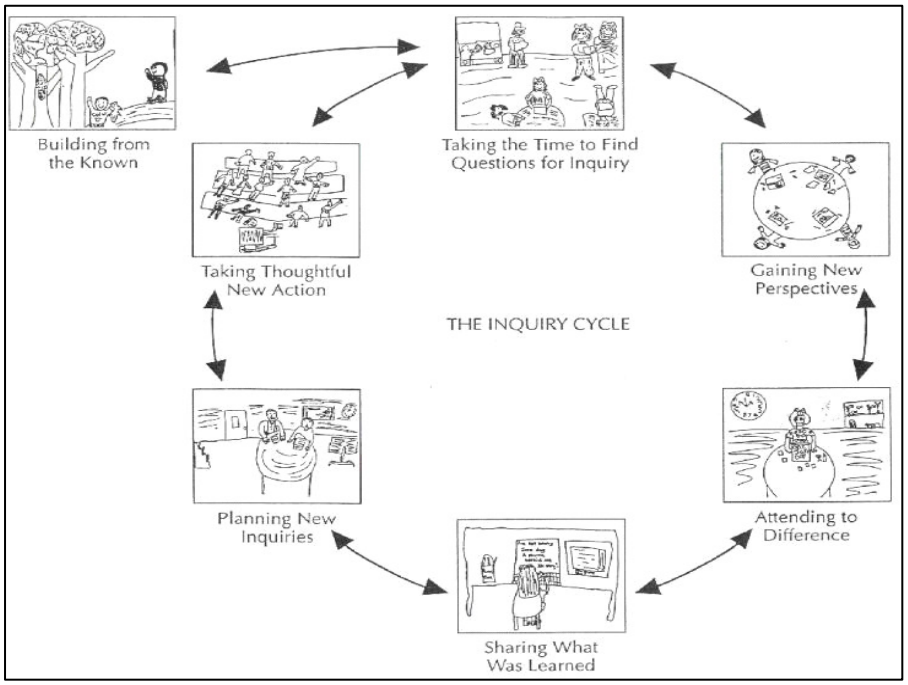

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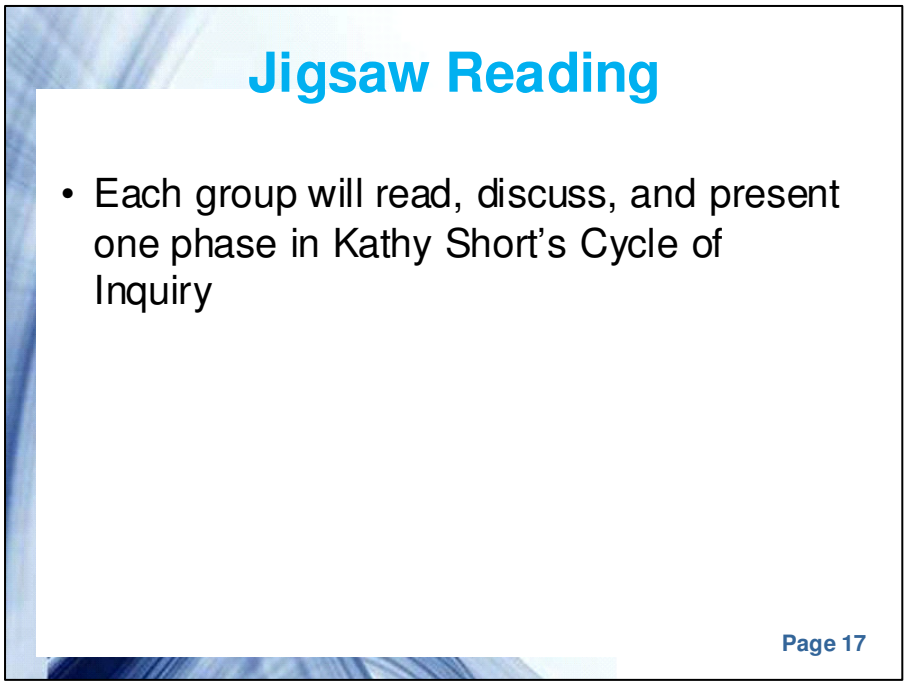

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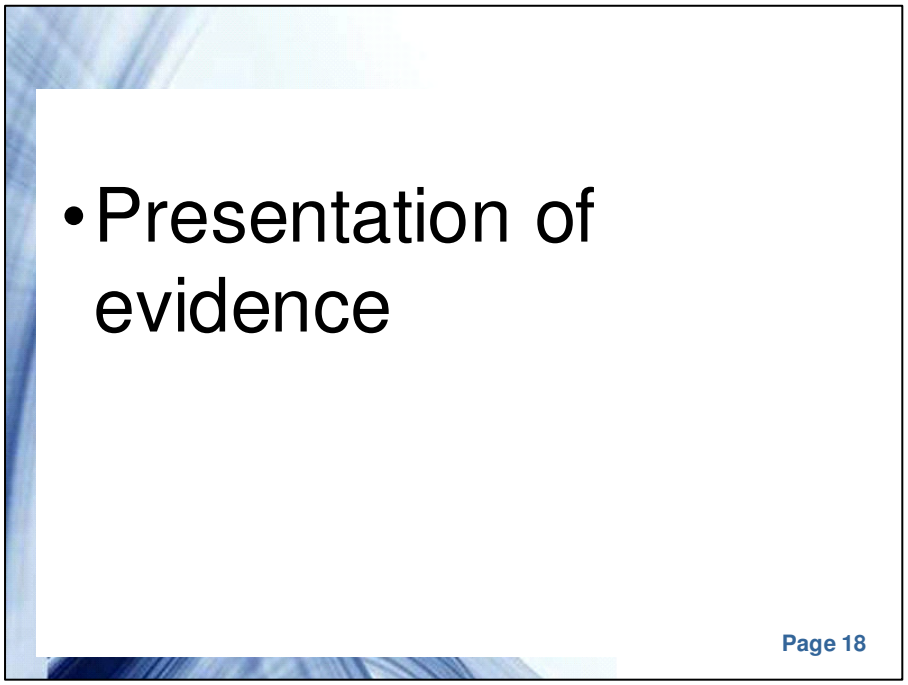

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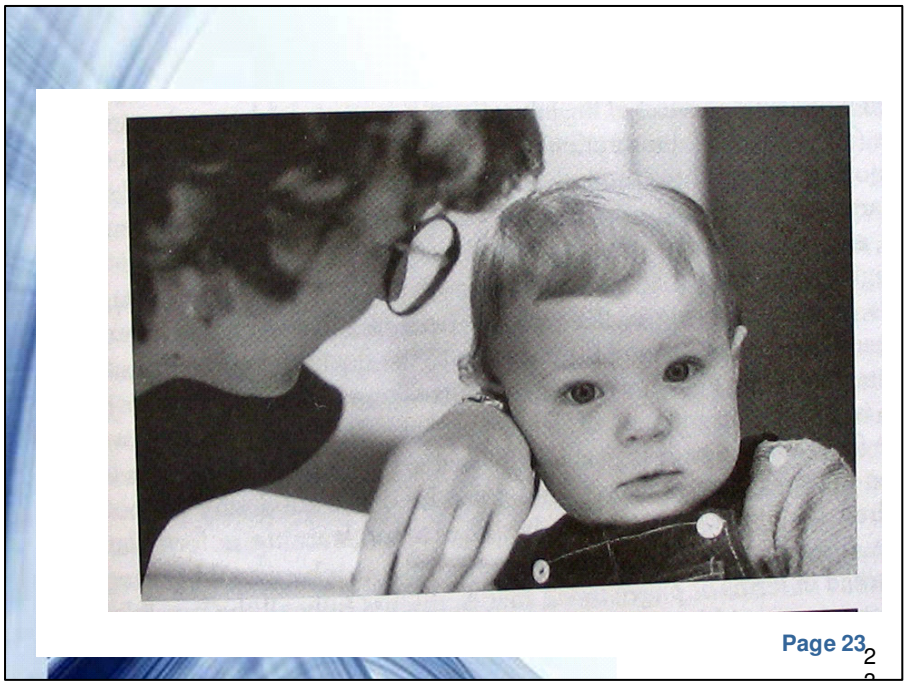

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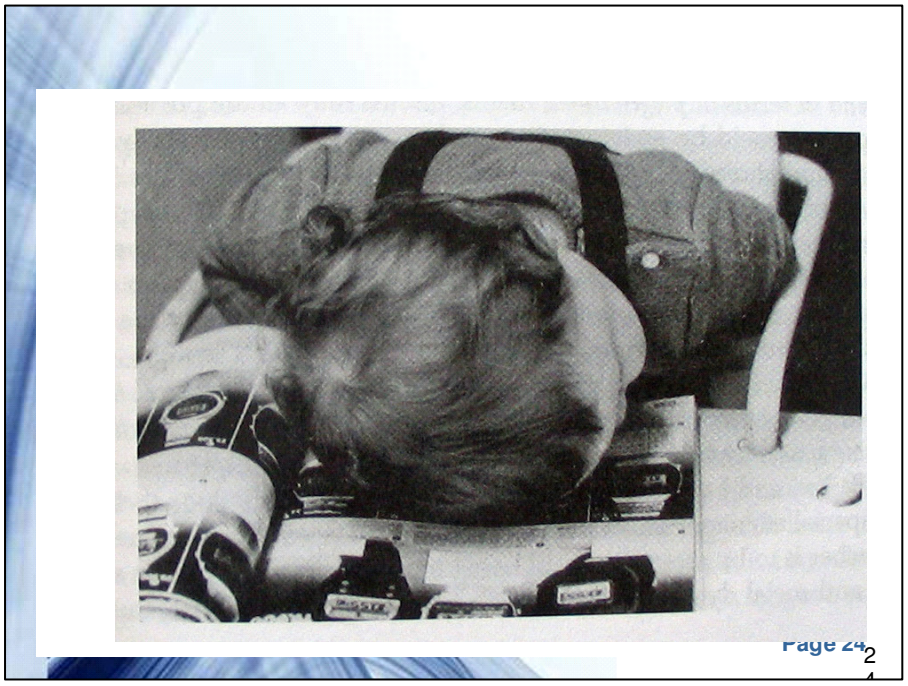

