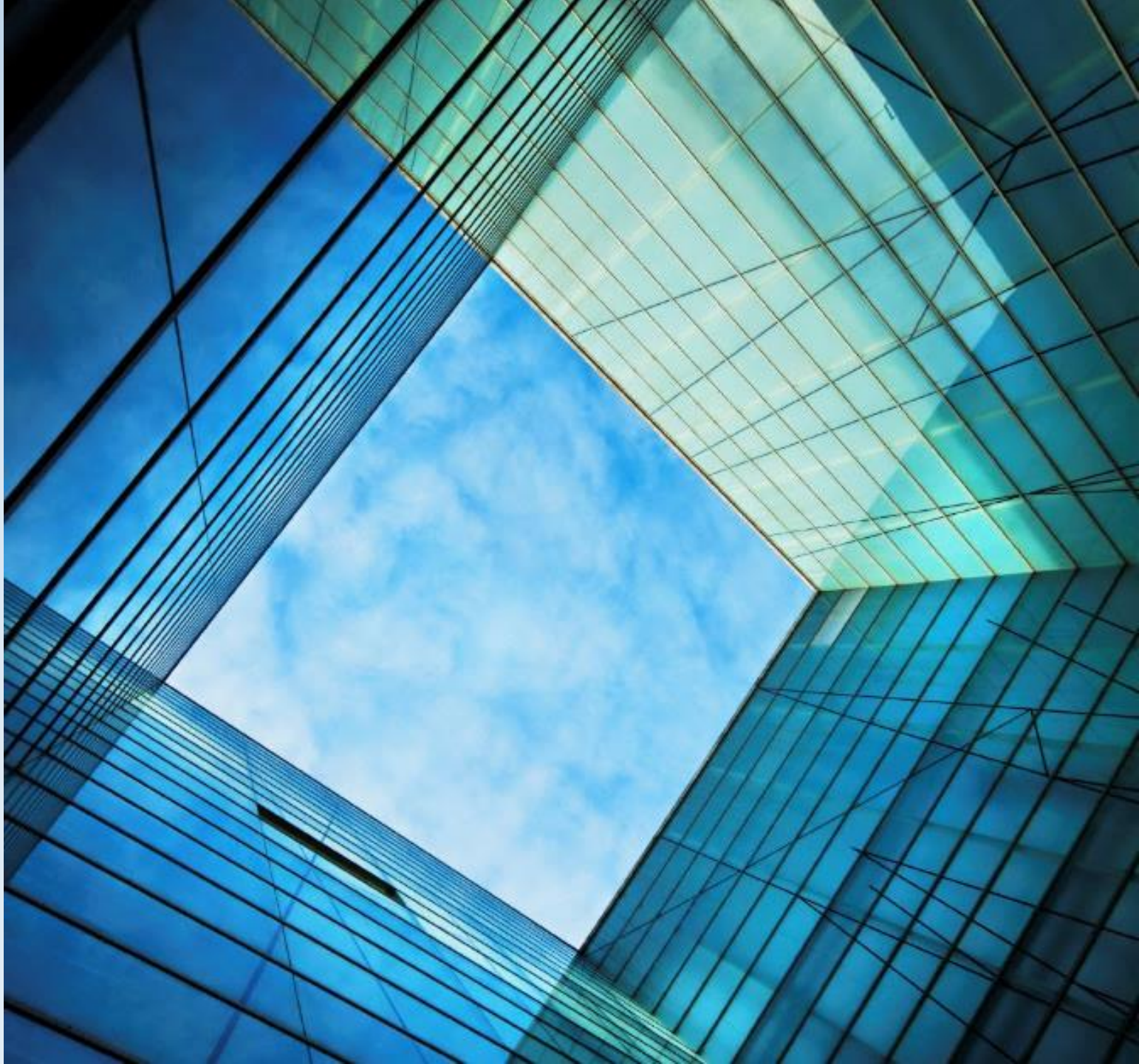
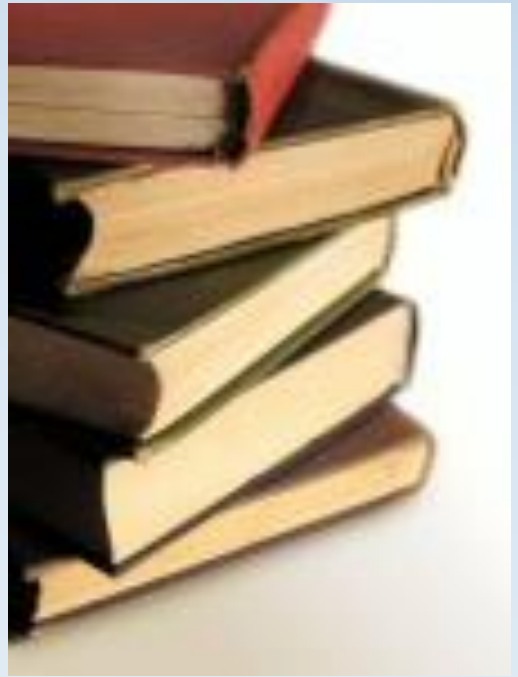
Using Discussion Questions to Promote Active Reading in Mathematics & Statistics

