Three-Act Task Guide

Purpose:

GENERAL DESCRIPTION

A Three-Act Task is a whole group mathematics task consisting of 3 distinct parts: an engaging and perplexing Act One, an information and solution seeking Act Two, and a solution discussion and solution revealing Act Three.

WHEN AND WHY IS THIS USEFUL?

A Three-Act Task is useful:

- To provide an engaging context for the use of mathematics and the development of mathematical understanding.
- To reduce the literacy demand
- To add engagement. Students wonder what will happen next.
- To create low barriers to entry, allowing the teacher to scaffold as necessary
- To provide an opportunity for estimation and reasonableness
- To provide opportunities to talk about mathematics
- To provide opportunities for reflective thought
- To build new knowledge from prior knowledge
- To encourage multiple approaches
- To honor diversity
- To create situations which require students to engage in mathematical modeling
- To build relational understandings among mathematics concepts
- To shift student ideas about justification of

WHAT CAN STUDENTS LEARN FROM THIS EXPERIENCE?

- Development of critical thinking skills
- How to make sense of problems and persevere in solving them
- How to reason abstractly and quantitatively
- How to construct viable arguments and critique reasoning
- How to model with mathematics
- How to choose and use tools strategically
- How to look for and make use of structure
- How to look for and express regularity in repeated reasoning
- How to justify thinking and answers (rather than relying on a teacher or answer key for validation of correctness)
- Creation of connections among mathematical concepts (relational understanding)

thinking and answers

Why 3-Acts? A teacher shares his thinking (from: http://mikewiernicki.com/)

Why use 3-Act Tasks? A Teacher's Response:

The short answer: It's what's best for kids!

If you want more, read on:

The need for students to make sense of problems can be addressed through tasks like these. The challenge for teachers is, to quote Dan Meyer, "be less helpful." (To clarify, being less helpful means to first allow students to generate questions they have about the picture or video they see in the first act, then give them information as they ask for it in act 2.) Less helpful does not mean give these tasks to students blindly, without support of any kind!

This entire process will likely cause some anxiety (for all). When jumping into 3-Act tasks for the first (second, third, . . .) time, students may not generate the suggested question. As a matter of fact, in this task about proportions and scale, students may ask many questions that are curious questions, but have nothing to do with the mathematics you want them to investigate. One question might be "How is that ball moving by itself?" It's important to record these and all other questions generated by students. This validates students' ideas. Over time, students will become accustomed to the routine of 3-act tasks and come to appreciate that there are certain kinds of mathematically answerable questions – most often related to quantity or measurement.

These kinds of tasks take time, practice and patience. When presented with options to use problems like this with students, the easy thing for teachers to do is to set them aside for any number of "reasons." I've highlighted a few common "reasons" below with my commentary (in blue):

- This will take too long. I have a lot of content to cover. (Teaching students to think and reason is embedded in mathematical content at all levels - how can you **not** take this time)
- They need to be taught the skills first, then maybe I'll try it. (An important part of learning mathematics lies in productive struggle and learning to persevere [SMP 1]. What better way to discern what students know and are able to do than with a mathematical context [problem] that lets them show you, based on the knowledge they already have - prior to any new information. To quote John Van de Walle, "Believe in kids and they will, flat out, amaze you!")
- My students can't do this. (Remember, whether you think they can or they can't, you're right!) (Also, this expectation of students persevering and solving problems is in every state's standards - and was there even before common core!)
- I'm giving up some control. (Yes, and this is a bit scary. You're empowering students to think and take charge of their learning. So, what can you do to make this *less* scary? **Do what we expect students to do:**
    - Persevere. Keep trying these and other open-beginning, -middle and -ended problems. Take note of what's working and focus on it!
    - Talk with a colleague (work with a partner). Find that critical friend at school, another school, online. . .
    - Question (use #MTBoS on Twitter, or blogs, or Google: 3-act tasks).