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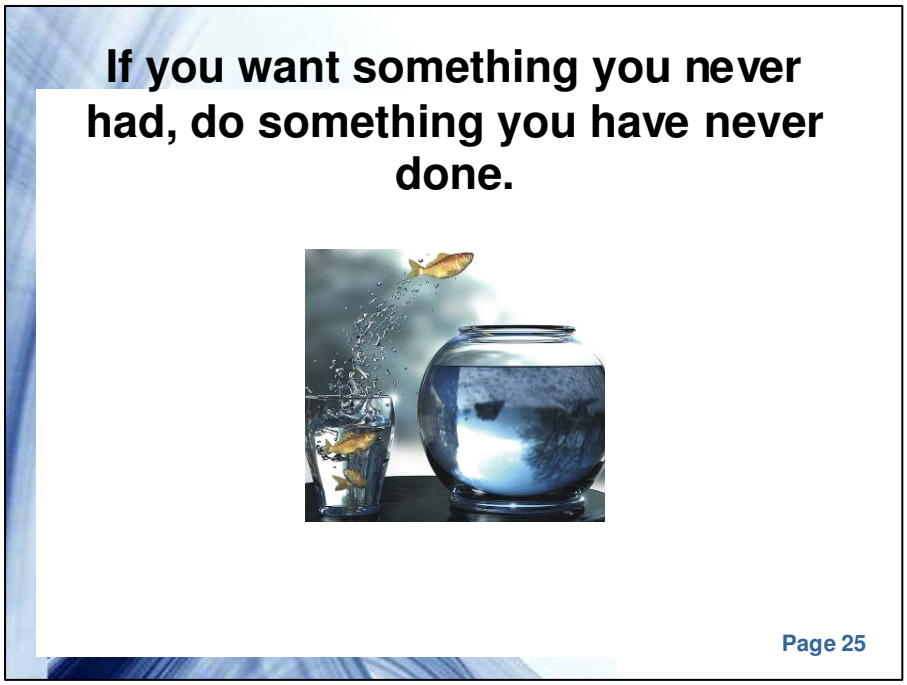

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The inquiry cycle

Stage	Strategies for Effective Learning Engagements
Building From the Known: -Making connection to what students already know - teaching the background information needed	1. ***Read-aloud*** followed by Class discussions of books close to their own experiences or are old favorites 2. Tell stories through ***written reflections, free writes, sketches***, or by using other art material. 3. Bringing artifacts, collecting data, or stories and talking about them in connection to their lives. 4. ***Getting to know you*** where students form partners, interview each other, take notes, and write or dictate an article for a class newspaper. (Relate to general interests or the class focus) 5. ***Interviews*** of family members, friends, and neighbors on issues related to the class focus encourage students to bring their experiences outside of school into the classroom. 6. ***Timelines*** of important events in their lives, their family history, the changes in their lives, and the places they have lived or visited. 7. ***"All About Me" books*** are places where children write and draw about their interests, family members, home, neighborhood, … These books build community and self esteem and serve as references for later work in the classroom 8. ***Museum of artifacts*** brought, displayed, and labeled by students. 9. ***Save the Last Word for Me*** where students talk about what the artifact tells about that individual who displayed it 10. ***An archaeological Dig*** where students search in backpacks, wallets, or shelf for evidence of others' literacy, sense of place, or who they are as learners **11. Webbing, Brainstorming, and discussion** 12. **Small-group Interviews**
Taking Time to Ask Questions for Inquiry -To look, listen, smell, and observe the world around us, to "wander and wonder" about the world - "Wandering and Wondering" must include examining a topic from many perspectives and through conversation and observation - Notice connections and contradictions around us	1. ***"Be in a Place"*** where students through observation feel an interest which leads to a focused question 2. Provide a list of ***challenging topics or questions***, and students should choose one for the group. 3. ***Read aloud*** books that go beyond the experiences that they have already shared in the previous phase 4. ***Exploration Center*** where students can brown a variety of books, pieces of music, art prints, cultural artifacts, dance videos … These engagements ought to be followed by ***class sharing time.***

- Questions should be raised to serve broad issues rather than collect facts -	5. ***Exploratory Field Studies*** (close observations) where students sketch and record their findings 6. ***Class meetings*** discussing what is recorded in the journal ***7. Webs and Graffiti Boards*** ***8. Graphs, Charts, and Diagrams*** to record data ***9. Improvisational drama*** on issues or events students are exploring ***10. Text Sets*** where groups meet to discuss and examine whether they there are any questions to pursue in greater depths ***11. Literature Circles*** of shared book sets followed by ***webs, graffiti boards, Save the Last Word For Me*** (Using quotes from the book), ***Anomalies (***List of what puzzles them as they read***), Sketch to Stretch*** (A sketch of them meaning of the story to them), or ***comparison Charts***. ***12. Say Something*** where each pair of students share the reading a picture book and frequently pause to pose a question, comment, prediction, or connection) ***13. Learning Logs or "I wonder" booklets*** where students keep track of their wonderings ***14. Class Inquiry Charts***
Gaining New Perspectives - Students examine questions from new perspectives through collaboration and investigation - Think with others (Consider new ideas and explain their thinking to others) - Teachers and students share responsibility to collect relevant material - Inquiry plan is developed	1. ***Forming inquiry groups*** relying on posed questions 2. ***Experience Centers*** where students explore the topic through some kind of investigation 3. Literature circles and field studies 4. ***Gathering relevant resources*** (books, pieces of music, art prints, videos of dances and drama) 5. ***Conduct surveys*** and ***Interview outside*** experts and examine other primary resources 6. ***Consider a topic*** or issue from a perspective of a certain role or profession (Cooperative learning wherr students are supposed to think authentically in real-life engagements) 7. ***Transmediation: Sketch to Stretch (From Language to Art or vice versa)*** 8. ***Reflective Drama*** (A reporter interviewing a student taking the role of a character in a story) 9. Students could ***create a tableau*** that embodies a significant scene from their research or reading. 10. ***Creating an extension*** of a research or reading push students to think about people and events they encounter in their investigation. 11. ***Develop experiments*** 12. ***Write letters to get information***

	13. ***Examine Artifacts*** 14. ***Book-and-toy sets*** 15. Written notes could be recorded using mathematical tools such as ***graphs, comparison charts, maps, Venn diagram, flow charts, webs, timelines, and others***. 16. Strategy Lessons: ***Interviewing, using timelines, writing letters, note-taking, creating surveys, constructing graphs, and reading informational materials*** 17. ***Whole-class inquiries*** create conceptual context for their small group inquiries. 18. ***Read-alouds*** should introduce new perspectives and encourage conversations about larger conceptual issues.
Attending To Difference - Students ideas and perspectives are challenged and they need quiet reflective time to reconsider what they believe and understand related to their inquiry	- ***Sketch in their inquiry journals*** - ***Reflection Logs*** - ***Group meetings and Class logs***
Sharing What was Learned - Transferring understanding to public	- ***Informal Sharing*** - ***Formal Presentations: Fiction or nonfiction book or piece of writing, mime, plays, choral readings, murals, songs, operas, masks, displays, oral presentations, paintings, sculpture, dramatizations, original musical compositions, diagrams, graphs, or charts.*** - ***Authors circles where students revise their presentations and enhance its effectiveness***
Planning New Inquiries -It is an opportunity for students to reflect on what they know (Content), how they come to know (Process), and why they inquire (purpose and goals) - Experience to broader meanings for their lives	- ***Group meetings*** making connection to the world and to their own lives - ***Reconsider questions*** in light of students' inquiries - ***Free writes*** - ***Learning Logs*** - ***Reflection Journals*** - ***Inquiry Portfolios:*** Students select the items that they consider to be the most important for their inquiry - ***Reflection portfolio***: it is compiled to show who they are as learners (projects from school and home experiences). Students examine their purposes as inquirers and establish goals for they want to go next.
Taking Thoughtful new Actions	- ***Setting new questions*** - ***Reading and writing work time*** where students read texts that interest them - ***Expert projects or Explorer's Club*** - ***Adding new understandings to the broad concept web***

	or create new one and compare - ***Identify new inquiries (Exploration Centers)***

Article about inquiry based science:

"Inquiry Based Science: What Does It Look Like?" Connect Magazine (published by Synergy Learning), March-April 1995, p. 13.

To help in answering this question, teachers and administrators participating in the Vermont Elementary Science Project observed and discussed the actions of students engaged in hands-on, minds-on science exploration. Then they created this, "On the Run Reference Guide to the Nature of Elementary Science for the student " (1991, with revisions 1992). They wrote, "The intent is not to use this guide as a checklist, but as a statement of what we value in the areas of science processes, science dispositions, and science concept development. We urge you to capture evidence of your own students engaging in these indicators ".

When students are doing inquiry based science, an observer will see that:
Children View Themselves as Scientists in the Process of Learning.
1. They look forward to doing science.
2. They demonstrate a desire to 1earn more.
3. They seek to collaborate and work cooperatively with their peers.
4. They are confident in doing science; they demonstrate a willingness to modify ideas, take risks, and display healthy skepticism.

Children Accept an "Invitation to Learn" and Readily Engage in The Exploration Process.
1. Children exhibit curiosity and ponder observations.
2. They move around selecting and using the materials they need.
3. They take the opportunity and the time to "try out" their own ideas.

Children Plan and Carry Out Investigations.
1. Children design a way to try out their ideas, not expecting to be told what to do.
2. They plan ways to verify, extend or discard ideas.
3. They carry out investigations by: handling materials, observing, measuring, and recording data.

Children Communicate Using a Variety of Methods.
1. Children express ideas in a variety of ways: journals, reporting out, drawing, graphing, charting, etc.
2. They listen, speak and write about science with parents, teachers and peers.
3. They use the language of the processes of science.
4. They communicate their level of understanding of concepts that they have developed to date.

Children Propose Explanations and Solutions and Build a Store of Concepts.
1. Children offer explanations from a "store" of previous knowledge. (Alternative Frameworks, Gut Dynamics).
2. They use investigations to satisfy their own questions.

3. They sort out information and decide what is important.
4. They are willing to revise explanations as they gain new knowledge.

Children Raise Questions
1. Children ask questions (verbally or through actions).
2. They use questions to lead them to investigations that generate further questions or ideas.
3. Children value and enjoy asking questions as an important part of science.

Children Use Observation.
1. Children observe, as opposed to just looking.
2. They see details, they detect sequences and events; they notice change, similarities and differences, etc.
3. They make connections to previously held ideas.

Children Critique Their Science Practices.
1. They use indicators to assess their own work
2. They report their strengths and weaknesses.
3. They reflect with their peers.