Betsy McCall
Columbus State Community College

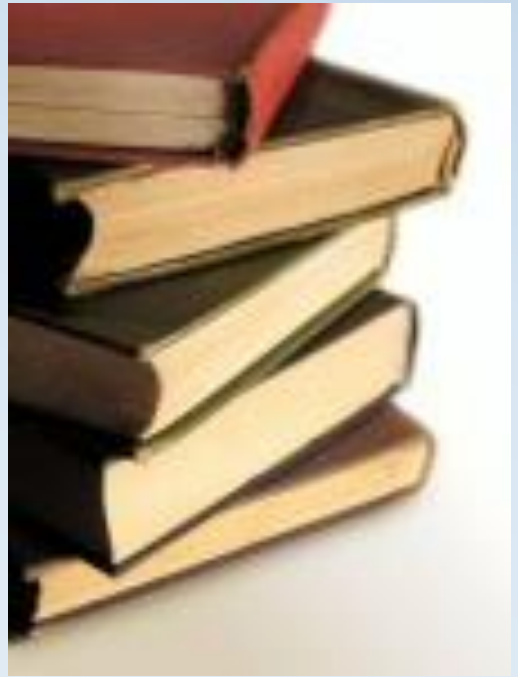


How many of your students come to class having already read the book?



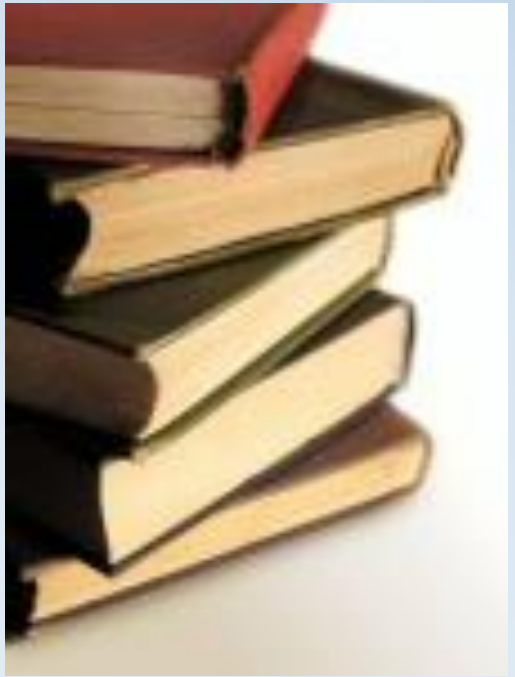
How many of your students come to class having already read the book?

- Students do better (not just in math), if they come to class prepared to learn.



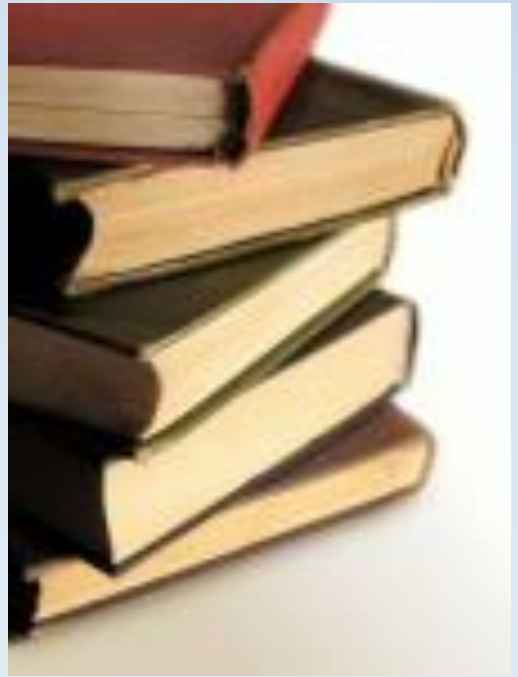
How many of your students come to class having already read the book?