The benefits of students learning to question, persevere, problem solve, and reason mathematically far outweigh any of the reasons (read excuses) above. The time spent up front, teaching through tasks such as these and other open problems creates a huge pay-off later on. However, it is important to note, that the problems themselves are worth nothing without teachers setting the expectation that students: question, persevere, problem solve, and reason mathematically on a daily basis. Expecting these from students, and facilitating the training of how to do this consistently and with fidelity is principal to success for both students and teachers.

Yes, all of this takes time. For most of my classes, mid to late September (we start school at the beginning of August) is when students start to become comfortable with what problem solving really is. It's not word problems - mostly. It's not the problem set you do after the skill practice in the textbook. Problem solving is what you do when you don't know what to do! This is difficult to teach kids and it does take time. But it is worth it! More on this in a future blog!

Tips:

One strategy I've found that really helps students generate questions is to allow them to talk to their peers about what they notice and wonder first (Act 1). Students of all ages will be more likely to share once they have shared and tested their ideas with their peers. This does take time. As you do more of these types of problems, students will become familiar with the format and their comfort level may allow you to cut the amount of peer sharing time down before group sharing.

What do you do if they don't generate the question suggested? Well, there are several ways that this can be handled. If students generate a similar question, use it. Allowing students to struggle through their question and ask for information is one of the big ideas here. Sometimes, students realize that they may need to solve a different problem before they can actually find what they want. If students are way off, in their questions, teachers can direct students, carefully, by saying something like: "You all have generated some interesting questions. I'm not sure how many we can answer in this class. Do you think there's a question we could find that would allow us to use our knowledge of mathematics to find the answer to (insert quantity or measurement)?" Or, if they are really struggling, you can, again carefully, say "You know, I gave this problem to a class last year (or class, period, etc) and they asked (insert something similar to the suggested question here). What do you think about that?" Be sure to allow students to share their thoughts.

After solving the main question, if there are other questions that have been generated by students, it's important to allow students to investigate these as well. Investigating these additional questions validates students' ideas and questions and builds a trusting, collaborative learning relationship between students and the teacher.

Overall, we're trying to help our students mathematize their world. We're best able to do that when we use situations that are relevant (no dog bandanas, please), engaging (create an intellectual need to know), and perplexing . If we continue to use textbook type problems that are too helpful, uninteresting, and let's face it, perplexing in all the wrong ways, we're not doing what's best for kids; we're training them to not be curious, not think, and worst of all . . . dislike math. (Many thanks to Mike Wiernicki for sharing his thoughts on 3-Act Tasks)

Three-Act Tasks: Step-by-Step "Cheatsheet"

3-Acts and Patient Problem Solving (Teaching without the Textbook)
Adapted from Dan Meyer

Developing the mathematical Big Idea behind the 3-Act task:

- Create or find/use a clear visual which tells a brief, perplexing mathematical story. Video or live action works best. (See resource suggestions in the Guide to 3-Act Tasks)
- Video/visual should be real life and allow students to see the situation unfolding.
- Remove the initial literacy/mathematics concerns. Make as few language and/or math demands on students as possible. You are posing a mathematical question without words.
- The visual/video should inspire curiosity or perplexity which will be resolved via the mathematical big idea(s) used by students to answer their questions. You are creating an intellectual need or cognitive dissonance in students.

Enacting the 3-Act in the Classroom

Act 1 (The Question):

Set up student curiosity by sharing a scenario:

- Teacher says, "I'm going show you something I came across and found interesting" or, "Watch this."
- Show video/visual.
- Teacher asks, "What do you notice/wonder?" and "What are the first questions that come to mind?"
- Students share observations/questions with a partner first, then with the class (Think-Pair-Share). Students have ownership of the questions because they posed them.
- Leave no student out of this questioning. Every student should have access to the scenario. No language or mathematical barriers. Low barrier to entry.
- Teacher records questions (on chart paper or digitally-visible to class) and ranks them by popularity.
- Determine which question(s) will be immediately pursued by the class. If you have a particular question in mind, and it isn't posed by students, you may have to do some skillful prompting to orient their question to serve the mathematical end. However, a good video should naturally lead to the question you hope they'll ask. You may wish to pilot your video on colleagues before showing it to students. If they don't ask the question you are after, your video may need some work.
- Teacher asks for estimated answers in response to the question(s). Ask first for best estimates, then request estimates which are too high and too low. Students are no defining and defending parameters for making sense of forthcoming answers.
- Teacher asks students to record their actual estimation for future reference.

