

Rethinking Homework's Role in Math Class



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#RethinkMathHW

NCTM Annual, Session 507
Hilton Bayfront, Sapphire 411
3:00 PM - 4:00 PM



Our (Optimistic) Agenda

- A story
- Reasons we assign homework
- Analyzing homework assignments
- Case studies
- Educational research about homework
- Crafting homework to meet our goals
- Wrapping up with reflections



“Every problem in every set.”

-Mrs. Callahan, Algebra 2, every school day, 1989-1990 (and probably every day of her 25+ year career at Milton High School, Milton, MA)

-Ethan Weker, every school day, September 2001 - June 2003

I can't wait to spend my evening doing homework with my kids instead of playing!

Said no parent ever.

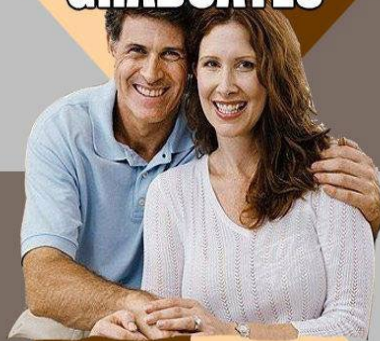


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user card


**KEEP
CALM
AND
HATE
MATH HOMEWORK**

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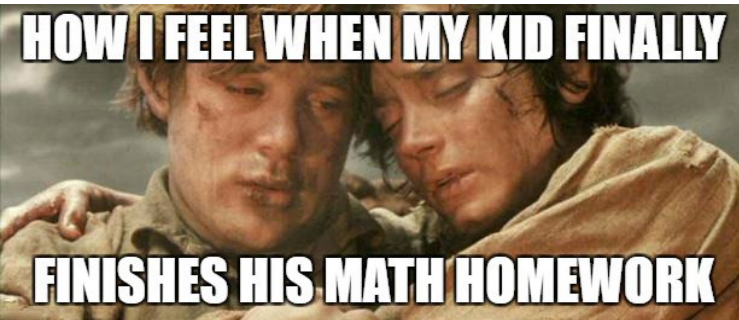
**BOTH COLLEGE
GRADUATES**



**INCAPABLE OF HELPING YOU WITH
HOMEWORK AFTER 4TH GRADE**

HOW I FEEL WHEN MY KID FINALLY

FINISHES HIS MATH HOMEWORK



**IF NO ONE HAS CRIED BY THE
TIME THE HOMEWORK IS DONE...**



**THEN YOU PROBABLY
DID THE HOMEWORK WRONG.**

FIRST GRADE MATH HOMEWORK



IS TEARING MY FAMILY APART.



Why do YOU assign homework?

- Practice newly learned material
- Preview new material
- Develop good study habits
- District, school, or department requirement
- Extra challenges
- Review older material
- Other reasons?



Does homework WORK (for your class) now?

- Practice newly learned material
- Preview new material
- Develop good study habits
- District, school, or department requirement
- Extra challenges
- Review older material
- Other reasons?



What are your homework concerns?

- Students don't do it
- Students do it but rush to finish it
- Students copy off of each other
- Some students have tutors to help them
- Some students don't have tutors to help them
- No time to grade homework
- No time for homework feedback
- Students don't read feedback

Which homework strategy is best?

- What will benefit all of your students?
- What do you have time to curate?
- What do you have time to check?
- What feedback can you give?
- What feedback will your students get?
- Will you get pushback from parents?
- Will you get pushback from your school?



Thoughts on Equity and Homework

- Time
- Opportunity
- Technology
- Support





How can you analyze homework assignment?

Considerations:

- Time
- Independence
- Challenge
- Repetition
- Review
- Preview
- Reflection





How can you analyze homework assignment?

Considerations:

Time: Too Little? Too Much?





How can you analyze homework assignment?