Démarche Scientifique et Interdisciplinarité en Science au Lycée
Rita Khanfour

Nous nous proposons dans cette présentation de mettre l'accent sur le travail co-disciplinaire en relation avec les spécificités des démarches scientifique dans les différents champs disciplinaires (biologie, mathématiques et sciences physiques) à travers l'enseignement MPS, un enseignement d'exploration (MPS) « Méthodes et Pratiques Scientifiques », qui a été mis en place en classe de seconde. Cet enseignement vise notamment à montrer aux élèves « l'apport et la synergie entre les disciplines scientifiques… » et à les initier « à la démarche scientifique dans le cadre d'un projet ». Notre groupe IREM (institut de recherche sur l'enseignement des mathématiques) a donc questionné sur le plan épistémologique le singulier utilisé dans « démarche scientifique » en s'interrogeant sur les similarités et les différences existant à ce niveau entre les disciplines. Cette réflexion préalable nous paraît indispensable puisque nous avons pu constater à travers différents témoignages que l'articulation des différents champs disciplinaires se réduit la plupart du temps à une juxtaposition d'activités disciplinaires. Une pratique s'appuyant sur l'expérience d'un enseignant qui a travaillé sur le thème science et investigation policière sera présentée. L'analyse du travail MPS et comment les injonctions du programme ont été gérés par les enseignants seront discutés avec les participants et une ébauche de scénarisation d'une séquence d'enseignement sur le thème de la vision sera détaillée.

Depuis Septembre 2010, en France, un enseignement d'exploration (MPS) « Méthodes et Pratiques Scientifiques », a été mis en place en classe de seconde (BOEN spécial n°4 du 29 avril 2010). Il vise notamment à montrer aux élèves « l'apport et la synergie entre les disciplines scientifiques… » et à les initier « à la démarche scientifique dans le cadre d'un projet ». Pour atteindre ces objectifs, une liste de six thèmes nationaux a été

proposée. L'équipe d'enseignants choisit deux ou trois thèmes mobilisant différents champs disciplinaires, qui feront l'objet de l'enseignement et des activités des élèves. Les six themes sont les suivants : science et aliments, science et cosmétologie, science et investigation policière, science et œuvre d'art, science et prévention des risques d'origine humaine et science et vision du monde. Différents types d'entrée dans le thème sont laissés au choix de l'équipe enseignante. Notre groupe de travail IREM (institut de recherche sur l'enseignement des mathématiques http://www.irem.univ-paris-diderot.fr/sections/groupe_modelisation/), qui est un groupe pluridisciplinaire dans lequel, depuis plusieurs années, des enseignants et des chercheurs travaillent collaborativement sur la modélisation et élaborent des formations continues pour les enseignants de mathématiques et de sciences, a décidé d'accompagner la mise en place de ce nouvel enseignement, notamment en élaborant des formations. Lors de ces formations, l'objectif est de mettre l'accent sur le travail co-disciplinaire (cf. Prieur, Sanchez & Aldon, 2011) en prenant en compte les spécificités des démarches scientifiques (Grangeat, 2011) dans les différents champs disciplinaires. Notre groupe a donc questionné la pertinence épistémologique du singulier « démarche scientifique » utilisé dans le texte officiel sur les MPS, en s'interrogeant sur les similarités et les différences existant à ce niveau entre les disciplines. Ce questionnement nous paraît indispensable pour rendre possible un réel travail co-disciplinaire en MPS et dépasser la simple juxtaposition d'activités disciplinaires très souvent observée. . L'idée dans cet atelier est de faire partager aux participants notre réflexion sur ces questions de co-disciplinarité et de démarche scientifique dans le cadre des MPS où 3 champs disciplinaires sont présents : mathématiques, sciences physiques et biologie. Durant l'atelier, les participants seront placés en tant que professeurs en formation continue en mathématiques ou en sciences physiques. Une pratique s'appuyant sur l'expérience d'un enseignant, faisant partie de notre groupe de travail IREM, qui a travaillé sur le thème science et investigation policière sera présentée. L'analyse du travail MPS réalisé et de la façon dont les injonctions du programme y ont été gérées par les enseignants seront discutés avec les participants. Après cette discussion sur les avantages, les limites de ce travail et plus généralement du thème traité, les participants auront à réfléchir sur deux documents concernant cette fois le thème de la vision afin de dégager eux-mêmes des pistes pour un travail co-disciplinaire. Une ébauche de scénarisation d'une séquence d'enseignement sur ce thème clôturera l'atelier.

L'atelier est planifié de la manière suivante:

a) présentation du contexte de l'enseignement d'exploration MPS et de ses caractéristiques (5 minutes)
b) discussion avec les participants de leur pratique co-disciplinaire (10 minutes)
c) présentation du travail sur police scientifique (20 minutes)
d) réactions des participants sur les avantages et les limites de ce thème (15 minutes)
e) Travail des participants sur des documents afin de dégager des pistes d'activités co-disciplinaires sur la vision (15 minutes)
f) présentation rapide de l'ébauche de la scénarisation d'une séquence d'enseignement autour du thème de la vision. (10 minutes)

Références

Combelles C (2011). Dossier méthodes et pratiques scientifiques. Bulletin de l'APMEP.N°45. http://www.apmep.asso.fr/Sommaire-du-Bulletin-495.

Grangeat, M. (2011). La diffusion des démarches d'investigation : une dynamique en devenir. In M. Grangeat, les démarches d'investigation dans l'enseignement scientifique - Pratiques de classe, travail collectif enseignant, acquisitions des élèves. Lyon : INRP, 14-21.

Prieur, M., Sanchez, E. & Aldon, G. (2011). Enseignement scientifique co-disciplinaire en classe de seconde : éléments à prendre en compte pour sa mise en œuvre. In M. Grangeat, les démarches d'investigation dans l'enseignement scientifique - Pratiques de classe, travail collectif enseignant, acquisitions des élèves. Lyon : INRP, 100-112.

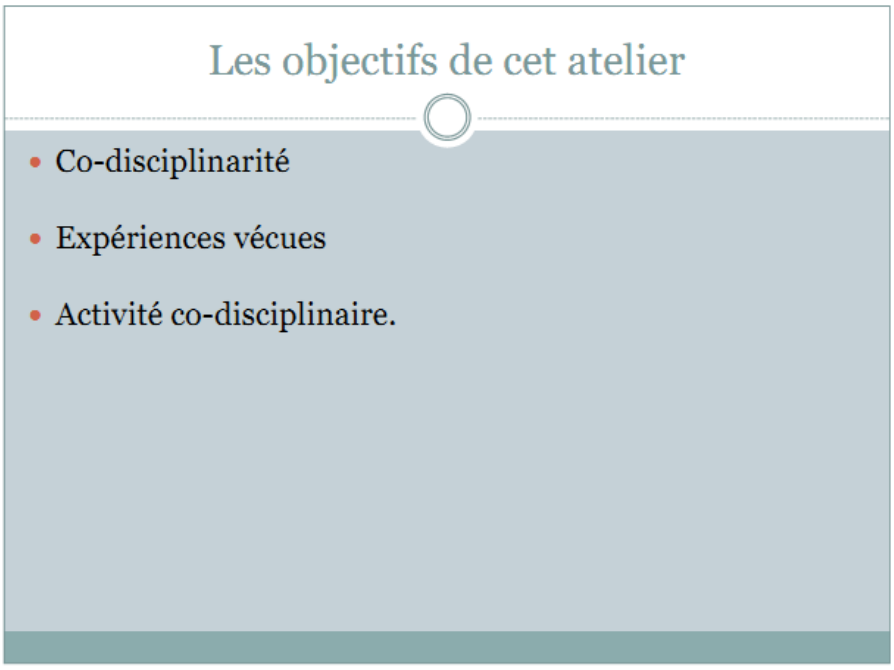
Liens utiles

L'enseignement d'exploration ressources pour la seconde générale et technologique Méthodes et pratiques scientifiques : http://eduscol.education.fr/cid52256/ressources-methodes-et-pratiques-scientifiques.html

Introduction et exemples de projets du programme d'exploration MPS: http://media.eduscol.education.fr/file/MPS/21/3/LyceeGT_Ressources_2_Exploration_MPS_0-1_introduction_152213.pdf

Archive du fichier de travail sur le thème police scientifique : http://media.eduscol.education.fr/file/MPS/18/0/LyceeGT_Ressources_2_Exploration_MPS_3-1_disparition_de_Monsieur_X_maj2011_197180.pdf

Archive du fichier de travail sur le thème autour de la vision: http://media.eduscol.education.fr/file/MPS/23/9/LyceeGT_Ressources_2_Exploration_MPS_6-2_vision_152239.pdf



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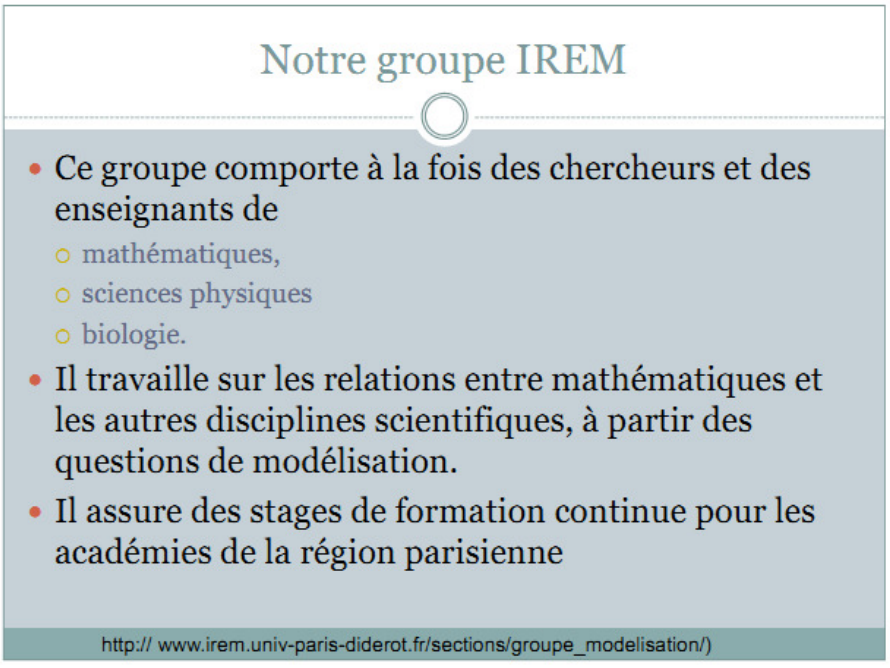

