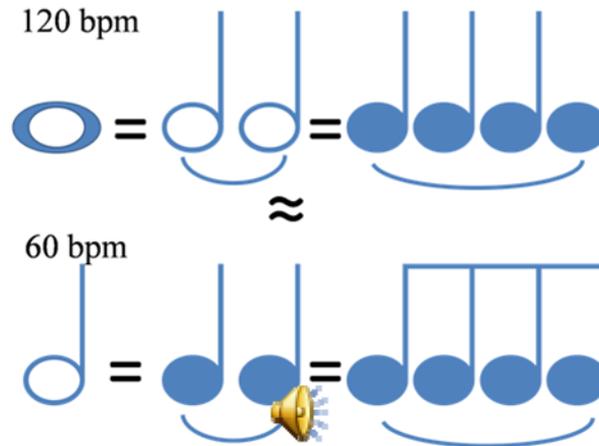# Making Connections

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Connections

- **Introduction**

- **Section 1**: Connections within Mathematics

- **Section 2**: Connections with Everyday Life

- **Section 3**: Connections with Other School Subjects

- **Reflections and Evaluation**

Purpose of Module

Provide grades 6 – 8 mathematics teachers with

- additional mathematics content knowledge

- pedagogical knowledge for how to use mathematical connections to assist their students in developing deeper comprehension of mathematical concepts

Goals and Objectives

- Extend comprehension of connections between various mathematical areas

- Explore appropriate connections between mathematics and everyday life

- Develop ideas of how to make connections across the curriculum using mathematics and social studies, language arts, music, and the sciences

Standards

NCTM states in their *Principles and Standards* that K-12 students should be able to-

- Recognize and use connections among mathematical ideas;

- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;

- Recognize and apply mathematics in contexts outside of mathematics.

State Expectations

- The Michigan Department of Education states in the *Mathematics Grade Level Content Expectations,*

    "Students must be able to apply knowledge in new situations, to solve problems by generating new ideas, and to make connections between what they learn in class to the world around them."

- Many other state programs, such as 'Writing Across the Curriculum' and the Michigan Curriculum Framework, advocate a stronger emphasis on interdisciplinary and real life connections.

Types of Connections

Three main topics emerge when mathematics connections are discussed:

- Connections between mathematical subjects

- Connections between mathematics and everyday life

- Connections between mathematics and other school subjects

Section I: Connections within Mathematics

- Mathematics is cumulative in nature.

- 'When students lack a strong conceptual understanding, they tend to view mathematics as a set of arbitrary rules. To overcome this tendency, students need experiences that involve them directly in connecting mathematical processes with mathematical concepts.' – *Navigating Through mathematical Connections in Grades 6-8* (NCTM, 2008)

Modeling

- Modeling is the quintessential connection making tool.

- One major connection that mathematicians often take for granted is the connection between different representations.

- By modeling a situation using various mathematical concepts, connections can be created between the representations.

Ordering Pizza

- Use the internet to find a local pizza delivery menu.

- How do you think a pizza delivery menu could be used to show connections between different representations of linear relationships?

- Discuss your ideas with the group.

Sample Pizza Menu: Genos Pizza Menu.doc

Hands Up! Who Likes Anchovies?

- Where would you start with this? Throw out some ideas!

- Using the form of your choice, represent the price of a small pizza as the number of toppings varies.

- Compare your representation to your neighbors. Did you choose the same way of representing the problem? Explain why you chose, say, a formula over a graph, or a data table over a formula.

Pizza Order:

1 small pizza w/ anchovies...
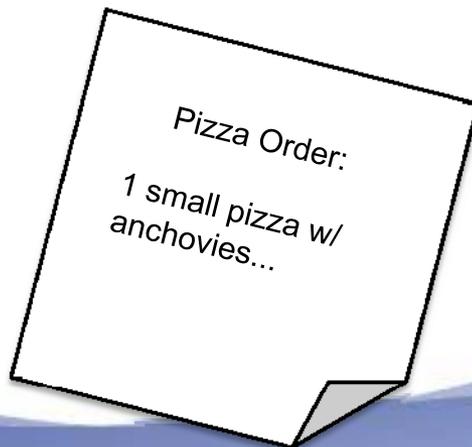
But What's a Better VALUE?

- Swap papers with someone who represented small pizza prices differently than you and use their method to add medium pizzas to their paper.

- Compare the two sizes. What do you notice?

- Most often, topping prices increase as the pizza size increases. Why does this happen?