Considerations:

Independence



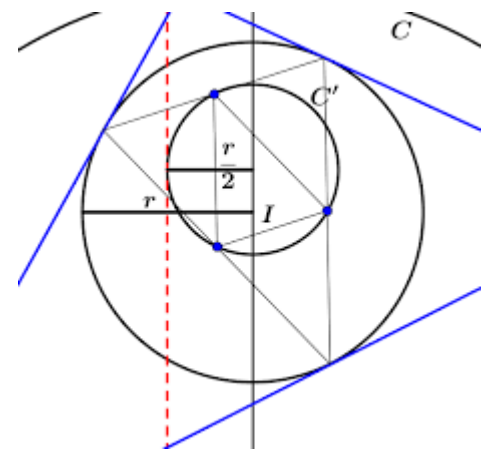
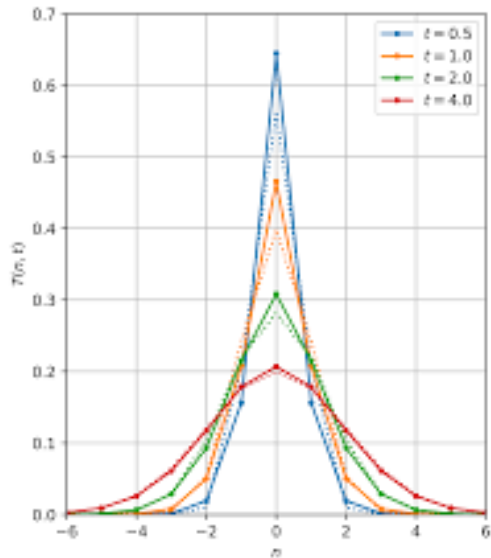


How can you analyze homework assignment?

Considerations:

Challenge

$$\begin{array}{ccc} C_n(X) & \xrightarrow{f\#} & C_n(Y) \\ \downarrow \pi_x & & \downarrow \pi_y \\ C_n(X)/C_n(A) & \overset{\varphi}{\dashrightarrow} & C_n(Y)/C_n(B) \end{array}$$





Considerations:

Repetition

Repetition

Repetition

Repetition

Repetition

Repetition

Repetition

Repetition

petition

petition₂

petition

Competition

petition

Competition

Competition

petition

Competition

Competition

Multiplication Facts to 49 (A)

Multiply by 2.

0

1

2

3

4

5

6

$\times 2$

$\times 2$

$\times 2$

$\times 2$

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$\times 2$

$\times 2$

2

2

2

2

2

2

2

$\times 0$

$\times 1$

$\times 2$

$\times 3$

$\times 4$

$\times 5$

$\times 6$

2

2

2

2

5

2

2

$\times 7$

$\times 6$

$\times 0$

$\times 4$

$\times 2$

$\times 2$

$\times 3$

2

2

7

0

5

2

2

$\times 4$

$\times 3$

$\times 2$

$\times 2$

$\times 2$

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$\times 5$

$\times 1$

$\times 3$

$\times 0$

$\times 3$

$\times 4$

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2

$\times 0$

$\times 3$

$\times 4$

$\times 7$

$\times 2$

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6

$\times 2$

$\times 2$

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$\times 2$

Math-Drills.Com

Kuta Software - Infinite Pre-Algebra

Simplifying Variable Expressions

Simplify each expression.

1) $-3p + 6p$

2) $b - 3 + 6 - 2b$

3) $7x - x$

4) $7p - 10p$

5) $-10v + 6v$

6) $-9r + 10r$

7) $9 + 5r - 9r$

8) $1 - 3v + 10$

9) $5n + 9n$

10) $4b + 6 - 4$

11) $35n - 1 + 46$

12) $-33v - 49v$

13) $30n + 8n$

14) $7x + 31x$

15) $10x + 36 - 38x - 47$

16) $-2(7 - n) + 4$

17) $-8(-5b + 7) + 5b$

18) $-4p - (1 - 6p)$



How can you analyze homework assignment?

Considerations:





How can you analyze homework assignment?

Considerations:

Preview





How can you analyze homework assignment?

