Thin Slicing: Three Keys to Success

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Introduction:

- I’ve taught math for 31 years at Coleville High School in Coleville CA.
- We’re a small rural school with around 50 students.
- I teach all levels from Algebra 1 to AP Calculus including Probability and Statistics, Computer Science and financial literacy

Coleville High School

My experience with BTC:

- Followed Peter on Twitter
- 2020 November–the book comes out–read it in a weekend
- Started doing BTC

Warm up:

- Form Random groups
- Introduce yourselves
- Rate your BTC experience   NEW <————— > LOTS
- Our math topic for today is solving quadratic equations:
    - Write three problems you think students might need to solve in this topic
    - Rank them in order of difficulty

Three of the keys to success

- Finding the right starting point
- Thin slicing the sequence–using variation theory to create sequences of problems
- Keeping the class in flow

Peter on tasks:

“It turns out that almost any curriculum tasks can be turned from a mimicking task to a thinking task by following this same formulation–begin by asking a question that is review of prior knowledge; then ask a question that is an extension of that prior knowledge.”

Building Thinking Classrooms pg 28

In your groups discuss:

- Which of the following problems would be a good starting point for a unit on solving quadratic equations and why?

Solve the following:

a. $4x^2 - 7 = 13$

b. $(x - 2)^2 = 144$

c. $x^2 + 3x - 5 = 0$

d. $x^2 = 25$

Key one: Where to start?

- Unit overview
- Identify the prerequisite skills students should have and may need to review. You want to be sure to connect the new learning to these prerequisite skills.
- Identify the easiest possible problem in the prerequisite skills and that is probably your starting point.
- If your students are struggling with your thin sliced tasks–no matter how “easy” you think they are–you haven’t lowered the floor enough. Students need to experience success in order to be willing to continue to try.

Goals of thin slicing

- To present curriculum to students in a way that allows them to “discover” the mathematical concepts by working them out.
- By developing their own understanding of the concepts, students are able to take ownership of their processes.
- Create an “optimal experience” where students are so involved in the learning process that they will tackle any problem you put in front of them.

In your groups:

- Write some problems
  - One should cover background knowledge and be your "intro" problem
  - The next few should vary slightly from that problem
  - Extension: Can you write a problem that is similar to the first few, but involves slightly different or more complex thinking?

Key two: Variation theory—filling in the blanks

- What is the end point of the lesson?
- What are the “leaps” in difficulty that your problems will take throughout the sequence?
- Can you think of these problems on the spur of the moment, or do you need to write extra problems in advance?
- Are they in your textbook?

Discuss: In what order should these problems be sequenced?

1. $x^2 = 25$

a. $(x + 2)^2 = 25$

b. $x^2 + 2 = 27$

c. $x^2 = 17$

d. $2x^2 = 50$

e. $x^2 = 81$

f. $2x^2 - 5 = 15$

Which problems involve a leap in difficulty?

What is the sequence of logical steps leading to the quadratic formula?

- Get the x^2 by itself, then take the square roots
- Get the $(x - h)^2$ by itself, then take the square roots
- Create the $(x - h)^2$ by completing the square, then solve
  - First with $x^2 + bx =$ some number (b is even)
  - Then $x^2 + bx + c =$ some number (b is even or odd)
- Create the $a(x - h)^2$ by completing the square, then solve
- Start with $ax^2 + bx + c = 0$, solve using the letters

Discuss: What questions are your students going to ask and how will you address them to keep students in flow?

Example: $x^2 = 25$

Problems:

1. $x^2 = 36$
2. $x^2 = 121$
3. $x^2 = 11$
4. $2x^2 = 32$
5. $3x^2 = 27$
6. $5x^2 = 35$
7. $x^2 + 4 = 53$
8. $x^2 - 7 = 88$
9. $2x^2 + 5 = 55$
10. $5x^2 + 8 = 73$
11. $9x^2 = 400$
12. $4x^2 - 8 = 73$

Key three: Keeping the class in flow

- How will you address the “leaps” in difficulty as your students encounter them?
    - (Decrease challenge/increase ability)
- How can you tell which group is struggling?
- Can you think of these problems on the spur of the moment, or do you need to write extra problems in advance?
- Are they in your textbook?

What ifs:

- What if one group finishes early?
- What if one group doesn’t get it?
- What if no one finishes?
- What if they all finish?
- Questions…

Discuss: Using this first sequence as "today's lesson," how would you consolidate this?

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But what about scaffolding?

- You build that in to the thin slices.
- Think about the things you would tell your students during a lecture on the subject.
- Write problems that do the scaffolding for you through the thin slices–these are the “leaps”
- For your 5 minute introduction, what is the least you can do or show them to get them started?

Thank you for your time!

Link to shared folder

GUIDED PRACTICE

E 1 Solve using square roots. Check your answer.

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1. $x^2 = 225$
2. $x^2 = 49$
3. $x^2 = -100$
4. $x^2 = 400$
5. $-25 = x^2$
6. $36 = x^2$

E 2

3

7. $3x^2 - 75 = 0$
8. $0 = 81x^2 - 25$
9. $49x^2 + 64 = 0$
10. $16x^2 + 10 = 131$
11. $0 = 4x^2 - 16$
12. $100x^2 + 26 = 10$

E 3 Solve. Round to the nearest hundredth.

3

13. $3x^2 = 81$
14. $0 = x^2 - 60$
15. $100 - 5x^2 = 0$

E 4

4

16. **Geometry** The length of a rectangle is 3 times its width. The area of the rectangle is 170 square meters. Find the width. Round to the nearest tenth of a meter. (*Hint:* Use $A = bh$.)

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Solve by using square roots.

12. $-2x^2 = -72$

13. $9x^2 - 49 = 0$

14. $3x^2 + 12 = 0$

Solve by completing the square.

15. $x^2 + 10x = -21$

16. $x^2 - 6x + 4 = 0$

17. $2x^2 + 16x = 0$

18. A landscaper has enough cement to make a patio with an area of 150 square feet. The homeowner wants the length of the patio to be 6 feet longer than the width. What dimensions should be used for the patio? Round your answer to the nearest tenth of a foot.

Solve using the Quadratic Formula. Round to the nearest hundredth if necessary.

19. $x^2 + 3x - 40 = 0$

20. $2x^2 + 7x = -5$

21. $8x^2 + 3x - 1 = 0$

Find the number of x-intercepts of each function by using the discriminant.

22. $4x^2 - 4x + 1 = y$

23. $y = 2x^2 + 5x - 25$

24. $y = \frac{1}{2}x^2 + 8$

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