The Frayer Model (Frayer, Frederick & Klausmeier, 1969)

Definition in your own words	Characteristics/Attributes
Rigor	
Examples	**Non-Examples**

MARTHA'S CARPETING TASK

Martha is recarpeting her bedroom, which is 15 feet long and 10 feet wide. How many square feet of carpeting will she need to purchase?

The carpet costs $2.60 per square foot. How much will the carpet for Martha's bedroom cost?

THE FENCING TASK

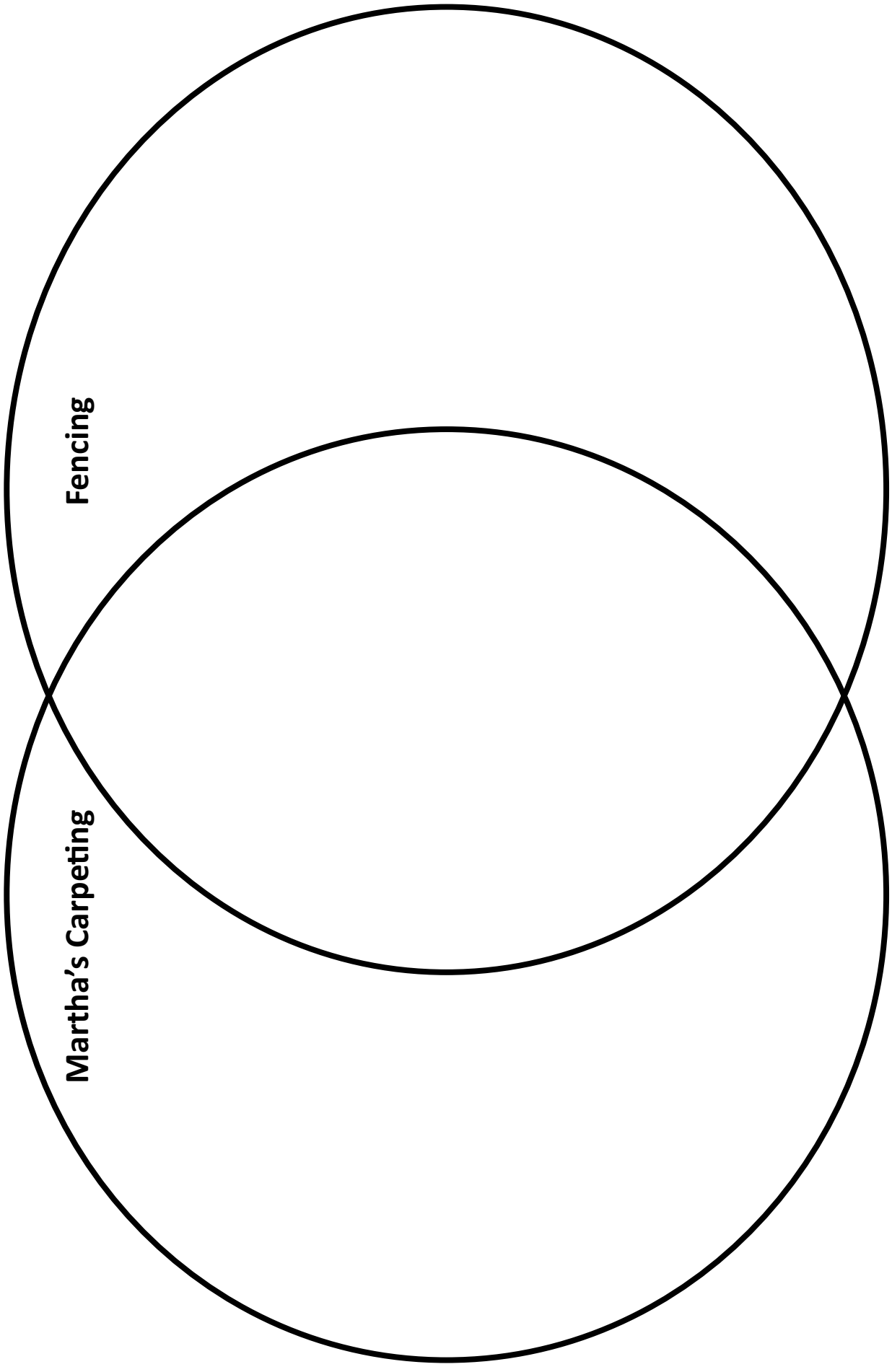
Ms. Brown's class will raise rabbits for their spring science fair. They have 24 feet of fencing with which to build a rectangular rabbit pen to keep the rabbits.

1. If Ms. Brown's students want their rabbits to have as much room as possible, how long would each side of the pen be?

2. How long would each side of the pen be if they had only 16 feet of fencing?

3. How would you go about determining the pen with the most room for any amount of fencing?
   Organize your work so that someone else who reads it will understand it.

COMPARING TWO TASKS



Adopted 2012 Texas Essential Knowledge and Skills (TEKS) for Mathematics

(1) Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

(A) apply mathematics to problems arising in everyday life, society, and the workplace;

(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;

(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;

(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;

(E) create and use representations to organize, record, and communicate mathematical ideas;

(F) analyze mathematical relationships to connect and communicate mathematical ideas; and

(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

http://www5.esc13.net/thescoop/insight/2015/02/rigor-and-relevance-in-the-math-classroom/
In-Sight. A Newsletter for Curriculum, Instruction and Assessment.

RIGOR AND RELEVANCE IN THE MATH CLASSROOM

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We read and hear quite a lot about rigor on the STAAR Mathematics test. In the past few years the State of Texas has been trying to up the ante in students' conceptual understanding of mathematics. Let's try to break down what rigor may mean.