Considerations:





Homework Assignment Options for Analyzing

[EngageNY Grade 2 Module 3 Topic B Lesson 2](#)

[Everyday Math Grade 6 Math Journal Lesson 1-11](#)

[DeltaMath.com](#) (Dynamic Online Math Assignments)

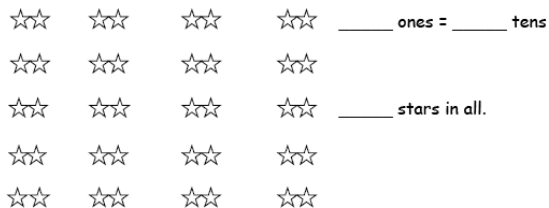
[Glencoe Geometry Workbook Lesson 8-2](#)

[Houghton-Mifflin Algebra 2 & Trigonometry, p. 196-197](#)

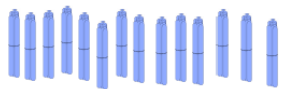


Thoughts about...EngageNY Grade 2 Assignment?

1. How many in all?



2. These are bundles with 10 sticks in each.



a. How many tens are there? _____

b. How many hundreds? _____

c. How many sticks in all? _____

3. Sally did some counting. Look at her work. Explain why you think Sally counted this way.

177, 178, 179, 180, 190, 200, 210, 211, 212, 213, 214

4. Show a way to count from 68 to 130 using tens and ones. Explain why you chose to count this way.

5. Draw and solve.

In her classroom, Sally made 17 bundles of 10 straws. How many straws did she bundle in all?

- Time?
- Independence?
- Review?
- Preview?
- Challenge?
- Repetition?
- Reflection?

Thoughts about...McGraw-Hill Grade 6 Assignment?

1

Time for Solving a Math Problem

Time (minutes)	Number of Students
12-14	1
14-16	1
16-18	1
18-20	2
20-22	2
22-24	3
24-26	4
26-28	3
28-30	5
30-32	6
32-34	1

Write a statistical question that could be answered using the graph above.

2 Nicole did the sit-and-reach test at the gym and stretched $18\frac{1}{2}$ inches. The next month she tried again and reached an additional $2\frac{1}{4}$ inches. How far did she reach on the second try?

Solution: _____

3 Write *true* or *false* next to each number sentence.

a. $9 \times 75 = (9 \times 70) + (9 \times 5)$ _____

b. $9 \times 75 = 75 \times 9$ _____

c. $9 \times 75 = 630$ _____

d. $9 \times 75 = 10 \times 74$ _____

4 Writing/Reasoning Without multiplying to find what both sides equal, how do you know whether Problem 3b is true or false?

- Time?
- Independence?
- Review?
- Preview?
- Challenge?
- Repetition?
- Reflection?

Thoughts about...CPM Algebra 1 Assignment?



3-48. For the entire rectangle at right, find the area of each part and then find the area of the whole. [Homework Help](#)

3-49. Write the area of the rectangle at right as a *product* and as a *sum*. [Homework Help](#)

3-50. When solving $\frac{x}{6} = \frac{5}{2}$ for x , Nathan noticed that x is divided by 6. [Homework Help](#)

- What can he do to both sides of the equation to get x alone?
- Solve for x . Then check your solution in the original equation.
- Use the same process to solve this equation for x : $\frac{x}{10} = \frac{2}{5}$.

3-51. Jamila wants to play a game called "Guess My Line." She gives you the following hints: "Two points on my line are (1, 1) and (2, 4)." [3-51 HW eTool \(Desmos\)](#). [Desmos](#)
[Accessibility](#) [Homework Help](#)

- What is the slope of her line? A graph of the line may help.
- What is the y -intercept of her line?
- What is the equation of her line?

	11	8
7		
3		

x	x				
x	x				
x^2	x^2	x	x	x	x



- Time?
- Independence?
- Review?
- Preview?
- Challenge?
- Repetition?
- Reflection?

Thoughts about...Houghton-Mifflin Algebra 2?

Written Exercises

Transform the given rational expression into a sum by dividing.

