

Can 3 wrongs make a right?

Using Test Items to Drive Student Thinking

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What is assessment?

- Voodoo
- Punishment
- The bane of my existence
- A sadistic plot
- A process of reasoning from evidence
- All of the above
- None of the above



My answer, and some other points

- Assessment is a process of **reasoning** from **evidence** about **student understanding**.
- Assessment is an essential part of instruction.
- **Teachers** can learn from assessment.
- **Students** can learn from assessment too.



Introductions

- Who am I?
- Who are you?
- Why are we here (unless you say otherwise)?
 - What assessment is for and how to do it well
 - How we as teachers can learn from assessment
 - Using items to spur higher-order student thinking
- Why *aren't* we here (for the most part)?
 - Test prep, lots of theory, large-scale / high-stakes



Let's get ready

- Pick a course you're teaching...
- ... a (focused) topic you'll teach soon...
- ... and write:
 - One thing you want students to know
 - How they could show you they know it
 - Ways in which you think they might go wrong

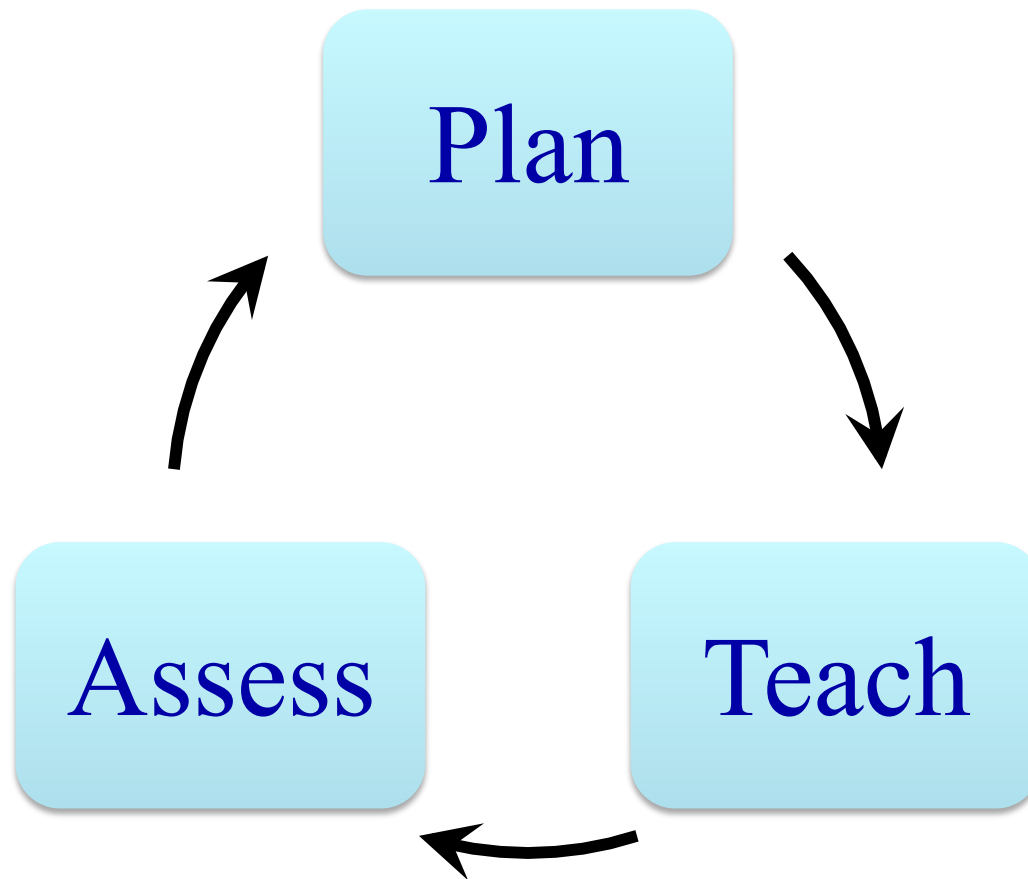
- We'll use this shortly



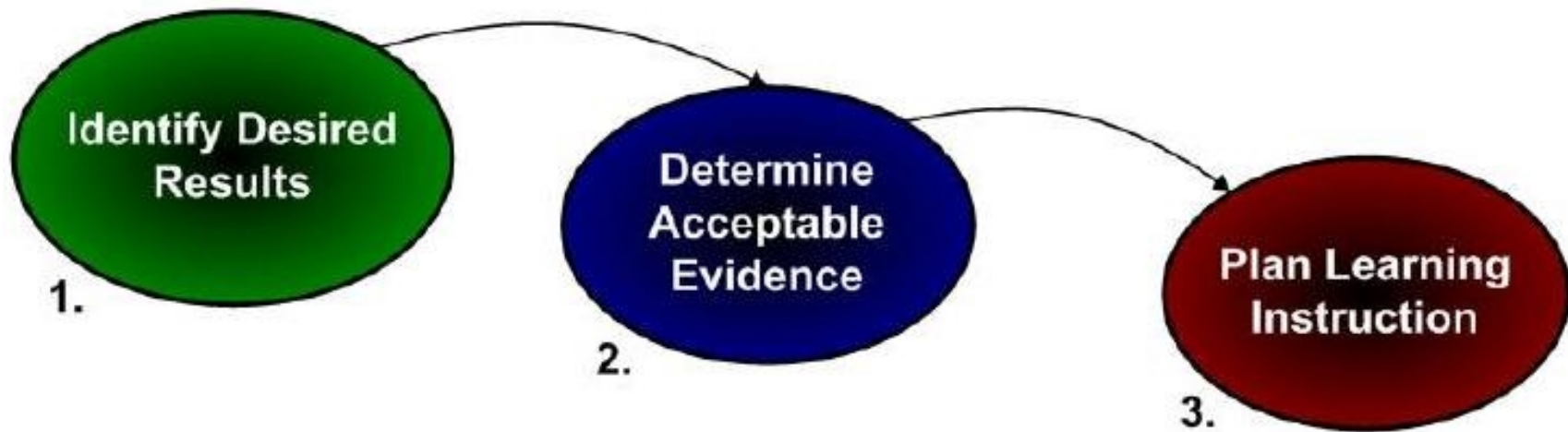
Part 1

- What is assessment for?
 - ... and, who is assessment for?
- What makes assessment good?
 - ... for what?
- How do we do it well?
 - ... given our context and constraints?

Assessment is part of teaching



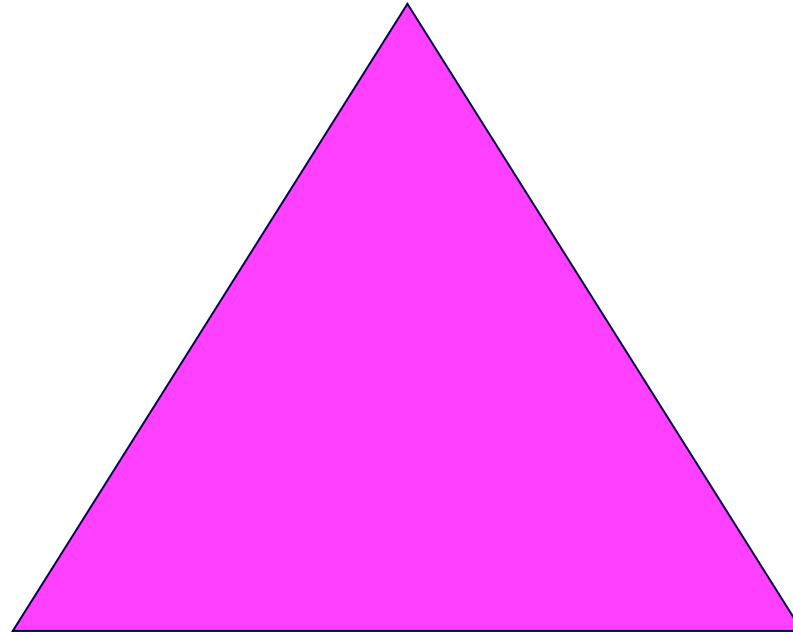
Understanding by Design





The assessment triangle

Interpretation



Cognition

Observation



The goal

Kids get the item right for the right reason, and wrong for the right reason.

