K – 12 Mathematics Vertical Team Meeting Notes
January 13, 2015

Members

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*__Bold__ – Members in Attendance

I. K – 12 Review of Math Concepts Students Struggle With

A. Mindy led the team through the Data Driven Dialogue Process (Predict, Go Visual, Observe, Infer – Action) to begin the process of understanding the big concepts/topics that students struggle with the most, K – 12.

B. Team members organized math topics by strand: Number and Operation (Red), Algebra (Blue), Geometry and Measurement (Green), Data Analysis & Probability (Purple).

C. Summary:

1. Results: See Attachment 1 (Mathematics Go Visual Process)
2. Results: See Attachment 2 (K – 12 Summary of Math Topics Students Struggle With)

II. Discussion of Mathematics Best Practice

A. The team previewed a list of instructional practices considered to be "Old School" and "21st Century Best Practice" and organized them into the two categories.

B. Groupings were compared to a handout provided by MDE, and adapted from Zemelman, Daniels, & Hyde (2005). Best Practice, (3rd Ed.). Heinemann: Portsmouth, NH. See Attachment 3: Best Practices in Mathematics

C. The team read an article, "What Does Good Math Instruction Look Like?" by Nancy Protheroe and then engaged in dialogue around the reality of mathematics instruction in our district as compared to what research says is best practice. Found online at:

http://www.naesp.org/resources/2/Principal/2007/S-Op51.pdf

III. Mathematics Vertical Team Next Steps

A. Develop strategies for pre-teaching next grade level standards after MCA test is complete (grades 3 – 5).
B. Revisit district power standards and review power standards established in other districts.
C. Concrete/Representational/Abstract – How do we do this? What is the relationship between this and the district-wide issue with math facts.
D. Create a professional development plan (booklet) of mathematics best practice/tool kit. Preview Pre-AP manuals from other districts.
E. Share strategies (K -12)

IV. Next Meeting

A. The next Mathematics Vertical Team Meeting is on March 24 (8 – 11) in the IGHMS Flexible Learning Space.

Attachment 1: Mathematics Go Visual Process

Observations

- Number and operations stand out = Math facts
- 6/10 posters list geometry
- Some struggles aren't in strand areas – habits of mind
- Independent transitions work/group skills – academic language
- Fractions – Grade 3 – Grade 4 transition
- Improper fractions, mixed, decimals – different tests ask for the answer in different forms

Inferences

- If we revisit the concrete base of understanding of processes and revisit them each year, will our students have a better understanding of math facts?
- Concrete – Representation – Manipulative
- Memorization – Abstract
- What is the best way to get from representation to memorization?
    - Number lines

Actions

- Assessment – Program/Re-teach – Monitor – Reassess
- Heineman. Com – moving kids beyond memorization

Attachment 2: Summary of Math Topics Students Struggle With

	Number & Operation	Algebra	Geometry & Measurement	Data Analysis & Probability
K	Addition & Subtraction (distinguishing between the two) (SH, PB) Teen #s (identifying , representing) (SH, PB)		Geometric Shapes 2D & 3D comparing) (SH, PB)	
1	Compose/Decompose #'s (PB) Ten more/less (All) Skip counting - 2's, 5's, 10's (PB)	Word problems (All) Missing number in equation (All)		
2	Fact fluency, number sense (PB) Place value, +/- number patterns, 2 digit addition (SH) rounding (especially down) HT problem solving/story problems (HT, PB) subtraction (SH, HT)	Number patterns - +/- rule (SH) Problem solving with unknown partners (HT)		
3	Place Value, Multiplying/Dividing, subtracting with regrouping, word problems	Word problems	Word problems, ometry, elapsed time	word problems, data analysis
4	Place value, long division, reducing fractions, improper - mixed - improper, equivalent fractions/common denominators, decimals, multi digit multiplication	Converting words into an equation	Elements of a uadrilateral (square is a rectangle but a rectangle is not a square) Area of triangle Area/Perimeter of irregular shapes	Scale of graphs
5	Order of operations (What method?) (HT) +/- Fractions (PB) Estimating (SH) Fractions (RNP?) Equivalents/Decimals (PB, HT) Real world problem solving (SH, PB) Decimals on a number line (SH, HT)	Properties (HT) Inequalities (SH)	Volume and Surface Area(PB)	

6	Number Sense - Facts (+, -, x, /), strategy transition into next levels (partial quotient division to dividing decimals) Fractions - Operational, problem solving, algorithms	Order of Operations - Rules- "Multiplication or Division" vs. "Always multiplication First" Organizing work	Use of math tools rotractors, rulers…) gorithms ocabulary and lygon identification	Note taking, showing work, working independently, test taking
7	Fractions- meaning of, connection to place value, operational Number Sense - basic operations - fluency, determining which operations to use, comparisons, procedural computations (ex. Fraction - Decimal)			Graphing - scaling x-axis, correct axis, plotting points Order of Operations
8	Integers Fractions	Linear Functions, solving equations, setting up algebraic expressions/equations, seeing the connection - graph/equation/table/words		
9	Integers - Pre Algebra Skills, fractions, decimals, non-calculator integer & whole # skills, understanding answer as fraction(mixed or improper), decimal equal to what fraction	Pre algebra skills, basic linear algebra remembered, non-calculator skills, graphing In linear algebra, meaning of what graph tells students, graphing calculator skills no longer taught, problem solving (word problems), how properties relate to skills	Vocabulary - hombus does not ual diamond, kite, oofs - 2 column ems most difficult, gebra skills lacking or learned creates big sues in geometry	Scientific notation - significant digits Skills no longer taught on graphing calculator & it is quickest way for MCA & ACT STEM & Leaf, Box plots, histograms, trends of graphs (Many classrooms do not have graphing calculators to teach with) Normal curve on MCA & not taught except in Mini Trig Unit Explanation of graphical results & translating to meaning

