

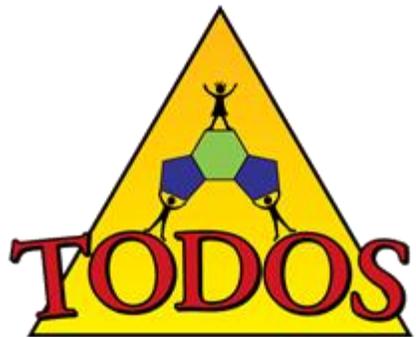
Exploring Universal Design with Writing Prompts on Mathematics Exams

NCTM Annual Meeting

April 15, 2016

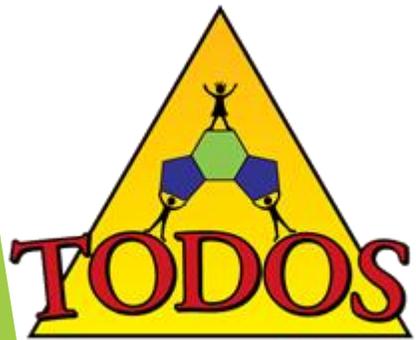
Dr. Angela Thompson

Governors State University



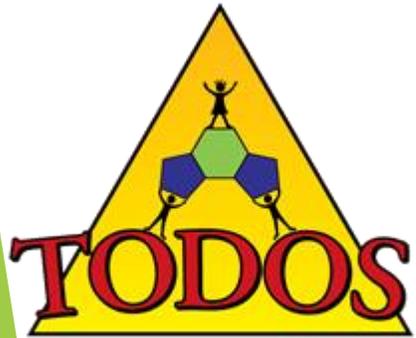
Mathematics for ALL

So... what kinds of things go wrong with mathematics testing?



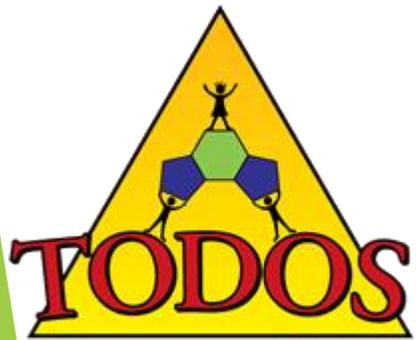
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Ok, nevermind!



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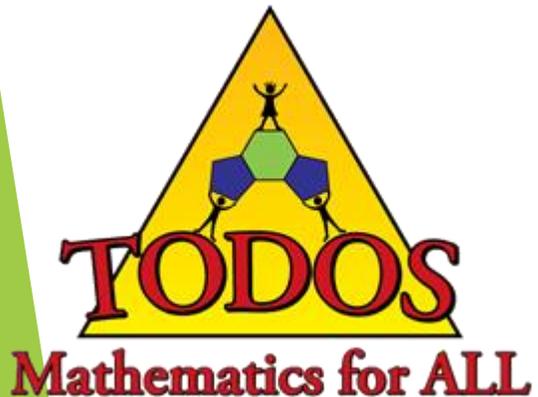
Did you ever feel that the value assigned to a test score was lower than your actual mathematical understanding? Why?



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Test Scores

- ▶ Are just a snapshot of one day, one time
- ▶ Factor in anxiety: the clock is ticking!
- ▶ Factor in distractions, both on the test and in life
- ▶ Careless errors
- ▶ Typos on the calculator
- ▶ “I know the math, I just read it wrong”

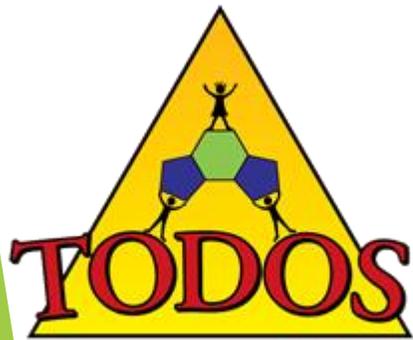


An idea is born!

- ▶ With my preservice teachers, I began thinking about how to try to capture *more* of the mathematics students know and can do. My goals were:
 1. Incorporate Universal Design
 2. Get students to slow down and think conceptually
 3. Engage in the mathematics practices
 4. Give students an “out” by letting them choose some of their exam questions
 5. Find out more about my students

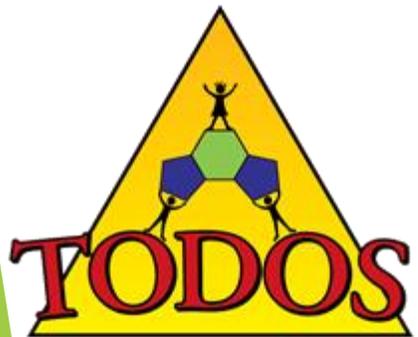
Writing prompts on mathematics exams

- ▶ On a full page on the last page of exams
- ▶ Choose one of three prompts and write a paragraph
- ▶ Prompts are shown to students in advance of the exam
- ▶ Grammar, spelling, punctuation are not scored
- ▶ Points are awarded for
 - a complete response
 - that includes mathematics
 - and is mathematically correct



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Think about which prompt you would most likely choose, and what you might write in the following examples



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Example 1: Write a paragraph on ONE of the following three topics.

a) What is *factoring*? Describe what you know about factoring and its characteristics. Use an example from page 4.

b) Write instructions and a detailed explanation of how you did this problem on page 4

$$\frac{z^2 + 5z + 6}{z^2 + 6z + 9} \div \frac{z^2 + 2z}{z^2 + 9z + 18}$$

c) Using a Common Denominator to add and subtract quotients. Give a demonstration and explanation on how to simplify the following expression

$$\left[-\frac{1}{8x} - \left(-\frac{1}{4} \right) \right] - \left(\frac{3}{2} - \frac{9}{8x} \right)$$

Example 2: Write a paragraph on ONE of the following three topics.

a) What is *slope*? Describe what you know about slope and its characteristics. Use an example equation and graph.

b) What is the quadratic formula for? Describe what you know using a graph and the function from #3.