The right reason is understanding of the objective.



What's involved in the process?

- Creating items and assessments
- Understanding the results of assessments
- What we do in the classroom around this

- What about our students?
 - What should they **know** about this process?
 - What are some important **feelings** to reinforce?
 - Could this improve their **math understanding**?



What makes a good item...

- ... on a classroom test?
- ... on a large-scale assessment?

- In what ways would the answers be the same?
- In what ways might they differ? Why?

- A non-obvious criterion: **alignment**



A rectangle has length 3.7 cm and width 5.4 cm. What is its perimeter?

A. 8.1 cm

B. 9.1 cm

C. 16.2 cm

D. 18.2 cm

A. 18.2 cm

B. 18.2 cm²

C. 19.98 cm

D. 19.98 cm²



Build a multiple-choice item

- ❑ Figure out what you're trying to assess
- ❑ Make a task (stem or prompt) and answer it
- ❑ What misconceptions most concern you?
- ❑ Create distractors based on misconceptions
- ❑ Clean up your item and options
- ❑ Is it still aligned with the objective?



Building good tests

- Start with good items
- Items, learning goals, and inference
- Using multiple items on a learning goal...
 - at one sitting
 - through time
- Cumulative testing
- Novel learning goals, or asking in a novel way



Part 2

- What can we, as teachers, do with the results?
 - ... on our own?
 - ... with our colleagues?
 - ... with our students?
- Do the results change anything?
 - Instruction?
 - Future assessment?
 - Something else?



You wrote a test. Now what?

- Now that we have good items, how do we as teachers learn from the assessment results?

- All data gets meaning through **comparison**
 - Across domains for one student at one time
 - Across time for one domain for one student
 - Across students for one domain at one time



Grading

- Why do we grade?
- What do **we** really want to know?
- What do we want **students** to know?
- Do we need to grade the way we do?

Growth through time: Proficiencies



Geometry – Fall Proficiencies

Student name:

Year: **2006/7**

Assessments	Angle Relationships		Area and Perimeter		Similarity	Right Triangle Trigonometry		Volume and Surface Area	
	Angle A – recognizes angle relationships and can find missing angles	Angle B – can find interior and exterior angles in polygons	Area A – can determine when area and perimeter are relevant and can find for various polygons	Area B – determines when to use trig and P. T. in complex problems that don't directly ask	Can determine if two shapes are similar and find missing lengths in similar shapes	Trig A – can apply trig ratios to find missing lengths in right triangles	Trig B – Can decide when, where, and how to apply trigonometry in situations beyond right triangles	Volume A – can explain the difference between (surface) area, perimeter, and volume	Volume B – knows when volume and surface area should be used, and can find both
1.23.07	NY	NY	P	NY	P+	NY	NY	P+	NY

P+ means 'Expert'

P means 'Proficient'