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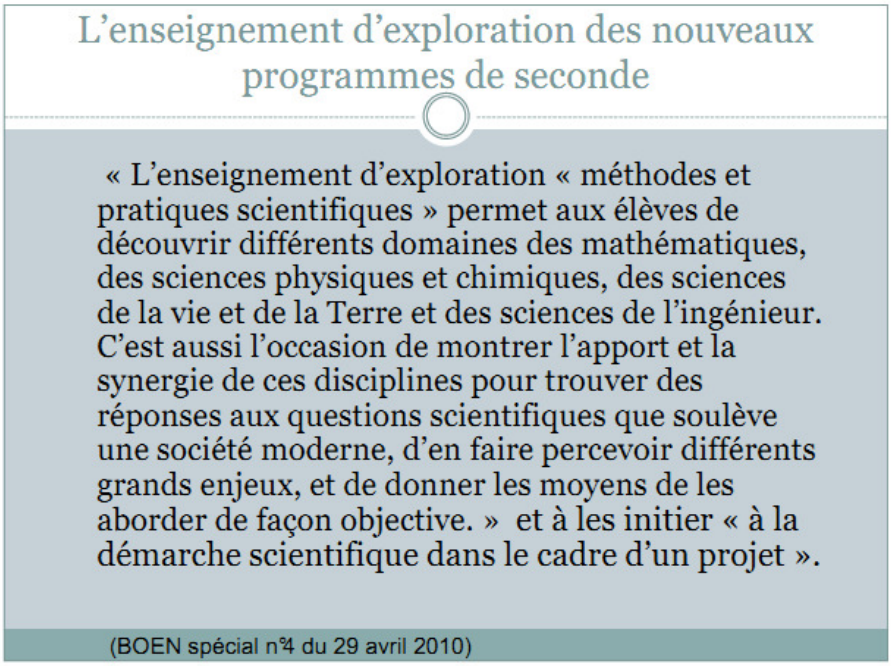

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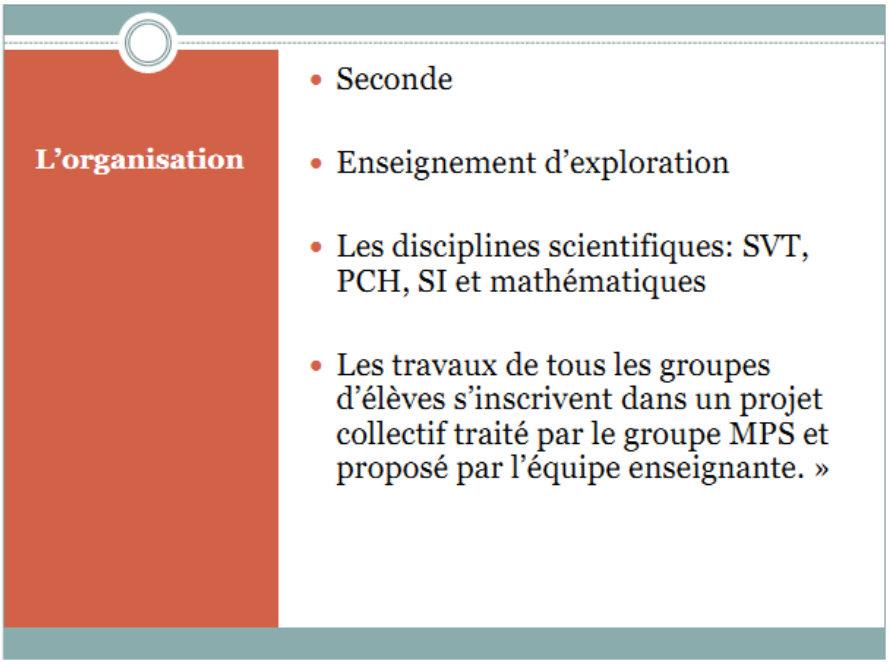

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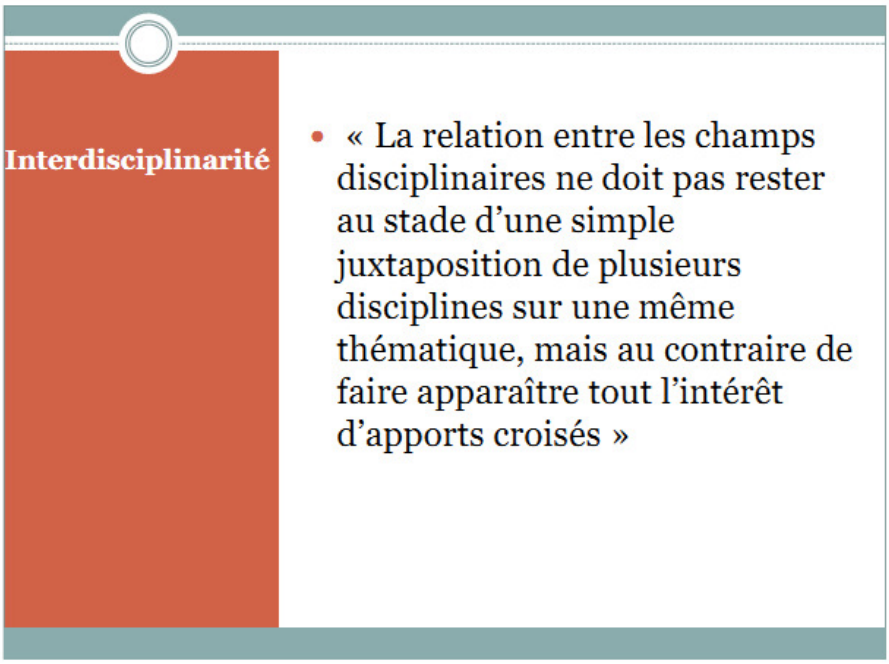

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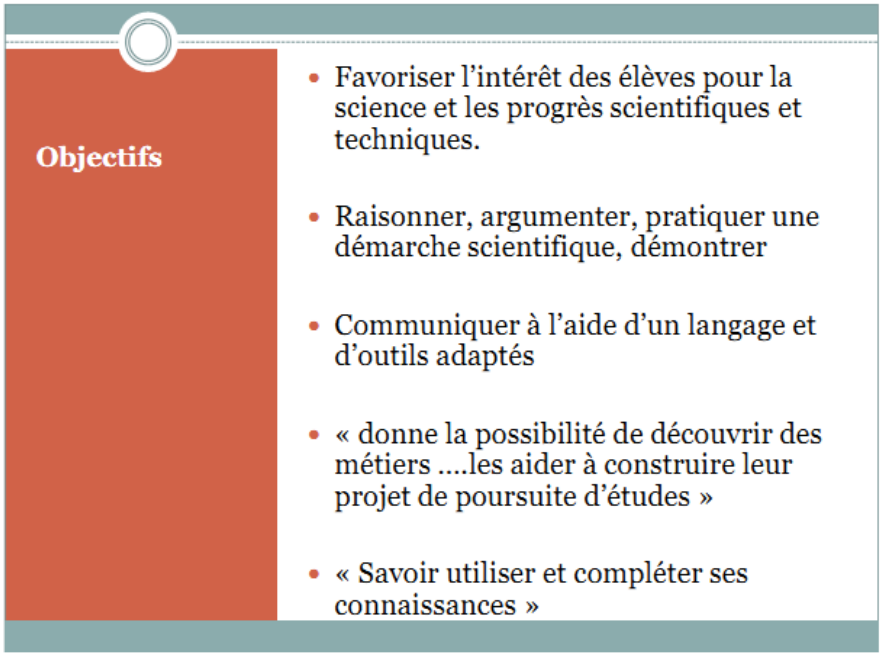

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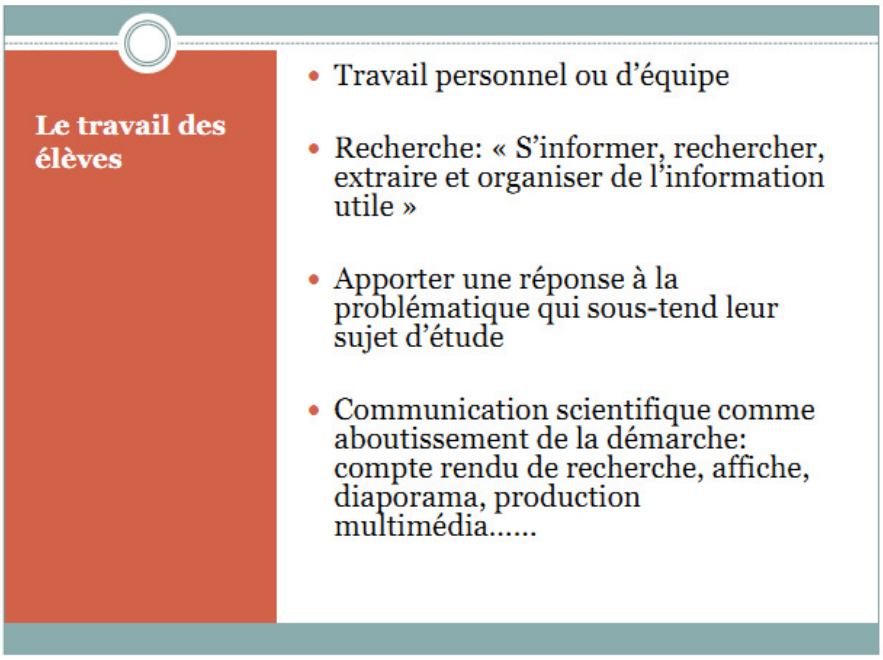

