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## **Creating and Sustaining a Culture of Numeracy**

### **Guiding Principles**

- 1. Numeracy, along with literacy, is a co-equal building block of human intellectual prowess. (Capacity)**
- 2. Numeracy is everybody's business and pervades a school's culture. (Community)**
- 3. All students can and must develop numeracy skills and dispositions and become powerfully numerate. (Inclusion, Attitude & Rigor)**
- 4. Numeracy is developed by learning beyond just mathematical procedures; these procedures must be embedded in guided, open quests; explorations and investigations. (Creativity & Collaboration)**
- 5. Numeracy connotes a familiarity and confidence with notions of change, chance, quantity, shape, and dimension. (Content)**
- 6. Relevance and connections – real-world, cross-discipline and within mathematics, are the cornerstones to developing numeracy skills. (Context & Connections)**
- 7. The development of numeracy skills requires an integration of effective communication, both written and oral. (Communication)**

**1. Numeracy, along with literacy, is a co-equal building block of human intellectual prowess. (Capacity)**

**Evidence:**

- ◆ Many projects were integrated, focusing both on QR concepts and skills as well as written aspects (KT)
- ◆ Integration of data (world data) and discussing what it really represents (JB)
- ◆ Supposition and projections of how data will change in the future (RCH)
- ◆ Tracking progress now to influence (goals) for a future result.
- ◆ Multiple data representation and exploration of changes in data.
- ◆ SR/QR: Attitude among students demonstrated belief that QR competency is important for all people.
- ◆ International Health students' use of literacy and numeracy to develop a country profile and suggest interventions.
- ◆ Translating words and structure in poetic text to interpret specifically ambiguous quantities and determine necessary mathematical operations.
- ◆ Students engaging in self-paced learning to grasp Math/QR concepts at their own levels demonstrates notion of "intellectual prowess" and co-equal nature of numeracy with literacy.

**Opportunities:**

- ◆ Find ways to move from words to #'s so students see connections & can apply content knowledge in different situations (state testing) when it doesn't look as integrated (KT)
- ◆ Expectations of results
- ◆ I agree with the above comment! There is a lot of opportunity for students to still translate what they know from English to mathematics and also vice-versa. Stations can be effective in a Science or Math classroom that students rotate through, for example, a "communicating Mathematics" station might focus EXCLUSIVELY on Math to English translations and be set up similar to a Spanish to English or any other "2<sup>nd</sup> language" class. Vocabulary, translations, etc. And maybe even field trips to regions "where Math is spoken." (NJ)
- ◆ More concrete, less abstract. (Write it down and present, share, incorporate into future assessment activities)
- ◆ Students may need to add depth to the work. Can I say it with numbers more? (JB)
- ◆ Introducing the definitions of mathematical operations and in discussing appropriate situations to apply them to.

## 2. Numeracy is everybody's business and pervades a school's culture. (Community)

### Evidence:

- ◆ Each teacher was incorporating Numeracy/QR in the lessons.
- ◆ PMU, hallways - all school & visual (KT)
- ◆ Activity in Advisory led students to use QR in analyzing their completion of assignments (LB)
- ◆ PMU activity could be a QR activity (JB)
- ◆ Goal planning and academic/social achievement using students' own work (RCH)
- ◆ PMU - problem solving, community involved - symbolic representation of numeracy, "numeracy without numbers"
- ◆ PMU engaged advisories in healthy competition to solve a Math/QR problem.
- ◆ School hallways are covered with posters featuring Math/QR related data (e.g. Math/QR specific posters, BP Longitudinal Study)
- ◆ Posters in non-math classrooms presented information/data on topics not specific to math (e.g. graph of students' homework turned in for class, Sudoku puzzles, etc.)

### Opportunities:

- ◆ Projects (fraction, graphing a line) could be extended and more student-centered with students choosing a recipe (fractions) or a sport to graph data for. Great activities - keep going with them. (KV)
- ◆ Students might need to become more used to seeing QR outside official math rotations. One student asked, "Its math so we're getting math credit for this, right?" (LB)
- ◆ More depth with the PMU project. Give each Advisory more time together . . . record thoughts (process), display results . . . outcomes (JB)
- ◆ Expectations of results
- ◆ All educational professional educators should use the "teachable moments" to help further numeracy and the understanding of the use of numbers.

**3. All students can and must develop numeracy skills and dispositions and become powerfully numerate. (Inclusion, Attitude & Rigor)**

**Evidence:**

- ◆ SR/QR Rotation: Students developed method for calculating avg. rate of change with very patient guidance from instructor but not too much direction (LB)
- ◆ Students learned to evaluate statistics to derive meaning (world health); to use measurement in a recipe to better understand fractions; to graph a line on a computer; to evaluate their scores from the CSAP test (KV)
- ◆ Students using own data in tons of real world, in portfolios and on learning plans (KT)
- ◆ Students and Advisor make connection between their work and CSAP (JB)
- ◆ Creation of real-world budget is appropriately rigorous
- ◆ Engagement with numbers to understand and make decisions.
- ◆ Lesson on art and “perspective” also demonstrates mathematical problem solving skills (e.g. step-by-step, following rules to reach desired result, sequences)

**Opportunities:**

- ◆ Keep extending activities to deepen learning.
- ◆ Make more of test results and set goals . . . per student (JB)
- ◆ Expectations of results
- ◆ Questions re: Cognitive Tutor. Seems to provide opportunity for rigor. Are most students using it well/does it seem to work? (LB)
- ◆ Student-generated approaches to math procedures seem to be more beneficial than instructor-directed. (LB)

**4. Numeracy is developed by learning beyond just mathematical procedures; these procedures must be embedded in guided, open quests, explorations and investigations. (Creativity & Collaboration)**