Act 2 (Information Gathering):

Students gather information, draw on mathematical knowledge, understanding, and resources to answer the big question(s) from Act-1:

- Teacher asks, "What information do you need to answer our *main question*?"
- Students think of the important information they will need to answer their questions.
- Ask, "What mathematical tools do you have already at your disposal which would be useful in answering this question?"
- What mathematical tools might be useful which students don't already have? Help them develop those.
- Teacher offers smaller examples and asks probing questions.
    - What are you doing?
    - Why are you doing that?
    - What would happen if…?
    - Are you sure? How do you know?

Act 3 (The Reveal):

The payoff.

- Teacher shows the answer and validates students' solutions/answer.
- Teacher revisits estimates and determines closest estimate.
- Teacher compares techniques, and allows students to determine which is most efficient.

The Sequel:

- Students/teacher generalize the math to any case, and "algebrafy" the problem.
- Teacher poses an extension problem- best chance of student engagement if this extension connects to one of the many questions posed by students which were not the focus of Act 2, or is related to class discussion generated during Act 2.
- Teacher revisits or reintroduces student questions that were not addressed in Act 2.

Choosing a Three-Act Task

A Three-Act Task may stand alone, introduce new content, or may be a part of a series of related mathematical tasks which share or develop connections among mathematical ideas.

Three-Act Tasks- Defining Features

The chart below outlines some of the features of a Three-Act Task which distinguish it from other mathematical tasks.

Facilitation Feature	Student Experience
Problems are presented without structure	• Students develop questions to be explored • Students develop the manner in which mathematics will be used to model the situation presented in the problem
Teacher scribes the questions asked by students during Act One	• Multiple questions are made public • Students see multiple mathematical possibilities for exploration taken from a single context • Students feel ownership of the questions rather than being shown a question and solution path
Estimations are expected prior to beginning to solve the problem	• Students learn to make conjectures • Students develop the ability to determine the reasonableness of answers
All answers are shared and discussed	• Every student has the opportunity to share his/her way of approaching, thinking about, and solving the problem • Mistakes and misconceptions surface and are treated as learning opportunities • Students examine and critique the reasoning of others
Teacher guides the flow of the Three-Act through skillful questioning, creating questions that lead to student thinking and respond to student thinking	• Students have the opportunity to explore the math rather than simply find the answer • Students develop deep understanding of the mathematics and create connections to known mathematical ideas

Three-Act Planning Resources

The following list includes resources for Three-Act Tasks.

Resources further explaining Three-Act Tasks:

- https://www.ted.com/talks/dan_meyer_math_curriculum_makeover
- http://www.youtube.com/watch?v=jRMVjHjYB6w
- http://www.youtube.com/watch?v=EKdiXLIcqVQ
- http://vimeo.com/35324789
- http://perplexity.mrmeyer.com/

Resources for developed Three-Act Tasks:

- Dan Meyer's 3-Act Tasks
- 3-Act Tasks for Elementary and Middle School
- Graham Fletcher
- http://www.livebinders.com/play/play_or_edit?id=330579
- http://mikewiernicki.com/

Resources for developing Three-Act Tasks:

- http://blog.mrmeyer.com/category/3acts/
- www.estimation180.com
- www.visualpatterns.org
- 101 Questions
- Andrew Stadel
- Jenise Sexton
- Fawn Nguyen
- Robert Kaplinsky
- Open Middle
- http://perplexity.mrmeyer.com/
- http://exit10a.blogspot.com/
- # MTBoS on twitter - you'll find tons of support and ideas!

Resources used in the development of this document:

- http://blog.mrmeyer.com/category/3acts/
- http://blog.mrmeyer.com/wp-content/uploads/OUSDMathInstructionalToolkit2013-14.pdf
- http://perplexity.mrmeyer.com/
- http://mikewiernicki.com/