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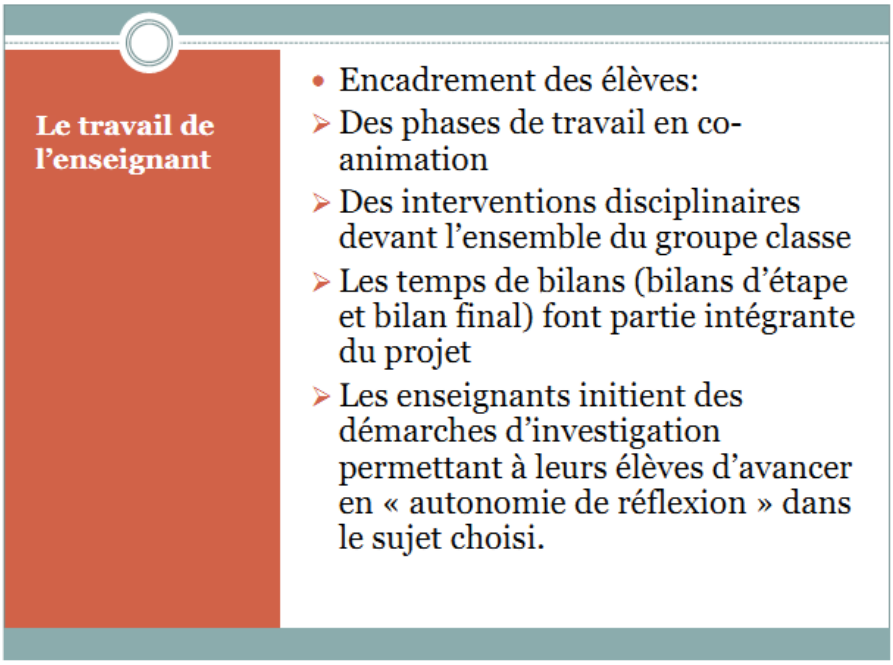

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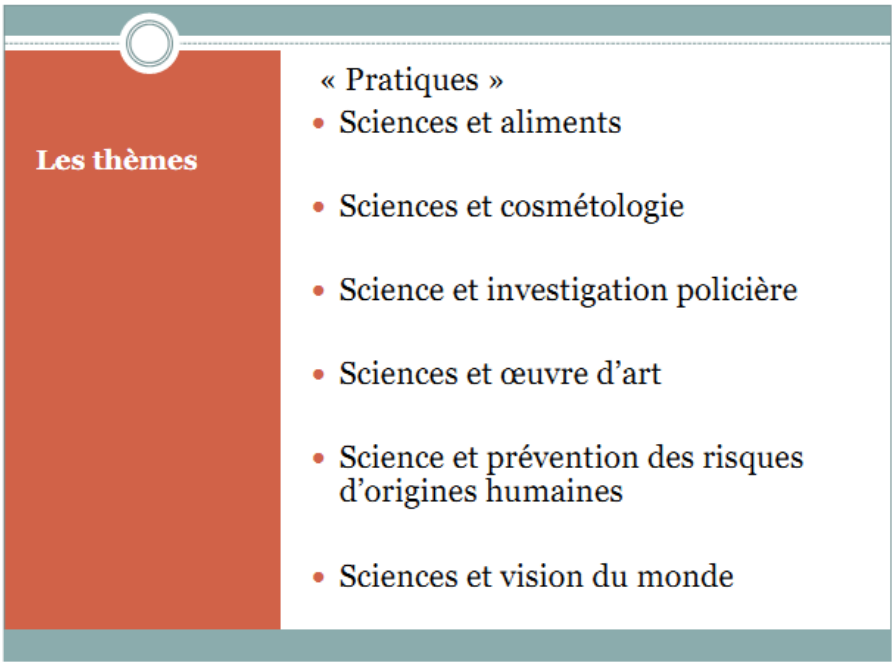
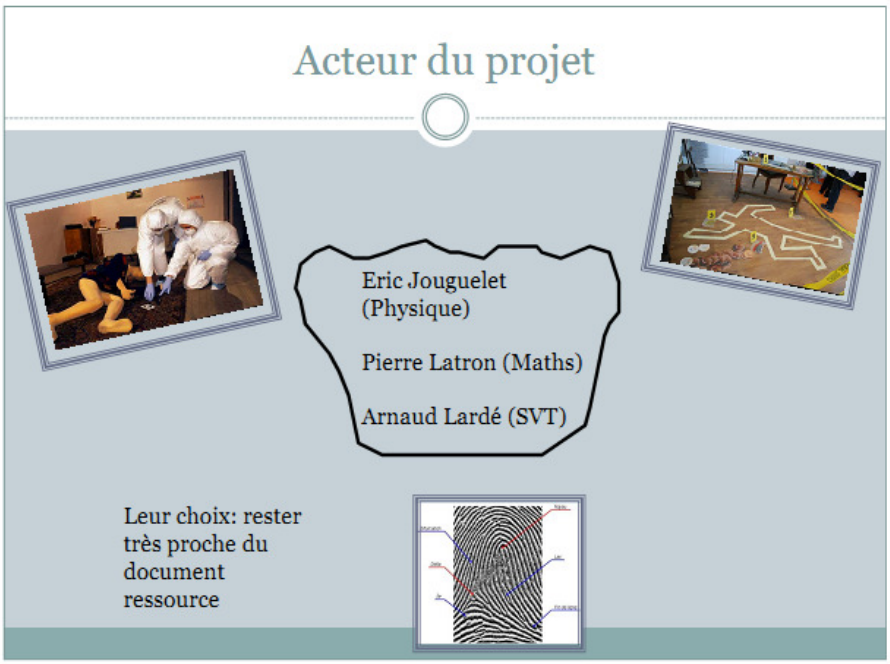


SLIDE 11

SLIDE 12

SLIDE 13

SLIDE 14



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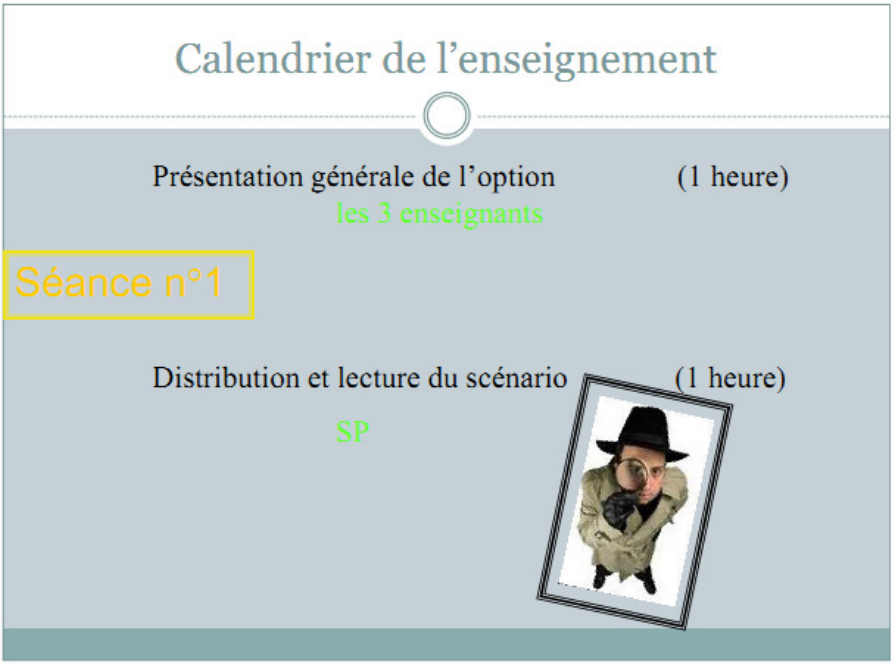
SLIDE 16



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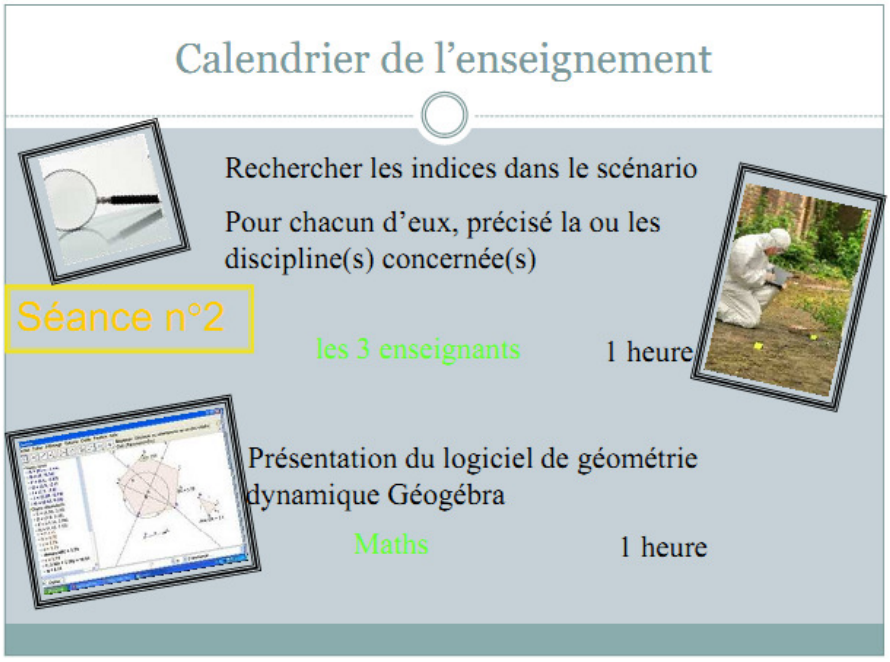

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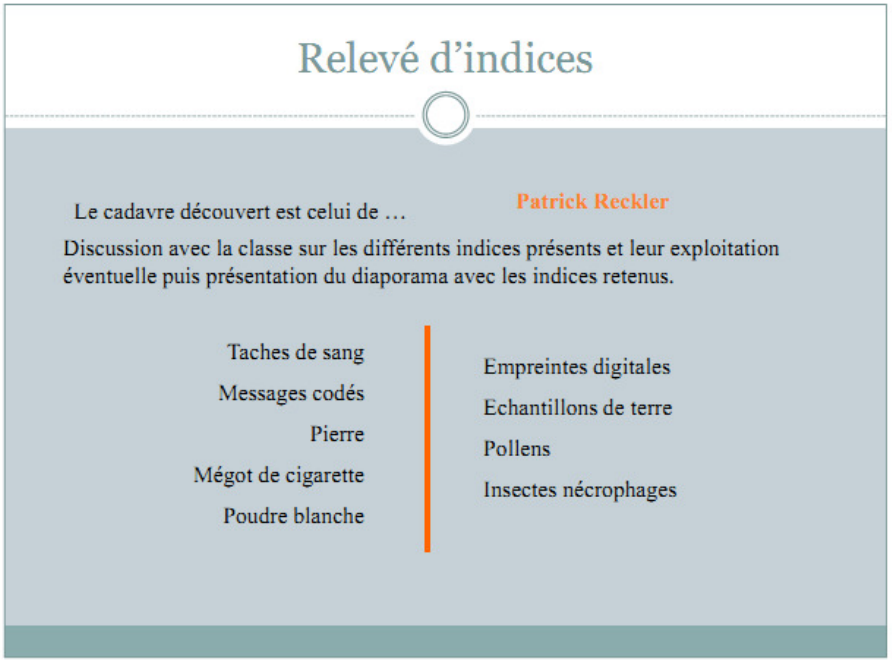