- Students do better (not just in math), if they come to class prepared to learn.
- Most students don't read the book before lecture…



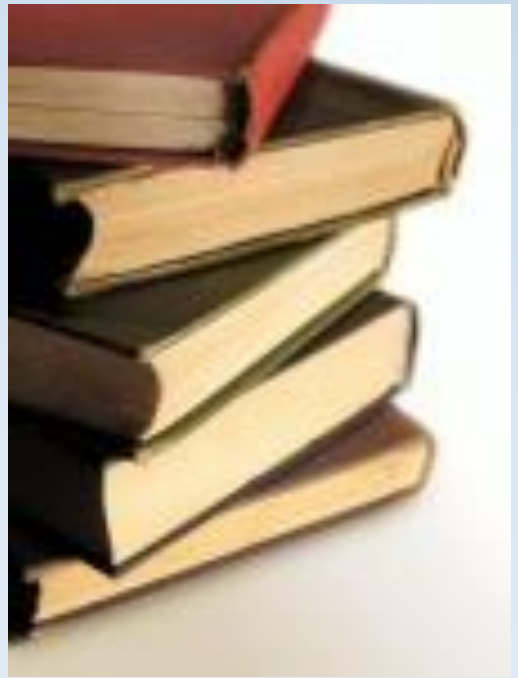
How many of your students come to class having already read the book?

- Students do better (not just in math), if they come to class prepared to learn.
- Most students don't read the book before lecture…
- Many students may never read their math books at all.



How many of your students come to class having already read the book?

- Students do better (not just in math), if they come to class prepared to learn.
- Most students don't read the book before lecture…
- Many students may never read their math books at all.
- Confession time: I was one of those students.



What makes reading math so hard?

What makes reading math so hard?

- Students get the most practice reading prose literature.

What makes reading math so hard?

- Students get the most practice reading prose literature.
- Non-fiction topics like history, which tend to require more reading, read more like prose fiction than technical fields like science and math.

What makes reading math so hard?

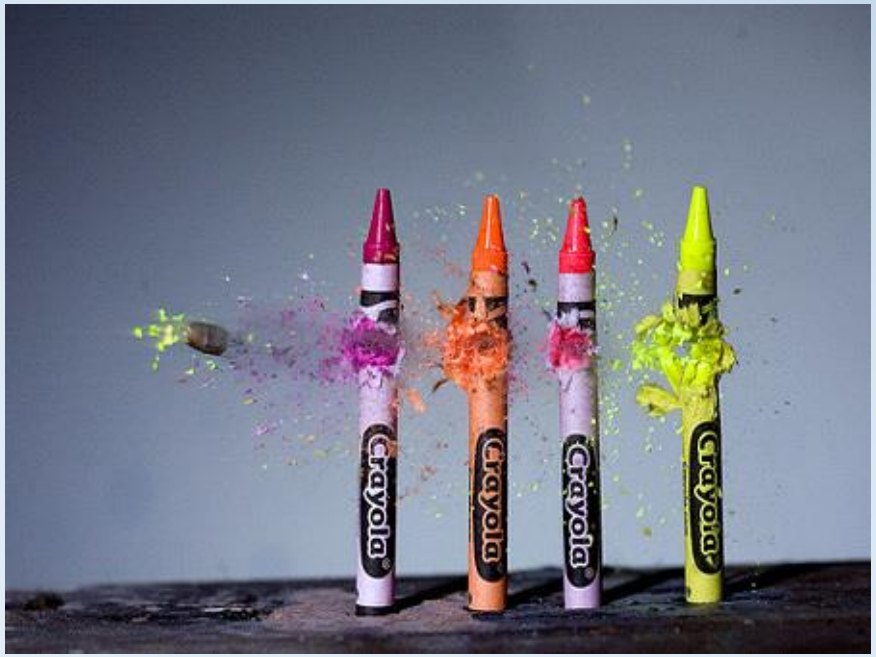
- Students get the most practice reading prose literature.
- Non-fiction topics like history, which tend to require more reading, read more like prose fiction than technical fields like science and math.
- Strategies students are taught to read in these fields quickly are counterproductive to learning to read mathematics and science.

What makes reading math so hard?

- Students get the most practice reading prose literature.
- Non-fiction topics like history, which tend to require more reading, read more like prose fiction than technical fields like science and math.
- Strategies students are taught to read in these fields quickly are counterproductive to learning to read mathematics and science.
- The closest analogy is actually philosophy where quick skimming can lead to erroneous impressions of the meaning of a text.