10	Integers - Pre Algebra Skills, fractions, decimals, non-calculator integer & whole # skills, understanding answer as fraction(mixed or improper), decimal equal to what fraction		Vocabulary - hombus does not qual diamond, kite, oofs - 2 column ems most difficult, gebra skills lacking or learned creates big sues in geometry	Scientific notation - significant digits Skills no longer taught on graphing calculator & it is quickest way for MCA & ACT STEM & Leaf, Box plots, histograms, trends of graphs (Many classrooms do not have graphing calculators to teach with) Normal curve on MCA & not taught except in Mini Trig Unit Explanation of graphical results & translating to meaning
11	Integers - Pre Algebra Skills, fractions, decimals, non-calculator integer & whole # skills, understanding answer as fraction(mixed or improper), decimal equal to what fraction	Pre algebra skills, basic linear algebra remembered, non-calculator skills, graphing In linear algebra, meaning of what graph tells students, graphing calculator skills no longer taught, problem solving (word problems), how properties relate to skills		Scientific notation - significant digits Skills no longer taught on graphing calculator & it is quickest way for MCA & ACT STEM & Leaf, Box plots, histograms, trends of graphs (Many classrooms do not have graphing calculators to teach with) Normal curve on MCA & not taught except in Mini Trig Unit Explanation of graphical results & translating to meaning

12	Integers - Pre Algebra Skills, fractions, decimals, non-calculator integer & whole # skills, understanding answer as fraction(mixed or improper), decimal equal to what fraction			Scientific notation - significant digits Skills no longer taught on graphing calculator & it is quickest way for MCA & ACT STEM & Leaf, Box plots, histograms, trends of graphs (Many classrooms do not have graphing calculators to teach with) Normal curve on MCA & not taught except in Mini Trig Unit Explanation of graphical results & translating to meaning

7th Grade - Other
Utilizing Resources/Problem Solving-
Using notes, using glossary, asking questions, checking work/answers

Attachment 3: Best Practices in Mathematics

Best Practices in Mathematics	
FROM	**TO**
Teaching Practices	
• Rote practice • Rote memorization of rules and formulas • Teaching by telling • Single answers and single methods to find answers • Stressing memorization instead of understanding • Repetitive written practice • Use of drill worksheets • Teaching computation out of context • Reliance on paper and pencil calculations • Being the dispenser of knowledge • Testing for grades only	• Use of manipulative materials • Cooperative group work • Discussion of mathematics • Questioning and making conjectures • Justification of thinking • Writing about mathematics • Problem-solving approach to instruction • Content integration • Use of calculators and computers • Being a facilitator of learning • Assessing learning as an integral part of instruction
Problem Solving	
• Use of cue words to determine operation to be used • Practicing problems categorized by type • Practicing routine, one-step problems	• Word problems with a variety of structures and solution paths • Everyday problems and applications • Problem-solving strategies (especially representational strategies) • Open-ended problems and extended problem solving projects • Investigating and formulating questions from problem situations
Creating Representations	
• Copying conventional representations without understanding • Reliance on a few representations • Premature introduction of highly abstract representations • Forms of representations as an end product or goal	• Creating one's own representations that make sense • Creating multiple representations of the same • problem or situation • Translating between representations of the same • problem or situation • Representations using electronic technology • Using representations to make the abstract ideas more concrete • Using representations to build understanding of concepts through reflection • Sharing representations to communicate ideas

Best Practices in Mathematics	
FROM	**TO**
Communicating with Mathematical Ideas	
• Doing fill-in-the-blank worksheets • Answering questions that need only yes or no responses • Answering questions that need only numerical responses	• Discussing mathematics • Reading mathematics • Writing mathematics • Listening to mathematical ideas
Reasoning and Proof	
• Relying on authorities (teacher, answer key)	• Drawing logical conclusions • Justifying answers and solution processes • Reasoning inductively and deductively
Making Connections	
• Learning isolated topics • Developing skills out of context	• Connecting mathematics to other subjects and to the real world • Connecting topics within mathematics • Applying mathematics
Numbers/Operations/Computation	
• Early use of symbolic notation • Memorizing rules and procedures without understanding • Complex and tedious paper-and-pencil computations	• Developing number and operation sense • Understanding the meaning of key concepts such as place value, fractions, decimals, ratios, proportions, and percent • Various estimation strategies • Thinking strategies for basic facts • Using calculators for complex calculations
Geometry/Measurement	
• Memorizing facts and relationships • Memorizing equivalencies between units of measure • Memorizing geometric formulas	• Developing spatial sense • Actual measuring and exploring the concepts related to units of measure • Using geometry in problem solving
Statistics/Probability	
• Memorizing formulas	• Collecting and organizing data • Using statistical methods to describe, analyze, evaluate, and make decisions
Algebra	
• Manipulating symbols • Memorizing procedures	• Recognizing and describing patterns • Identifying and using functional relationships • Developing and using tables, graphs, and rules to describe situations • Using variables to express relationships

Best Practices in Mathematics	
FROM	**TO**
Assessment	
• Having assessment be simply counting correct answers on tests for the sole purpose of assigning grades • Focusing on a large number of specific and isolated skills • Using exercises or word problems requiring only one or two skills • Using only written tests	• Making assessment an integral part of teaching • Focusing on a broad range of mathematical tasks and taking a holistic view of mathematics • Developing problem situations that require applications of a number of mathematical ideas • Using multiple assessment techniques, including written, oral, and demonstration formats