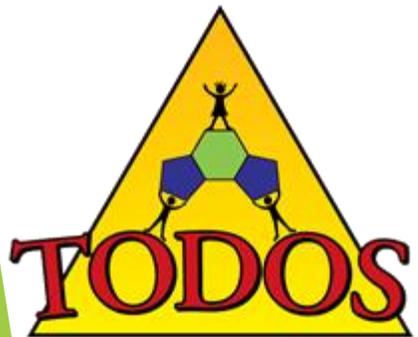
c) When doing word problems, how do you know when you are finished, and how do you know your answer is correct? Choose one word problem from page 6 and give a complete explanation.

Example 3: Writing Choose one of the following three topics and write a paragraph.

- A) Explain the difference between *definite* integrals and *indefinite* integrals. Choose one of each from your test items and specifically refer to the functions as a part of your response.
- B) Explain how to set up an integral to find the area under the curve. Specifically refer to problem 9, 10, or 11 and ***include a sketch***.
- C) Explain in complete sentences how to set up and then take a double indefinite integral of $S = 4e^{4x}$ Do the integral as a part of your response.

Let's look at some examples of
student responses

More here



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A generic scoring rubric

0	1	2	3	4	5
No response	Response is minimal, does not address the question, or is conceptually incorrect	At least one correct statement. Response is minimal and incomplete	Response contains some of the required components; some is correct. One or more incorrect statements	Response is mostly complete OR is complete but with a minor error	Response contains all components AND is mathematically correct

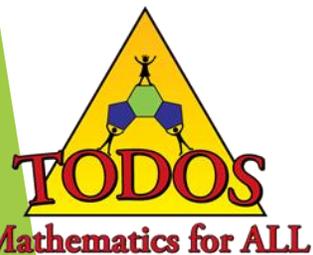
Some Results

- ▶ Some students who get an overall *low* score on a test give excellent responses to prompts
- ▶ Some students who get an overall *high* score on a test give poor responses to prompts
- ▶ I am learning more about my students and their conceptual understanding
- ▶ There is evidence that students are learning *during* the exam

Let's go back to my goals:

► My goals were:

1. Incorporate Universal Design
2. Get students to slow down and think conceptually
3. Engage in NCTM mathematics practices (next slides)
4. Give students an “out” by letting them choose some of their exam questions
5. Find out more about my students



Which mathematics teaching practices map to this idea?

- ▶ Establish mathematics goals to focus learning
- ▶ Implement tasks that promote reasoning and problem solving
- ▶ Use and connect mathematical representations
- ▶ Facilitate meaningful mathematical discourse
- ▶ Pose purposeful questions
- ▶ Build procedural fluency from conceptual understanding
- ▶ Support productive struggle in learning mathematics
- ▶ Elicit and use evidence of student thinking

Which mathematics practice standards map to this idea?

- ▶ Make sense of problems and persevere in solving them
- ▶ Reason abstractly and quantitatively
- ▶ Construct viable arguments and critique the reasoning of others
- ▶ Model with mathematics
- ▶ Use appropriate tools strategically
- ▶ Attend to precision
- ▶ Look for and make use of structure
- ▶ Look for and express regularity in repeated reasoning

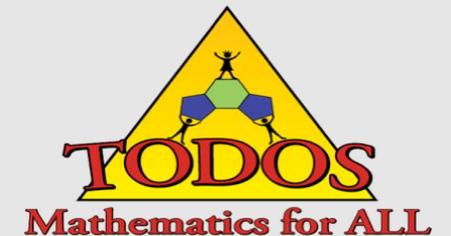
Questions and Comments

- ▶ Have you tried anything like this at your institution?
- ▶ How would you modify these writing prompts to suit your needs?
- ▶ How do you think your students will react to writing on their mathematics exams?
- ▶ Are you going to try it? Why or why not?



Five Good Reasons to Become a TODOS Member!

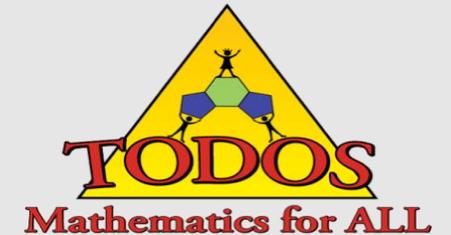
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TODOS Membership

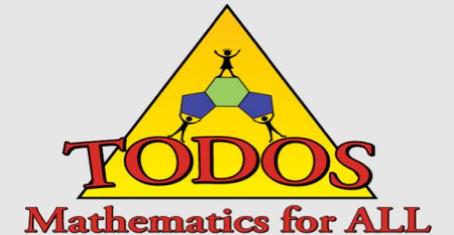
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**Thank You! I welcome
additional feedback**

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