SLIDE 19

Travail sur GéoGébra

Maths 1 heure

Séance n°3

Présentation du travail attendu sur les métiers

SVT 1 heure

SLIDE 20

Travail sur GéoGébra

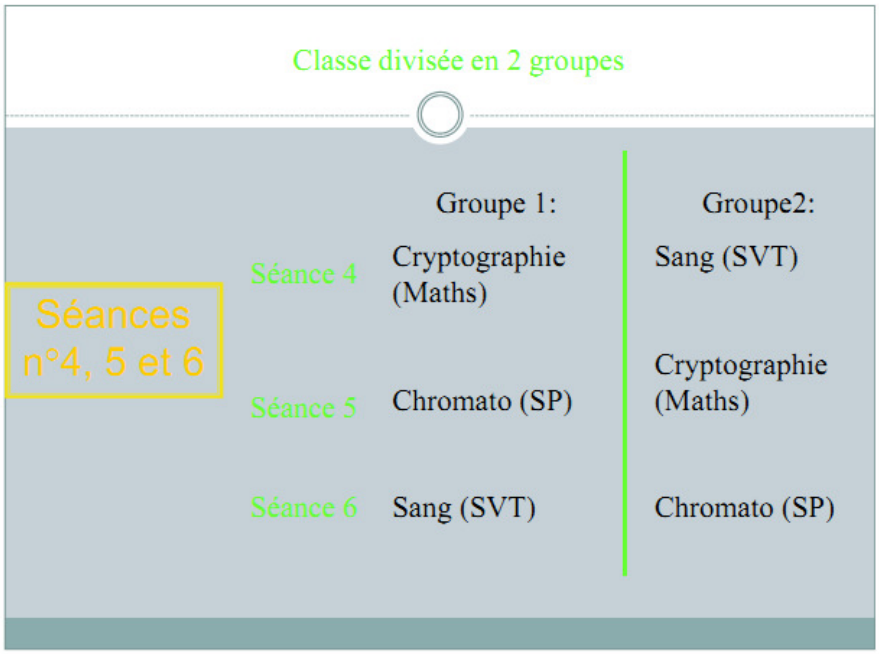
Les élèves s'approprient le logiciel GéoGébra;

Devoir à rendre (par groupe): refaire à l'échelle les plans à main levée réalisés par le commissaire Fleury.

Points pris en compte pour l'évaluation:

- Respect du croquis
- Respect de l'échelle
- Précision
- Propreté de la présentation: (suppression de noms ou d'objets inutiles).

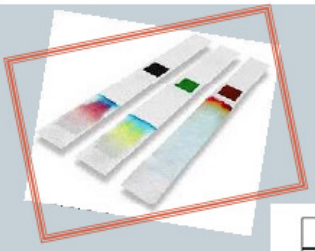
SLIDE 21



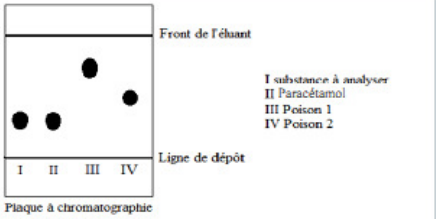
SLIDE 22

SLIDE 23

TP de chromatographie



Il s'agit de vérifier si la poudre blanche trouvée à côté du tube de paracétamol est bien du paracétamol



Avancée de l'enquête: la victime n'a pas été droguée

SLIDE 24

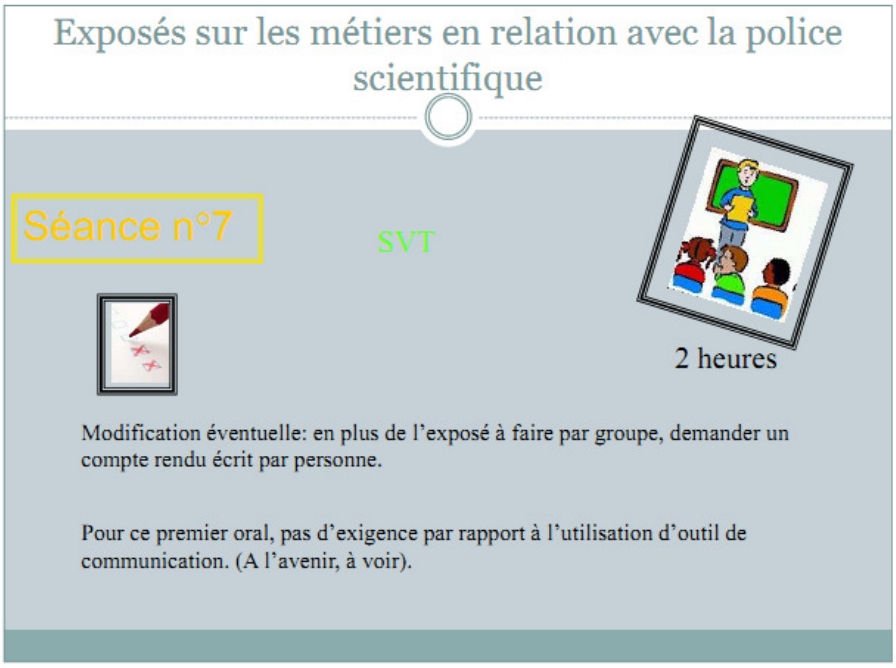
TP sur le sang

Etude des taches trouvées sur le mur et au sol dans l'appartement de Renaud Clapeyron:

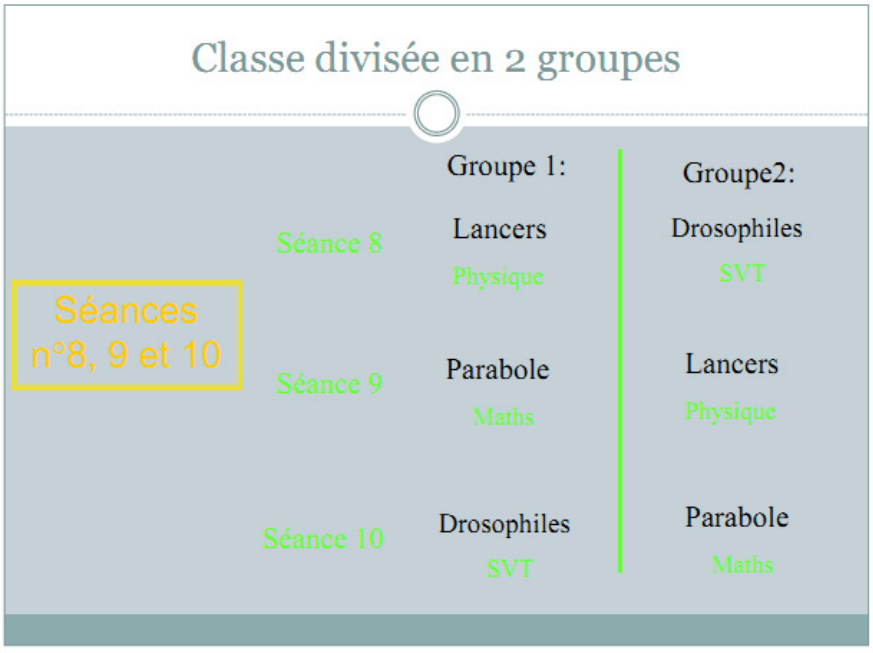
- S'agit-il de sang?
- Si oui, est-il compatible avec les groupes sanguins de ses parents (est-il possible que ce soit le sien)?

Avancée de l'enquête: il est possible que le sang trouvé soit celui de Renaud

SLIDE 25



SLIDE 26



SLIDE 27

Travail sur les lancers

Il s'agit de montrer qu'un corps en mouvement décrit généralement une parabole.

Utilisation du logiciel Latis Pro

Pour l'enquête: on s'interroge sur la présence de la pierre dans l'appartement de Renaud: peut-elle avoir été lancée de l'extérieur?

Conclusion: On ne peut pas répondre à la question sans l'aide des Mathématiques!

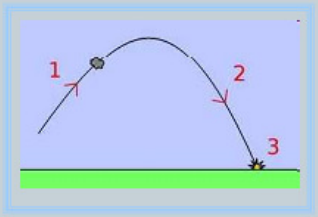
SLIDE 28

Travail sur la parabole

Sachant que si la pierre a été lancée de l'extérieur, elle décrit une parabole, chercher à l'aide de GéoGébra si une telle parabole existe.

On reprend donc le plan de la façade de l'appartement en tenant compte de la position de la fenêtre, de ses dimensions, de la hauteur du plafond…

Chaque groupe d'élèves trouve une telle parabole, en donne une équation.



Retour vers le professeur de Physique pour savoir si une telle trajectoire est plausible

Pour l'enquête: on ne dispose toujours pas de conclusion par rapport à cette pierre!!

SLIDE 29

Préparation de la sortie à l'ENSOP

0,5 heure

Physique

Séance n°11

Parabole, enfin la conclusion!!

Physique + Maths

1,5 heure

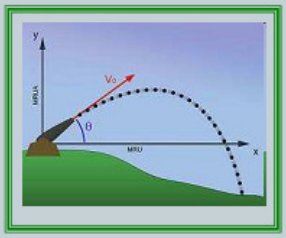
SLIDE 30

Peut-on tirer quelque chose de cette pierre???

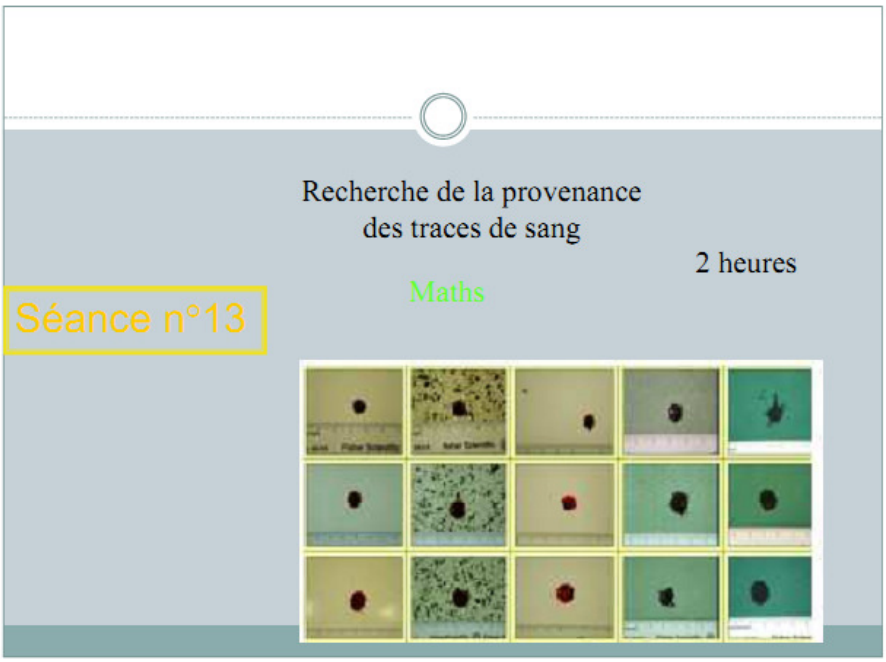
On reprend l'équation de la parabole obtenue précédemment et on calcule la vitesse initiale de la pierre pour que la parabole soit effectivement la trajectoire.