**Evidence:**

- ◆ The process of entering data into Excel (from Olympic swim competitions) and using this data to create scatter plots and “best fit” line was an excellent precursor to learning linear equations. It really helped show the relationship between the times of male & female swimmers and the mathematical TRENDS produced by their collective times. (NJ)
- ◆ Exploration of meaning behind poverty statistics and how they apply to a “global” concept of the world (“why should USA care?”) (RCH)
- ◆ Future written portion (Sports Illustrated article) couples literature and QR
- ◆ Using own data to set goals and practice skills, links to world and others and compare to self (KT)
- ◆ Using data from countries around the world in hot spots to determine health needs and develop intervention strategies (KV)
- ◆ Great exploratory question to develop concepts and task (JB)
- ◆ Socratic method of eliciting student responses to lead the lessons and push them forward (adding depth)
- ◆ Use of CSAP results and graphs to understand personal results and areas for growth.
- ◆ Students engaged in self-paced Math/QR lessons are pursuing guided, open quests, explorations, and investigations (though not necessarily experiencing creativity or collaboration)

**Opportunities:**

- ◆ Regarding Olympic time charts, students may have needed more time with “skill building” activities in order to PREPARE them for open quests, explorations and investigations. I guess a better term may be “WING BUILDING” exercises? (NJ)
- ◆ Strategies for diverse learners (read instructions aloud, written reflection, pictures)
- ◆ Offer students a chance to choose a specific topic of study or data dissection within a greater topic. (KV)
- ◆ Expectations of results
- ◆ Substantiation of thinking
- ◆ To expand use of CSAP results and graphs to meld math and literacy skills (fits multiple categories)

**5. Numeracy connotes a familiarity and confidence with notions of change, chance, quantity, shape, and dimension. (Content)**

**Evidence:**

- ◆ SR/QR: Students investigated rates of change in context of poverty stats (LB/JB)
- ◆ Projection and supposition
- ◆ Cause and effect
- ◆ Teaching art from a linear perspective - vocabulary was introduced, including “sequential” meaning one thing at a time.

**Opportunities:**

- ◆ Need for multiple representation and use of diverse learning strategies. (RCH)
- ◆ Comparison (compare, contrast, review, rewrite)
- ◆ Further opportunities for professional learning to build confidence and mathematical understanding.
- ◆ Vocabulary could be described using more mathematical definitions such as sequential items having the same difference. Other vocabulary (and concepts) could have been introduced as well such as symmetry in measurements and fractional components of overall distances.

**6. Relevance and connections – real-world, cross-discipline and within mathematics, are the cornerstones to developing numeracy skills. (Context & Connections)**

**Evidence:**

- ◆ The growth and development statistics of various countries were explored and the data was analyzed and represented in many forms connecting QR to SR; supposition and projection were used to discuss “alternate realities.” (RCH)
- ◆ Connection to QR in Math and Advisory through examination of student progress along with goal setting and future re-visitation. (RCH)
- ◆ Students’ data was involved in the work. (JB)
- ◆ Cooking exercise made the very real connection between cooking, fractions, arithmetic, and hunger. It is also a starting point for many other possible creative projects and activities that are more cross-curricular than this one. (NJ)
- ◆ Work tracker activity (Advisory): Students analyzed completion of their own work, calculated % of work completed, graphed. (LB)
- ◆ Swim Times Project: Students used technology (Excel graphing) to represent real data (LB)
- ◆ Using cooking to encourage a deeper understanding of fractions. (KV)
- ◆ Using data to think about world issues.
- ◆ Displaying student-produced art examples that demonstrate geometric perspective.
- ◆ Vocabulary such as “analysis of data”, “graphing density and mass”, and predicting future data based on historical patterns . . . all on a poster focusing on Science and the Scientific Process.
- ◆ Lesson on rules in art was applied to using rules in mathematics.

**Opportunities:**

- ◆ Exploration could have used strategies for diverse learners. (RCH)
- ◆ Some more focused activities and direct connection to students’ lives. (RCH)
- ◆ Written portion “reflection”; incorporate graphs into hand-outs for visual learners. (RCH)
- ◆ Continue to have students’ data be used for other work. (JB)
- ◆ Multiple representations of the same data. (JB)
- ◆ Use of real-world, student-relevant statistics. RadicalMath.org is good resource. (LB)
- ◆ Vocabulary connections - how it is being used in a “literary” setting and connections to the mathematical setting.
- ◆ To explore origins of formulas for greater understanding.
- ◆ Using current pictures of common buildings that every student can relate to (Ex: this school, Denver skyline, etc.)

**7. The development of numeracy skills requires an integration of effective communication, both written and oral. (Communication)**

**Evidence:**

- ◆ Students processing orally with each other during the process; i.e. what numbers represented? How will they be used? (JB)
- ◆ Students were to write mock magazine article following analysis/graphing of data set. (LB)
- ◆ Presentation/share out/show what you know.
- ◆ During the fraction & statistics (about countries) activities, students worked together to reason through problems and data sets. (KV)
- ◆ Students had the opportunity to talk about the work with each other. (KT)
- ◆ Students supported personal perspectives by using data analysis, both in math problems and poetry.
- ◆ Students using both text and teacher instruction to make sense of new concepts.

**Opportunities:**

- ◆ Give students opportunities to have written reflection. (JB)
- ◆ Give students opportunities to share with each other. (JB)
- ◆ More “fluid” and concrete connection between subject and QR integration (through activities and reflection/download time). (RCH)
- ◆ Many activities can be extended by offering students a chance to apply the concepts (Math/QR) to a greater and deeper depth (higher level math skills). Many great launching places were observed . . . keep it going!