- After getting in small groups with as many different representations in each group as possible, use each representation to compare the surface area of the pizza to the cost per additional topping. What observations can you make?

Activity Wrap-up

What connections were/could be made using this activity and a pizza menu?

- Connecting graphs, tables, and equations

- Introduction to why the Domain of a function matters (values for negative toppings don't make sense)

- Connecting Geometry and Algebra

This also uses a real life, non-contrived situation, which we'll discuss a little more in Section II.

Interventions: Flummoxed Functions

- One method of reinforcing this connection between different representations of a function is with a jigsaw game.

- The game, *Flummoxed Functions,* developed by Connie Doorlag (Western Michigan University), gives students an opportunity to practice these connections. Take a few minutes to review the game hyperlinked below and consider how you might use this resource in your classroom.

FLUMMOXED FUNCTIONS.doc

Interventions: Mathematics Teaching in the Middle School

- "Developing Mathematical Understanding through Multiple Representations" (*Mathematics Teaching in the Middle School,* 2008) by Preety Tripathi considers the purpose for studying multiple representations of a mathematical idea.

- Tripathi proposes that since mathematical representations often highlight only one aspect of a mathematical expression, multiple representations are necessary for deeper comprehension of mathematical concepts.

- After looking briefly at this article hyperlinked below, discuss your thoughts on this idea.

Multiple Representations MTMS Article.doc

Other Ideas

- Painting or carpeting a room/house has many mathematical implications, including connecting geometry to algebra and creating linear representations. Students could also explore the ideas of budgets in terms of picking products to use.

- Planning a road trip has many mathematical implications as well: converting miles per gallon to miles per dollar, finding times and costs of different routes, etc.

- Can you think of any other applications that would naturally encourage connections between different mathematical areas? Share these with the group.

Section II: Connections With Everyday Life

- The man ignorant of mathematics will be increasingly limited in his grasp of the main forces of civilization.
  ~John Kemeny

- The essence of mathematics is not to make simple things complicated, but to make complicated things simple.
  ~S. Gudder

- Watch this short You-Tube video, [Real Life Math](), that describes where we see math in the world around us.

Take a moment to consider. . .

- John is 12 years older than Jill, who is twice the age of Bob. Bob will turn 17 one year after Brandy, who is currently 14. How old is everyone?

- To clarify, I'd like you to take a moment to try to recall the last time you knew the mix of multiplicative and additive relationships between the ages of four people, the age of one, and needed to determine the age of all four.

Which World?

- An adult's world is filled with cars, shopping, work, and the occasional vacation. What fills a student's world?

- In connecting mathematics to the 'real world,' should it be the 'real world' of professional mathematicians and scientists, the 'real' adult world, or students' own world?

- Additionally, which world should we prepare them to enter, the current one, or the one that will be current five years from now?

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Take a Moment

- Consider the types of mathematical questions appropriate for your students. Take into account the connection to your students' real world and the appropriate skill level. Are there other considerations you should allow for?

- Analyze the word problems hyperlinked below. As a group, discuss how well students in your particular school would connect to these questions.

Connected Questions.doc

Resources for Real-World Problems

- Many websites exist that can be utilized as resources for real-world problems.

- Spend a few minutes exploring the following sources:
  - NCTM's *Figure This!*
    http://www.figurethis.org/index.html
  - Annenberg Media's *Math in Daily Life*
    http://www.learner.org/interactives/dailymath/
  - National Science Digital Library's Middle School Portal
    http://msteacher.org/epubs/math/math11/math.aspx
  - Education World
    http://www.educationworld.com/a_curr/curr148.shtml
  - What Good is Math?
    http://chalk.richmond.edu/education/projects/webunits/math/

Section III: Connections with Other School Subjects

- Go down deep enough into anything and you will find mathematics. ~Dean Schlicter

- Music is the pleasure the human mind experiences from counting without being aware that it is counting. ~Gottfried Leibniz

Mathematics and Social Studies

- Realizing that mathematics was developed with contributions from every race and culture helps students see mathematics as being more accessible ('Using Ethnomathematics to Find Multicultural Mathematics Connections', L. Shirley).

- Current events can be a catalyst for teaching mathematical concepts.

- Two excellent sources for finding appropriate current events stories that include well-developed lesson plans are PBS's Newshour Extra or The New York Times' The Learning Network.

- With your group, select one of these sources and investigate the lesson.

Mathematics and Social Studies: Value?