Pour chaque groupe, la vitesse initiale est trop grande pour que la pierre soit lancée de l'extérieur.

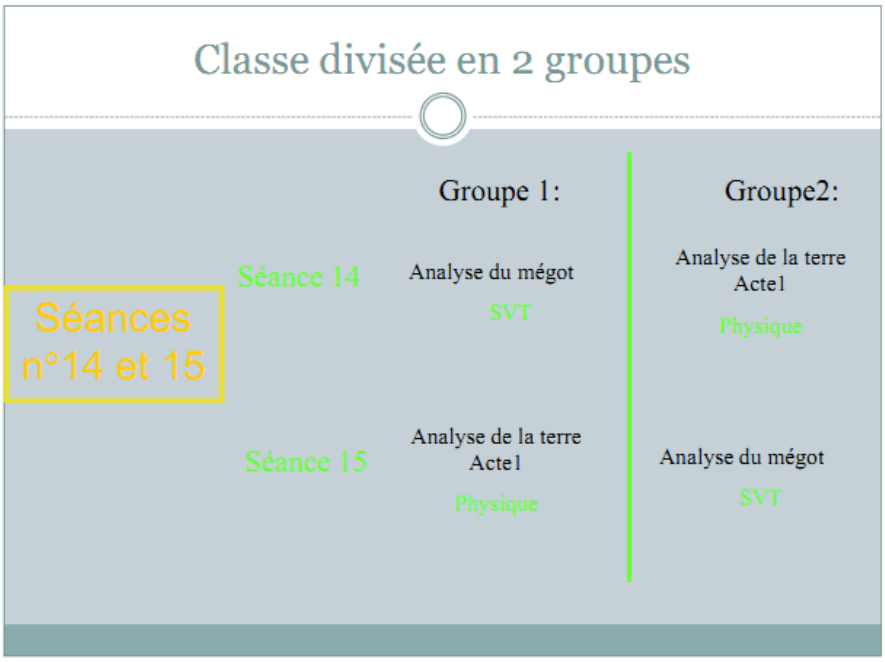
Avancée de l'enquête: la pierre n'a pas été jetée de l'extérieur, inutile donc de chercher des témoins oculaires!!



SLIDE 31



SLIDE 32



SLIDE 33

Analyse de la terre - Acte1

Déterminer le taux de calcaire de différents échantillons de terre pour identifier celle retrouvée sous les chaussures du cadavre.

Principe du TP:

Déterminer le volume de dioxyde de carbone dégagé par un gramme de craie.

Déterminer le volume de dioxyde de carbone dégagé par 10 grammes de chaque échantillon de terre.

Avancée de l'enquête: l'échantillon de terre provient de la vallée de la Seine, proche du lieu de travail de Karl Weierstrass.

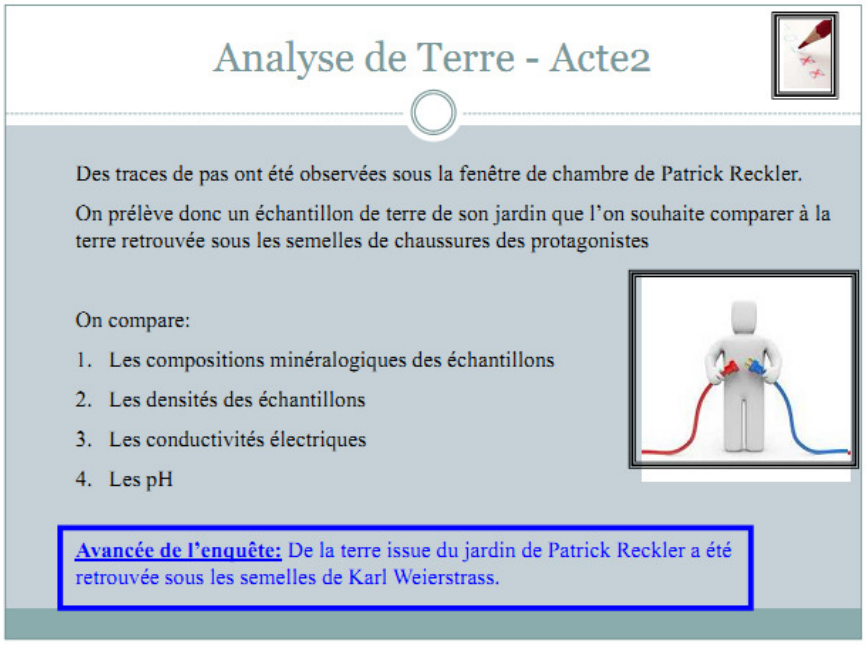
SLIDE 34

Classe divisée en 2 groupes

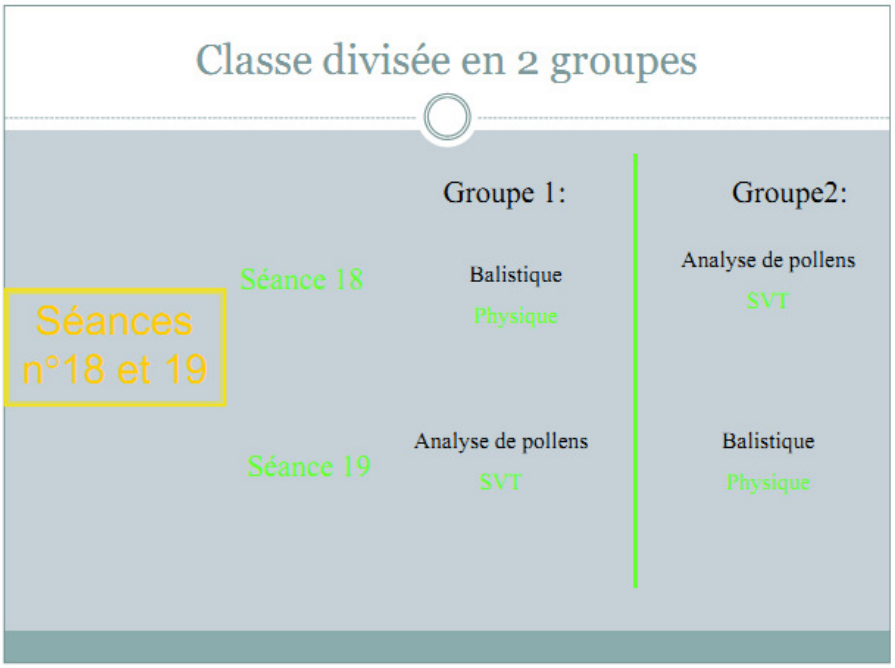
Séances n°16 et 17

	Groupe 1:	Groupe2:
Séance 16	Les indices discrets Physique	Analyse de la terre Acte2 SVT
Séance 17	Analyse de la terre Acte2 SVT	Les indices discrets Physique

SLIDE 35



SLIDE 36



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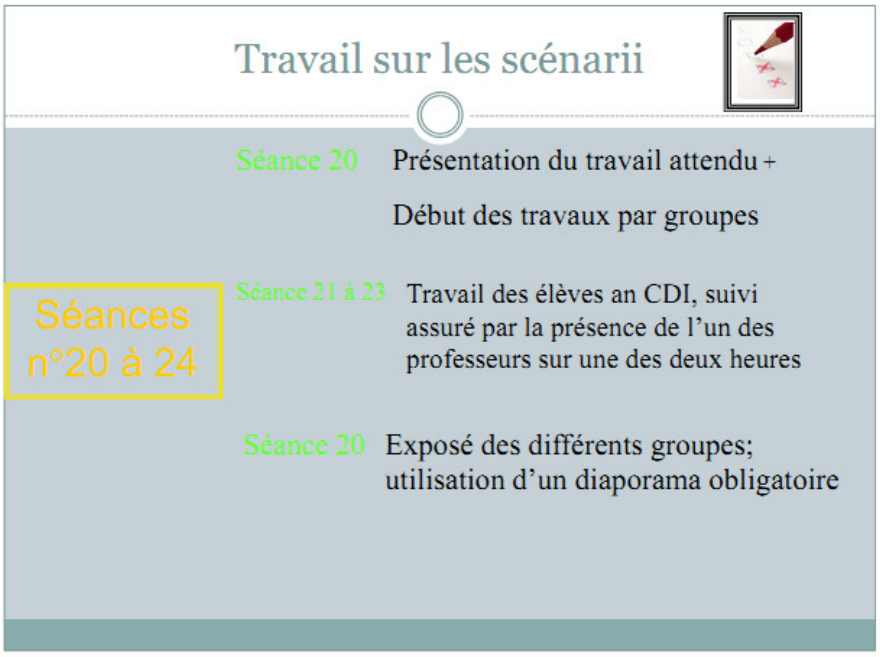
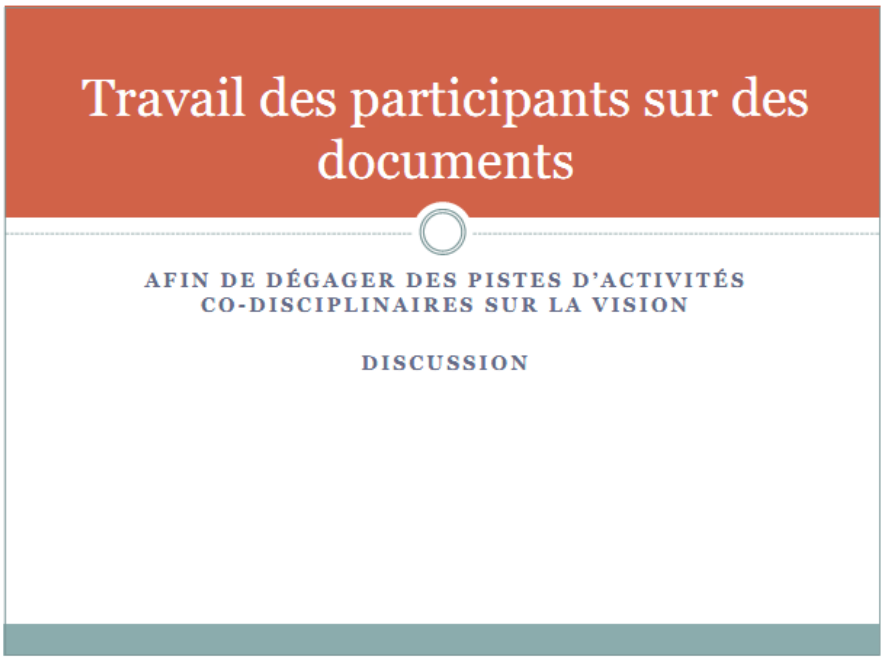


