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STRATEGIES FOR ENHANCING MATHEMATICAL CONTENT KNOWLEDGE

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Strategies for Enhancing Mathematical Content Knowledge

Synopsis:

The focus of this presentation will be mathematical strategies that were presented to teachers (K -8) in a funded project that was administrated by the Arkansas Department of Education.

Strategies for Enhancing Mathematical Content Knowledge

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Synopsis

This presentation is based upon a project funded in part by a federal grant under Title II Part B of the No Child Left Behind Act (P. L. 107-110) administered by Arkansas Department of Education.

The goal of this project is to increase the level of content knowledge and skills in STEM areas by integrating science, technology, engineering and mathematics with literacy programs.

Thirty teachers participated in a professional development course that integrated science, mathematics, literacy, and technology for elementary/middle level teachers from the central part of the state.

The focus of this presentation will be the mathematical strategies that were presented to teachers.

Background

The teachers were presented with several books and articles from *Teaching Children Mathematics* and *Mathematics Teaching in the Middle School*. The articles were discussed---summarized, how to implement, etc. The mathematical concepts were then connected with the science concepts that had been presented earlier that day.

June 24, 2014

This session was also in two parts. The first part of the literature section was to select an article from a, b, or c below.

- a. "Making Technology Work" by Tanja Soucie, Nikol Radovic, and Renata Svedrec in *Mathematics Teaching in the Middle School*, Vol. 15, No. 8, April 2010, 466-471.
- b. "Tech-Knowledgey & Diverse Learners" by Jennifer M. Suh in *Mathematics Teaching in the Middle School*, Vol. 15, No. 8, April 2010, 440-447
- c. "Integrate Technology with Student Success" by Drew Wolf, Patrick Lindeman, Trent Wolf, and Robert Dunnerstick in *Mathematics Teaching in the Middle School*, Vol. 16, No. 9, May 2011, 556-560.
- d. "I have the answer; who has the question?" by Jeffrey J. Kuntz in *Teaching Children Mathematics*, Vol. 17, No. 1, August 2010, 48-51.

Afterwards, each article was summarized and discussed (what impressed you, what would you like to ask the author/s, and how you would implement the idea in your class).

All teachers were to skim "I have the answer; who has the question?" They were then asked to write five answers to the topics that were discussed and write the five corresponding answers (see Figure 4).

Figure 4 I have the answer; who has the question?

List your five answers to concepts that were presented today. Then, list your five questions.

Five Answers	Five Questions
1.	
2.	
3.	
4.	
5.	

Their papers were collected. The instructor read the answers and they gave the questions. Many stated that this was just like the television program called "Jeopardy." Additionally, they stated that it was an ideal way to review as well as to assess their knowledge.

June 27, 2014

This session was divided into two parts: examining children’s literature books and altering a mathematics activity to review science concepts.

The teachers reviewed the following books from a county library:

Cobb, Vicki. *Whirlers and Twirlers: Science Fun with Spinning*

Daley, Michael. *Amazing Sun Fun Activities*

Discovery Channel School. *Physical Science: Electricity*

Gray, Leon. *Electricity*

Hollihan, Kerrie Logan. *Isaac Newton and Physics for Kids*

Parker, Steve. *Electricity*

Riley, Peter D. *Magnetism*

Woodford, Chris. *Electricity and Magnetism*

Although this part was not as engaging as others, the teachers valued the time to examine the children’s literature books and discuss them with teachers from different schools.

They were then introduced to “I’ve Got Your Number.” This seasoned activity involved having the number on one side of an index card and the question on the other side. The game was altered. For mathematics, several teachers changed to “Who has my card? For science, the title remained so that the science concepts could be used. Examples are given below (see Figures 1, 2, and 3).

Figure 1 Who knows the concept

Front	Back
My term is polarity.	Polarity is the separation of an electrical charge leading to... What three metals have the capability to be magnetized?
Iron, cobalt, and Nickel	These are the three metals. Where does the word magnet come?
Greek.	Magnet comes from Greek. What was the strongest magnet?

Figure 2 Who knows the concept

Front	Back
My concept is geometry.	Who has... What unit of measure are angles measured in?
I have degrees.	Who has... What kind of triangle has a 90° angle?
I have right triangle	Who has.. What kind of triangle has all angles less than 90° ?
I have acute angle	What has... What kind of triangle has 3 equal angles?

Figure 3 Who has my card

Front	Back
12	My number is 12. Who has $12 \times (-2)$?
-24	$-24 \div (-3)$
8	$8 + (-4)$
-4	$-4 - (-10)$

October 2014

After reading “Vocabulary Support: Constructing (Not Obstructing) Meaning” by Livers and Bay-Williams, the teachers made a Flow Decision Chart (Livers and Bay-Williams) similar to the one on page 155 of the article for the mathematical concepts that had been presented earlier that day. This activity/strategy was not as successful as others. The teachers were not certain with the vocabulary in terms of the concept and the context as presented in the article. Thus, more time was needed to discuss the article prior to the teachers making their own chart.