- Two important areas of emphasis in the state's content expectations for social studies

  - to give students a better understanding of current events

  - to promote a sense of civic responsibility and pride

- In addition to the examples already provided, what are some ideas for supporting these goals while teaching mathematics?

Mathematics and English Language Arts

- Students exhibit understanding in a variety of ways. A student may be able to explain the workings of a concept without being able to perform the mechanics thirty times in a row on a worksheet in fifty minutes.

- As an alternative method for assessing comprehension, ask students to write a short narrative in the first person from the point of view of a mathematical operation/formula/concept.

- With a partner, write a paragraph on "My Life as 'X'."

Done to Death . . . But Still Noteworthy

- A popular mathematics/literature link is the basic study of proportions linked to the three peoples – Lilliputians, Brobdingnagians, and Europeans in the book *Gulliver's Travels* ('*Projects in the Middle School Mathematics Curriculum*', Krulik and Rudnick or [MathThematics: Body Ratios](#).

- Similarly, *Alice in Wonderland* is often cited when teaching alternative base or modulo number systems. Lewis Carroll was, amongst other things, also a mathematician. The hyperlinked activities were developed by Mark Young as part of the Middle School Interdisciplinary Math Projects from Acadia University.

[Math and Alice In Wonderland.doc](#)

Reading List

- A reading list for extra credit could also be created using books with mathematical themes.

- *The Man Who Loved Only Numbers* is a relatively accessible book about Paul Erdös.

- *The Curious Incident of the Dog in the Night-Time* by Paul Haddon is a type of murder mystery told in the first person of a boy with Asperger's.

- Other suggestions can be found at www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp. All books, including the two listed, should be checked for age appropriateness for the community in which you live.

Interventions: Writing Word Problems

- Often, comprehension of mathematical concepts is increased by considering the concept from a different angle than previously studied.

- One example of this is to have students write their own word problems. Doing so forces students to consider what constitutes a good problem and to fully understand the concept.

- Amanda Stark, from the *Math in the Middle Institute Partnership*, created the hyperlinked worksheets that guide students through this process. Discuss whether using these worksheets would assist your students in developing mathematical connections to their real-world.

Student Written Word Problems.doc

Mathematics and ELA: Value?

- According to the MME, the area in which students are least proficient is writing. By incorporating writing into the mathematics classroom, we can not only give students an additional way to demonstrate proficiency, but also give them much needed practice in a vital subject in which their skills are woefully insufficient.

- U.S. adults rank 23rd in literacy compared to other countries.

- Students that go on to college will need to write about mathematics.

Mathematics and _____

- Geometry and Physical Education are closely linked, as are Fractions and Music.

- Review the hyperlinked materials and discuss other ideas you have regarding connecting mathematics with other school topics.

  Education World Sports and Geometry Lesson Plan
  Phil Tulga - Music Through the Curriculum
  Math and Music Unit.doc

Clarifying Points

- A mathematics classroom is a mathematics classroom. It is not being suggested that you give detailed or comprehensive instruction on another subject matter during mathematics time.

- You can, however, cooperate with a social studies teacher to use the context of a specific lesson, or coordinate with an ELA teacher to accept a writing about mathematics for English credit.

Reflections

- If you have used connections in your teaching, think about any that you have previously used. Compare and contrast your methods with those discussed in this session. Discuss with your colleague(s) what you have learned in this module and how you might apply some of the ideas within your own classrooms.

- You may have some favorite application problems for teaching connections effectively. Share yours with others at this time.

Evaluation

- Write a statement or two that summarizes what you have learned during this session.

- What would you like to have added to this session on connections?

- E-mail your responses to ruth.a.meyer@wmich.edu

References (Printed)

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- Holt, Rinehart, and Winston. *Mathematics in Context Level 3*. Chicago, IL: Encyclopedia Britannica, Inc, 2006. Print

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- www.cde.ca.gov/ci/sc/ll/ap/searchlist.asp
  - Searchable, filterable list of books with interdisciplinary value, including connections to mathematics.
- www.nctm.org
  - As always, the NCTM website is a rich resource of connections material, provided you have a membership.
- learning.blogs.nytimes.com/
  - The New York Times has established this area of its website to provide teachers lesson plans based on their news articles.
- www.pbs.org/newshour/extra/
  - PBS's News Hour, like the NY Times, provides lesson plans based off of current events.

Appendix

- Facilitator Notes

    Facilitator Notes Connections Module.doc