In 2013, Linda M. Gojak, Past President of the National Council of Teachers of Mathematics, was discussing rigor with a group of mathematics coaches from around the country. The coaches commented that many of their teachers were confused by exactly what was meant by teaching and learning with rigor and they were unsure about how to respond. Together they began exploring the notion of rigor with an online search of the word "rigor." The thesaurus led to a list of synonyms, including "affliction," "inflexibility," "difficulty," "severity," "rigidity," "suffering," and "traditionalism"—none of which describe characteristics of rigorous mathematics instruction. No wonder there was confusion! However, two additional words included in the list—"thoroughness" and "tenacity"—provided avenues for some serious thought about what "rigor" implies.

Without a common understanding of the meaning of the word rigor, how can teachers provide rigor in the classroom?

Take this quick true/false quiz.

1. _____ If standards are rigorous, the course is automatically rigorous.
2. _____ Rigor means using creative ways to solve relevant problems.
3. _____ Rigor means more work.
4. _____ Rigorous work should be more difficult.
5. _____ Rigor means selecting highly rigorous content.
6. _____ Rigorous instruction allows time and opportunity for students to develop and apply their understanding.
7. _____ Younger students cannot engage in rigorous instruction.
8. _____ In order to engage in rigor, students must first master the basics.

Rigor isn't as much about the standards as it is about how you ask students to reach the standards. There are times when students are asked to achieve highly rigorous standards in un-rigorous ways. At other times, teachers are able to take mediocre standards and help students achieve highly rigorous learning by designing rigorous learning experiences that correspond with those standards. Therefore, statement one above is false.

While rigorous instruction may require that students put forth more effort, it is not based on the volume of work students complete. Rigor is about the quality of the work students are asked to do, not the quantity. More assignments or more reading does not guarantee more rigor. In fact, rigorous classrooms often have fewer assignments and less homework. Therefore, statement three is false.

Rigorous classrooms do present more challenge to students but there is a difference between challenge and difficulty. Challenging work requires students to stretch and reach for new understanding. Work can be difficult for a variety of reasons. Examples include unclear instructions, a lack of necessary resources or adequate support, and demands that are too great for the time allotted. We can all think of assignments we endured that were difficult without being intellectually challenging. Thus, it is a mistake to think that just because students had difficulty completing their work, they have engaged in a rigorous assignment. Therefore, statement four above is false.

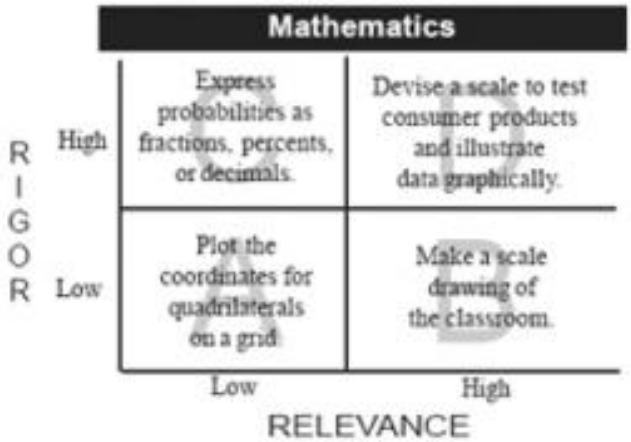
Selection of highly rigorous content does not guarantee a highly rigorous learning experience for students. How we ask students to engage in the content determines the level of rigor for the course. Therefore, the answer to statement five above is false.

Even young students can think and interact with material in highly rigorous ways. If given the opportunity, students will naturally take what they are learning to solve challenging problems. The key is for teachers make sure that rigorous instruction is developmentally appropriate. Therefore, statement seven is false.

Rigorous thinking is involved in learning even the most basic material. Students can learn the basics in highly rigorous ways. They can learn how to build adequate representations, organize those facts in some way, analyze and construct relationships among those facts, and make inferences beyond what is explicitly presented *while* they are mastering the basics. Therefore, statement eight is false.

Rigorous instruction allows time and opportunity for students to develop and apply their understanding by using creative ways to solve relevant problems. So, if you were thinking that statements two and six were true, then give yourself a pat on the back!

Study the following International Center for Leadership in Mathematics Education–Rigor/Relevance Framework®



Looking at the examples in the above quadrants, where do you see yourself and your classroom on this framework?

Quadrant A – Relevance and rigor are both low for the student as the task has no real meaning and is fairly easy for students.
Quadrant B – Relevance is high since it is associated to a real example for the student but rigor is still low.
Quadrant C – Rigor may be high in this activity but relevance to real world examples is low for the student.
Quadrant D – Relevance and rigor are both high for the student in this task. Here the student must understand what is being taught as well as understand how to apply knowledge to relevant situations.

Characteristics of a rigorous classroom include:

- Instructional environments that encourage students to take their learning one step further
- Teachers facilitating learning and using higher level questioning strategies
- Students pursuing deeper understandings through thoughtful investigations into the concepts they are learning
- Students applying new learning to other disciplines and to predictable and unpredictable real-world situations
- Evidence of teachers spending the majority of their time in quadrants B & D in the ICLE Rigor/Relevance Framework®

In conclusion, here are two scholarly definitions of rigor.

"The goal of helping students develop the capacity to understand content that is complex, and personally or emotionally challenging." (Strong, et al., 2001)

Jeff Paulson: "Rigor (n) An expectation that requires students to apply new learning to other disciplines and to predictable and unpredictable real world situations." (Quoted in Paulson, n.d.)

By agreeing on what rigor means, educators are better able to provide and recognize rigor in the classroom in a consistent way, and this benefits all students.

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