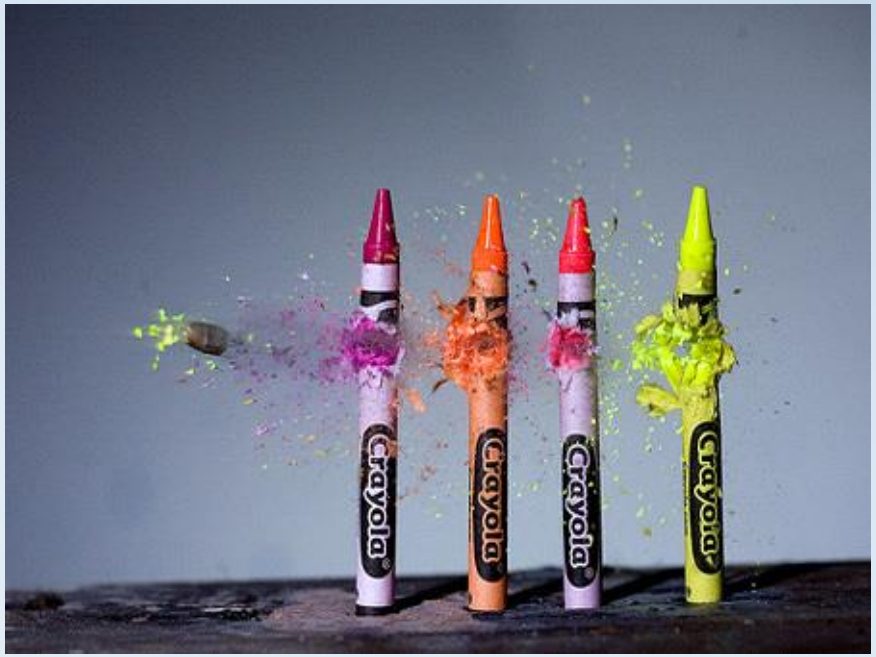
It’s not enough to tell them.

- Many math books have introductory sections telling students how to read their books.
- However, this isn’t enough.



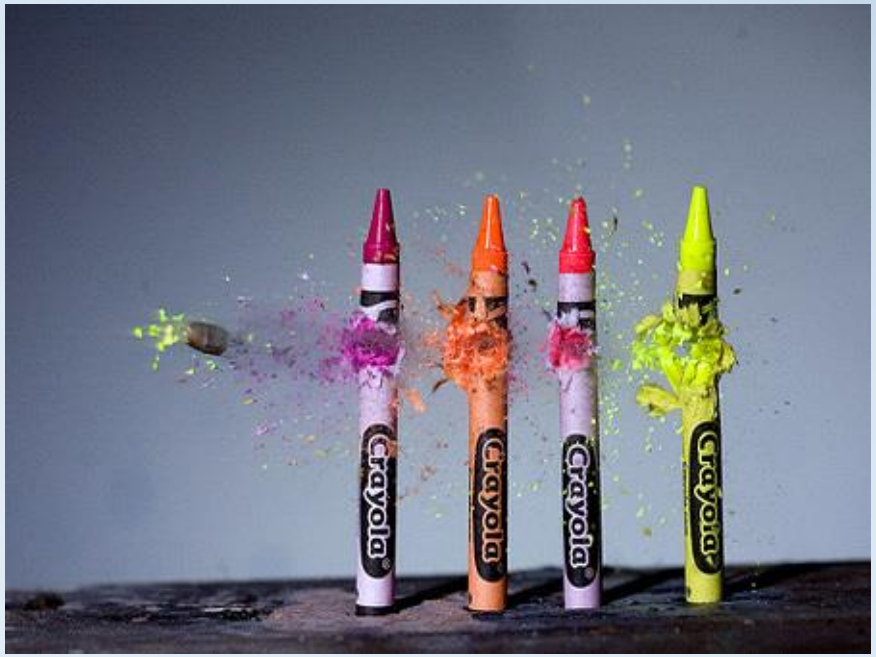
It’s not enough to tell them.

- Many math books have introductory sections telling students how to read their books.
- However, this isn’t enough.
- Students need to be shown how.