NY means you are 'Not Yet' proficient

More comparison: Item analysis

Last	First	1 Identify relation as function from ordered pairs	2 Evaluate composition of functions	3 Identify function from graph	4 Represent function as table from arrow diagram	5 Solve quadratic trigonometric equation	6 Apply trig identities to evaluate expression	7 Identify function from equation	8 Write rule of composition of functions	9 Identify absolute value function from graph	10 Identify equation of inverse of function	11 Application problem with direct variation	12 Application problem with inverse variation	13 Find range of function given rule and domain	14 Identify graph of inverse variation	15 Identify one-to-one function from graph	Total	%
###	###	4	6	6	6	12	12	5	7	5	5	6	7	6	4	6	91	
###	###	4	6	6	5	8	12	5		5	4	0					55	60%
###	###	4	4	6	5	10	12	5	6	5	5	6	7	0	4	5	84	92%
###	###	4	6	6	4	8	8	5	7	5	5	6	2	1	4	6	77	85%
###	###	3	1	5	4	12	12	2	7	5	4	6	2	6	4	3	76	84%
###	###	4	1	5	4	8	12	4	2	3	4	6	2		0		55	60%
###	###	4	6	4	5	10	12	4	7	5	4	6	2		0	6	75	82%
###	###	4	4	6	6	10	7	3	7	5	5	6	2	3	0		68	75%
###	###	4	6	6	6	12	12	5	7	5	5	6	7	6	5	9	101	111%
###	###	4	6	6	5	12	12	3	7	5	5	4	2	5	0	8	84	92%
###	###	4	2	6	6	4	2	2	4	5	5	6	7			4	57	63%
###	###	4	2	6	5	12	12	4	3	5		6	2	6	0	2	69	76%
###	###	4	6	6	5	10	4	3	8	5	5	6	2		4		68	75%
	Avg	98%	69%	94%	83%	81%	81%	75%	77%	97%	85%	89%	44%	38%	44%	60%	12	87%
	SD	7%	35%	11%	12%	20%	30%	23%	28%	12%	10%	30%	33%	42%	56%	40%		



Comparisons: for advanced users

- Increasing the scope of comparisons
 - The power of common goals and/or assessments

- Combining multiple dimensions
 - Action research
 - More distilled learning goals make this easier

- Shifting the load onto students



Part 3: Promoting student thinking

- How can assessment items, and our practices and use of them, promote student thinking?

- What are our ideas?
 - Might think of these as “feel” / “think” / “act”
 - Or, as “before” / “during” / “after” assessment
 - What are some common themes?



An interesting quote

- Students who have been able to explore why the wrong idea is wrong have a more secure and deeper understanding of why the right idea is right.

— Jonathan F. Osborne



Foundational MC knowledge

- Grading for work, not just for the answer
(also a way to give more feedback per minute)
- Build understanding of distractors as errors
linked to misunderstandings (not random)
- Build effective test-taking habits
(really, this is about critical reading)
 - Anticipating options
 - Using the information provided



Analyzing items

- Explain the errors behind distractors
- Devise distractors and write rationales

- Can lead up to writing items, if scaffolded:
 - at the end of a unit
 - for prior learning topics (review)
 - in groups
 - for more “procedural” topics



Cognitive demand

- (How) does this item make students think?
- Low: Recall, recognition, perform procedure
- Medium: Represent, multi-step, integrate, apply, solve a problem, compare, justify
- High: Plan, analyze, judge, create, abstract, generalize, formulate a problem
- What kinds of items can do each?
What kinds of activities can do each?

Analyzing performance

Algebra 2 Test 8 Analysis						Date
Name:						
#	Topic of the problem	Possible	Earned	Journal	Class %	Key Ideas for Problem
1	Evaluate composition of functions	6			49%	
2	Solve quadratic trigonometric equation	12			80%	
3	Identify absolute value function from graph	5			77%	
Which problems did <i>the class</i> have the most issues with? Which ones can <i>you</i> help with?						
What topics should you review? What should you add to your summaries? What do you expect on the next test?						



Carol Dweck: the growth mindset

Students [with] a growth mindset... believe their intelligence can be developed over time through their effort and learning... [and] that everyone can learn and become smarter. [It] creates a framework in which students... see effort as a good thing and as a tool for learning and becoming smarter... that setbacks mean that they must... ramp up their effort and look for new study strategies.

Educators need to send a message that intelligence and talent are developed through passion, learning, and persistence... that challenges are fun, effort is satisfying, mistakes are welcome clues, and even failures can put people on the path to success.



Studying

- Anticipating test content
- Reworking troublesome items
- The bottom line: Creating agency in students



Other classroom practices

- What methods have you used?
- Sharing challenges and successes
- What are your open questions?



How will this affect your teaching?

- What's one idea you've gained or one connection you've made?
- What's one thing you're going to try?
- What's one thing you'll tell someone about?



Thank you!

- Please email with feedback, corrections, questions, ideas, comments, and resources!
- I'm happy to send you these slides

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