SLIDE 38

SLIDE 39



SLIDE 40

SLIDE 41

Ebauche de scénarisation

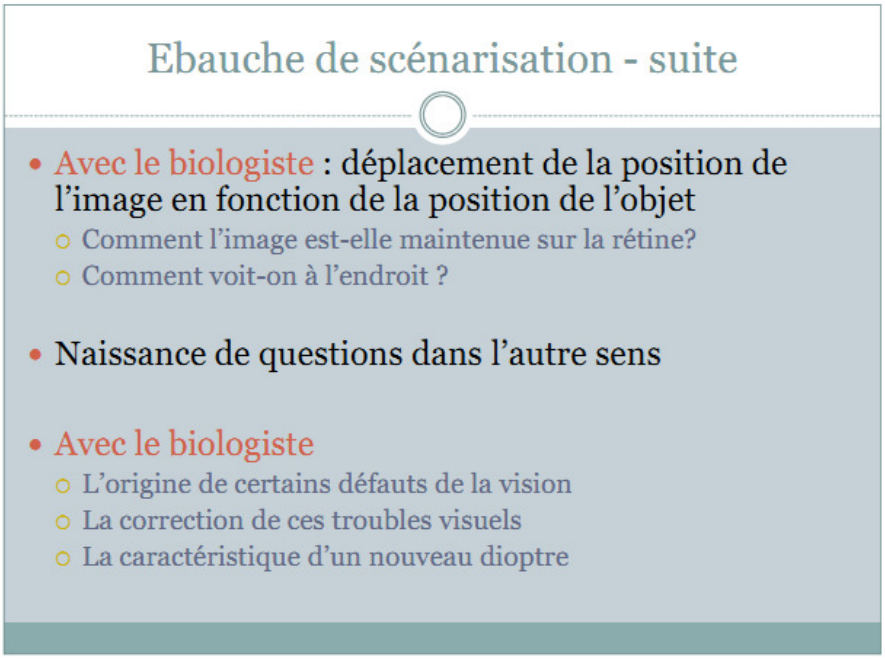
- Avec le biologiste : l'anatomie de l'œil : le cristallin est une lentille convergente
  - la formation d'une image réelle au fond de l'œil.
  - Le remplacement de la totalité de l'œil par une lentille mince convergente de 15 mm de distance focale qui serait positionnée sur le cristallin.
- Avec le physicien : la construction réelle des images dans l'œil : les changements d'indice de réfraction
  - en traversant la cornée
  - en traversant le cristallin

SLIDE 42

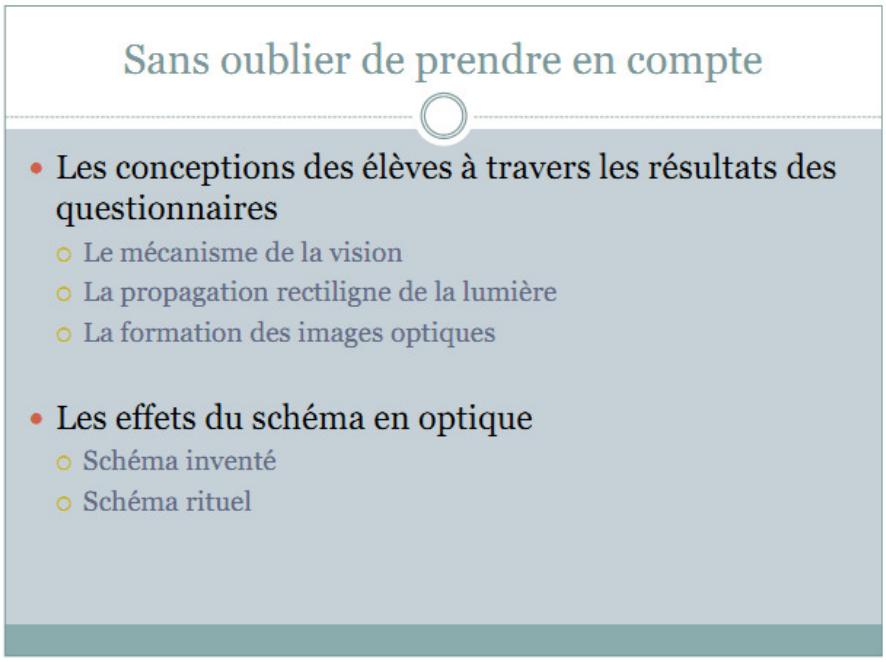
Ebauche de scénarisation - suite

- Le biologiste : la courbure du cristallin et sa position dans l'œil.
- Avec le mathématicien : explorations qualitatives et quantitatives à l'aide du logiciel GeoGebra
  - Image de même direction mais inverse
  - Taille d'un objet et celle de son image
  - L'abscisse d'un point image situé sur l'axe optique et celle du point objet
  - Relation de Descartes

SLIDE 43



SLIDE 44



SLIDE 45

LE CRIME DE LA RUE DES TANNEURS DE PROVINS

Louise, seule dans son appartement à villiers-Saint Georges, essayait de trouver le sommeil en regardant un vieux Derrick enregistré en allemand sous-titré. Soudain elle sursauta. Des cris semblaient jaillir des murs. Après quelques secondes, elle sentit que les bruits forts provenaient du studio au dessus d'elle. Que faire ? Elle tremblait ! Devait-elle appeler la police? Elle se rappela cependant qu'elle avait gardé le numéro de la sœur de son voisin du dessus.Elle appelle au téléphone la sœur de Monsieur Clapeyron, Anna Weierstrass. Elle répondit tout de suite: habitant Montereau, elle n'avait pas le choix : même s'il n'y avait rien, elle devait se rendre à Provins. Pendant le trajet en voiture, elle essayait de trouver des souvenirs communs avec son frère. Renaud est un homme discret qui travaille actuellement dans une entreprise de chimie proche de Nangis et vit seul dans l'appartement de Provins de la rue des Tanneurs. C'était un ancien camarade François Clerc chimiste qui lui avait conseillé la ville. Maintenant la seule passion en dehors de la chimie était le golf. Il y jouait souvent avec Jonathan Moivre, son adversaire préféré. Ils s'étaient connus dès son arrivée dans la Brie. Jonathan était professeur d'espagnol au lycée de la Sainte Chapelle. Le destin avait rapprochés Renault et sa sœur Anna qui avait suivi son mari Karl à Montereau. Elle n'aimait pas cette ville mais Karl était responsable d'un lieu de stockage du géant allemand de l'armement au bord de la Seine. Anna arriva à l'immeuble et vit Louise qui l'attendait nerveusement. Après plusieurs coups de sonnette infructueux, elle ouvre l'appartement avec le double de clés en sa possession. Tout est en désordre, le frère n'est pas là, n'est plus là. Anna, très anxieuse, appelle la police. Quelques dizaines de minutes plus tard, en arrivant sur place, les policiers estiment la situation suffisamment grave pour contacter le procureur de Melun. Celui-ci commande l'intervention immédiate des techniciens de la police scientifique qui arrivent et photographient les lieux. Dans l'appartement de Renaud, les inspecteurs ont retrouvé son carnet d'adresse : le commissaire se rend au domicile de Patrick Reckler indiqué rue de Charmois à Courton l'Eglise. Le lendemain, Muni de l'autorisation du juge et surtout accompagné du serrurier, le commissaire entre dans la maison. En poussant la porte, le bureau détone par rapport au reste : des traces de sang tachent la moquette. L'ordinateur est encore allumé. La brigade trouvera en effet le lendemain dans la corbeille du gestionnaire de messagerie de l'ordinateur, parmi des courriels d'échanges anodins, un email codé. Pendant ce temps, les mathématiciens de la section balistique ont été mobilisés pour identifier le point d'où a pu être lancée la pierre trouvée au domicile de Monsieur Clapeyron et présente les premiers résultats des premières études sur la trajectoire de la pierre…Le promeneur devait remplir son devoir quotidien : Negra, sa Jack Russell noire était bien exigeante : elle désirait une promenade tous les jours. Sur leur chemin, un corps dont la mort remontait visiblement à plusieurs jours a été trouvé. Le promeneur devient terrorisé, choqué : il prend son portable et appelle le 17. Arrivés sur les lieux, les policiers de permanence ce dimanche soir font le lien avec la disparition de Monsieur Clapeyron et appellent aussitôt le commissaire Fleury à son domicile. Malgré l'état avancé de décomposition du cadavre, ceux-ci l'identifient et chargent les techniciens de la police scientifique d'un relevé d'indices. Le corps est emporté à l'institut médicolégal pour autopsie et prélèvement d'indices supplémentaires. Le mystère semble s'épaissir…Quelques jours plus tard, Fleury finissait sa journée dans son jardin, il réfléchissait à l'affaire en taillant ses beaux rosiers avant les premières gelées. Et là, soudain, tout se mit en place : les dix indices qu'il avait répertoriés commençaient à s'assembler et il avait maintenant une vision claire de ce qui s'était passé. Il allait téléphoner tout de suite au juge d'instruction pour qu'il interpelle le coupable. C'était bien sûr cette personne! Le procès allait

être retentissant ! Du jamais vu à la cour d'Assises de Melun. Saurez-vous, vous aussi, trouver le meurtrier de Renaud Clapeyron? N'oubliez pas qu'il faut des preuves solides pour arrêter un homme et que, jusqu'à son passage devant Thémis, il demeure innocent.