April 2015

Prior to reading “Oral Language Needs: Making Math Meaningful” (Pace and Ortiz), the instructor modeled her choice. She asked the teachers to find examples of points, line segments, and triangles from one page in the newspaper. The examples of points were circle in red, the line segments in blue, and the triangles in green. The teachers gave her a list of what they found. For example, periods, colons, and dots were found points. She then shared with the teachers that she was using *d*, which will be explained later, as an assessment of the mathematical terms by incorporating literature (newspaper). As the teachers read the article,

they were to respond to a handout (see Figure 5 for some responses). For questions 1-4, they were to answer according to the authors and then their opinion. Next, they were to select *a* (strong foundation), *b* (vocabulary strategy), *c* (help students learn), or *d* (other) to use for a vocabulary word or term in science or mathematics. This information was to be placed on poster board prior to each group presenting their concept.

Figure 5 Making Math Meaningful

1. How can one build a strong foundation?

Article	<ul style="list-style-type: none"> Well-developed oral language=expansion Under developed oral language= development Instruction & activities should develop and extend oral language through opportunities such as hearing/using good language models, talking about/discussing meaningful topics, etc. Build vocab/create foundation
You	Give students a multitude of opportunities to develop/extend their oral language

2. What was the vocabulary strategy?

Article	<ul style="list-style-type: none"> Vocabulary chart activity Sharing their work
You	<ul style="list-style-type: none"> Students learn new words best by seeing multiple examples of work/def. (Ex: join= send one kid to a center-have another <u>join</u> him) Sharing makes learning more concrete/valuable

3. How are students helped to learn?

Article	<ul style="list-style-type: none"> Embrace the foundational needs of each student and create a firm basis that meet students at their individual level
You	Kids need a strong foundation that meets their needs.

4. What is a diverse, adaptable, useful tool?

Article	<ul style="list-style-type: none"> • Language development is an ongoing skill. • Learning of vocabulary words is a quick formative assessment for progress monitoring.
You	Language development continues throughout grade levels/life= constant process of growth

5. What were some vocabulary terms (meteorology, planisphere, etc.) that were used this morning?

- Climate
- Weather
- Constellation
- Clouds
- Doldrums

6. Select three terms from #5 above and then select one of the ideas to address.

- Strong foundation*
- Strategy*
- Help them learn*
- Other, describe*

Vocabulary	Selection	Your response
i. Doldrums	<i>a b c <u>d</u></i> Story telling	When it rains excessively below the equator it is called doldrums
ii. Climate	<i>a <u>b</u> c d</i>	Illustrations of what they think climate is
iii. Clouds	<i>a b <u>c</u> d</i>	Show how to draw types of clouds

Of those completing the handout, more selected (b) (see Figure 6). Their specific methods included illustrate what they think, model, label, create, define, and the like.

Figure 6 Selections

Choices	Frequency
A	8
B	15
C	8
D	5

Comments

The teachers stated that they enjoyed reading the current articles from *Teaching Children Mathematics* and *Mathematics Teaching in the Middle School* and examining children's literature books from the libraries (county and university). Several reported that the format was helpful; that is, in identifying the children's literature books, the location was given--- county library or university. Furthermore, connecting the mathematics ideas with the science modeled the integration of the subjects which they could use in their classrooms. Some voiced that they had tried a particular idea as well as how the idea could be amended for their classroom. Additionally, several wanted more time to discuss the articles. According to their questions about the direction of the arrows in the flow chart, more time was needed to discuss the article by Livers and Bay-Williams.

References

(Children's Literature not included)

Kuntz, Jeffrey J. (August 2010). I have the answer; who has the question? *Teaching Children Mathematics*, 17 (1), 48-51.

Livers, Stefanie D. and Jennifer M. Bay-Williams. (October 2014). Vocabulary Support: Constructing (Not Obstructing) Meaning. *Mathematics Teaching in the Middle School*, 20 (3) 152-159.

Pace, Michelle H. and Enrique Ortiz. (April 2015). Oral Language Needs: Making Math Meaningful. *Teaching Children Mathematics*, 21(8), 494-500.

Soucie, Tanja, Nikol Radovic, and Renata Svedrec. (April 2010). Making Technology Work. *Mathematics Teaching in the Middle School*, 15(8), 466-471.

Suh, Jennifer M. (April 2010). Tech-Knowledgey & Diverse Learners. *Mathematics Teaching in the Middle School*, 15(8), 440-447.

Wolf, Drew, Patrick Lindeman, Trent Wolf, and Robert Dunnerstick. (May 2011). Integrate Technology with Student Success. *Mathematics Teaching in the Middle School*, 16(9), 556-560.