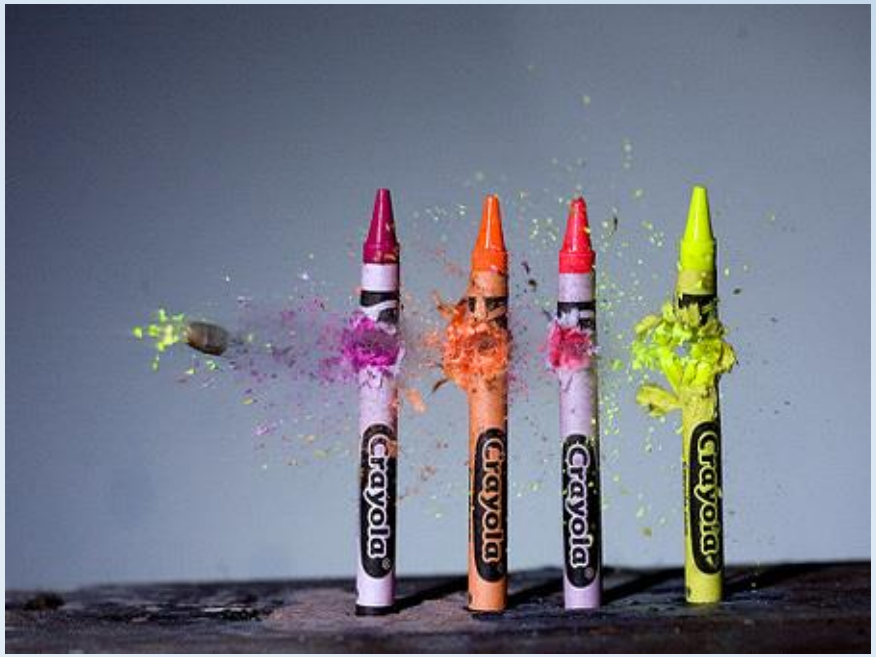
It’s not enough to tell them.

- Many math books have introductory sections telling students how to read their books.
- However, this isn’t enough.
- Students need to be shown how.
- Students need to practice these skills.



It’s not enough to tell them.

- Many math books have introductory sections telling students how to read their books.
- However, this isn’t enough.
- Students need to be shown how.
- Students need to practice these skills.
- They won’t do it on their own.



- Good lectures are how students avoid reading textbooks.
- This develops dependency on others to explain material they could learn on their own.
- Concept-focused classes like statistics need more than a "how-to": We need to students to think.

Low-Tech Classroom Flip

Why Discussion Questions?

- Discussion questions focus students' attention on important concepts.
- They can act as "guided notes" for reading.
- They ask students to dig deeper into the text than the skimming they learn in other classes.
- Students may reread the text looking for answers, increasing exposure to the material before class.

Discussion Questions should…

- Get students thinking about the material.
- Help students focus on definitions and important concepts.
- Highlight any important formulas.
- Encourage students to work together to find answers.

Discussion Questions should…

- Get students to work through examples similar to examples in the book, or fill in missing steps in worked examples.
- Illustrate concepts with real world scenarios.
- Ask students to compare and contrast.
- Use questions to review old material if it's needed now.

Examples

Discussion Questions don't need to…

- Be Hard
  - Students don't need to get all the answers on their own, just get exposure
- Be Graded
  - Get students to look at the material when the pressure is off. Give them credit for trying, then use discussion time in class to fill in the missing pieces. If you do grade, grade for reasoning not correctness.
- Cover absolutely everything
  - Save lecture time for "pain points", demonstrations, and collaborative work

Discuss the Answers in Class

- Students won't get all the answers right, and that's okay.
- Bring in related material and help connect the dots.
- Develop critical thinking skills.
- Use the book to point out where some of the answers are to help students know where to look next time.
- Model what you want from students.

Help Students Develop Good Habits

- Don't miss days
  - Every day you cover new material, they should have at least a few questions to prepare, even if it's just 3-4 short ones.
- Can use completed ones to review, or prepare extra questions so students don't waste a review day (hour).
- Can lead sessions in class periodically to guide students in developing their reading skills.

Adapts Easily to Online/Hybrid Courses

- Students can work out answers in threaded discussion boards led by students as much as by instructor.
- Give students options to get answers from online videos, but then cite sources in textbook.
- Easy to give pointers without giving answers as students dig for solutions.
- Bring in outside resources and articles to help illustrate concepts.

Don’t Expect Perfection

- Not all students will complete the discussion questions in advance without prompting.
- Students that do, however, will be better prepared. In my experience, more students will do it than would read the book otherwise.
- Students may complain at first (of course), but they get used to it.
- Well-chosen questions can make excellent review guides for exams.
- If a student misses a class, they know what they need to learn.

What Kind of Classes Can This be Used for?

- Courses with a lot of concept-oriented material work most easily.
  - Spending too much time going over basic definitions?
- Is some of the material in the course remedial or review?
  - Students have seen it before, it's easier to recall and piece together.
- Can be adapted to learning computation & procedures.
  - Use to do just-in-time remediation.
  - Explain steps shown in text.
- Can work for any level course.
  - I've used it for a statistical literacy course, and calc-based stats (and Liberal Arts Math).

The more students are familiar with the material, the more they see it, the less afraid of it they will be.