A 1. $\frac{15y^4 - 25y^3 + 10y^2}{5y^2}$

3. $\frac{c^2d^2 - cd^2 + cd}{-cd}$

5. $\frac{x^2 + 5x - 66}{x - 5}$

7. $\frac{-8x^2 - 14x + 11}{2x + 5}$

9. $\frac{3z^3 - 7z^2 + 6z - 8}{z - 2}$

11. $\frac{3r^3 + 7r^2 - 7r - 2}{3r + 1}$

13. $\frac{2c^3 - 5c^2 + 18}{2c + 3}$

15. $\frac{12x^3 - 3x^2 - 20x + 7}{4x - 1}$

17. $\frac{8d^3 + 125}{2d + 5}$

2. $\frac{12a^2b^2 - 4ab - 20}{4ab}$

4. $\frac{27r^2s + 15rs^2 + r}{3rs}$

6. $\frac{18t^2 + 3t - 10}{3t - 2}$

8. $\frac{u^2 - 8}{u - 3}$

10. $\frac{a^3 + a^2 - 22a + 8}{a - 4}$

12. $\frac{8v^3 - 10v^2 - 17v + 15}{4v - 3}$

14. $\frac{27t^3 - 6}{3t - 2}$

16. $\frac{10x^3 - 4x^2 + 15x - 6}{5x - 2}$

18. $\frac{x^4 + 2x^3 - 11x^2 - 7x + 20}{x + 4}$

B 19. $\frac{2y^4 - 7y^3 - 8y^2 + 17y - 4}{y^2 - 5y + 4}$

21. $\frac{5t^4 - 3t^3 - 8t^2 - 7}{t^2 - 2}$

23. $\frac{2x^3 + 7x^2y - xy^2 + 12y^3}{x + 4y}$

20. $\frac{t^4 - 2t^3 - 5t + 5}{t^2 + t + 2}$

22. $\frac{b^3 + 27}{b^2 - 3b + 9}$

24. $\frac{32r^5 + 4}{2r + 1}$

- C 25. By trying examples such as $\frac{x^5 - 32}{x - 2}$, make a conjecture about the

pattern of the quotient of any division of the form $\frac{a^n - b^n}{a - b}$, in which n is a positive integer.

26. Repeat the process mentioned in Exercise 25 to make a conjecture about the quotient of any division of the form $\frac{a^n + b^n}{a + b}$, in which n is a positive *odd* integer.

- Time?
- Independence?
- Review?
- Preview?
- Challenge?
- Repetition?
- Reflection?

Thoughts about...Glencoe Geometry Assignment?

Parallelograms

Find each measure.

1. $m\angle K$

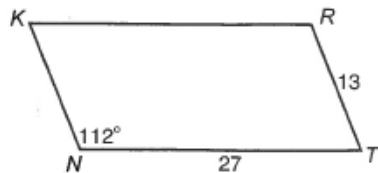
2. $m\angle R$

3. $m\angle T$

4. KR

5. KN

6. Suppose the diagonals of $\square KRTN$ intersect at point Y .
If $NY = 12$, find NR .



- Time?
- Independence?
- Review?
- Preview?
- Challenge?
- Repetition?
- Reflection?



Thoughts about...DeltaMath Assignment?

Mr. Weker

Multiply / Divide Complex Numbers in Polar Form

Nov 16, 12:58:34 PM



Given the complex number $z_1 = 18\left(\cos \frac{17\pi}{9} + i \sin \frac{17\pi}{9}\right)$ and $z_2 = 3\left(\cos \frac{2\pi}{9} + i \sin \frac{2\pi}{9}\right)$, express the result of $\frac{z_1}{z_2}$ in rectangular form with fully simplified fractions and radicals.

Answer:

Submit Answer



- Time?
- Independence?
- Review?
- Preview?
- Challenge?
- Repetition?
- Reflection?

A Few Approaches to Rethinking Homework Assignments

- [Lagging Homework](#) (Henri Piccioto)
- [2-4-2](#) (or other variation) (Steve Leinwand)
- [No/Limited Homework](#) (Alfie Kohn)
- [Retrieval Practices](#) (Pooja Agarwal)
- [Open Middle Problems](#) (Several great educators)
- Student Created Problems
- Flipped Classroom Models ([Khan Academy](#) or you)

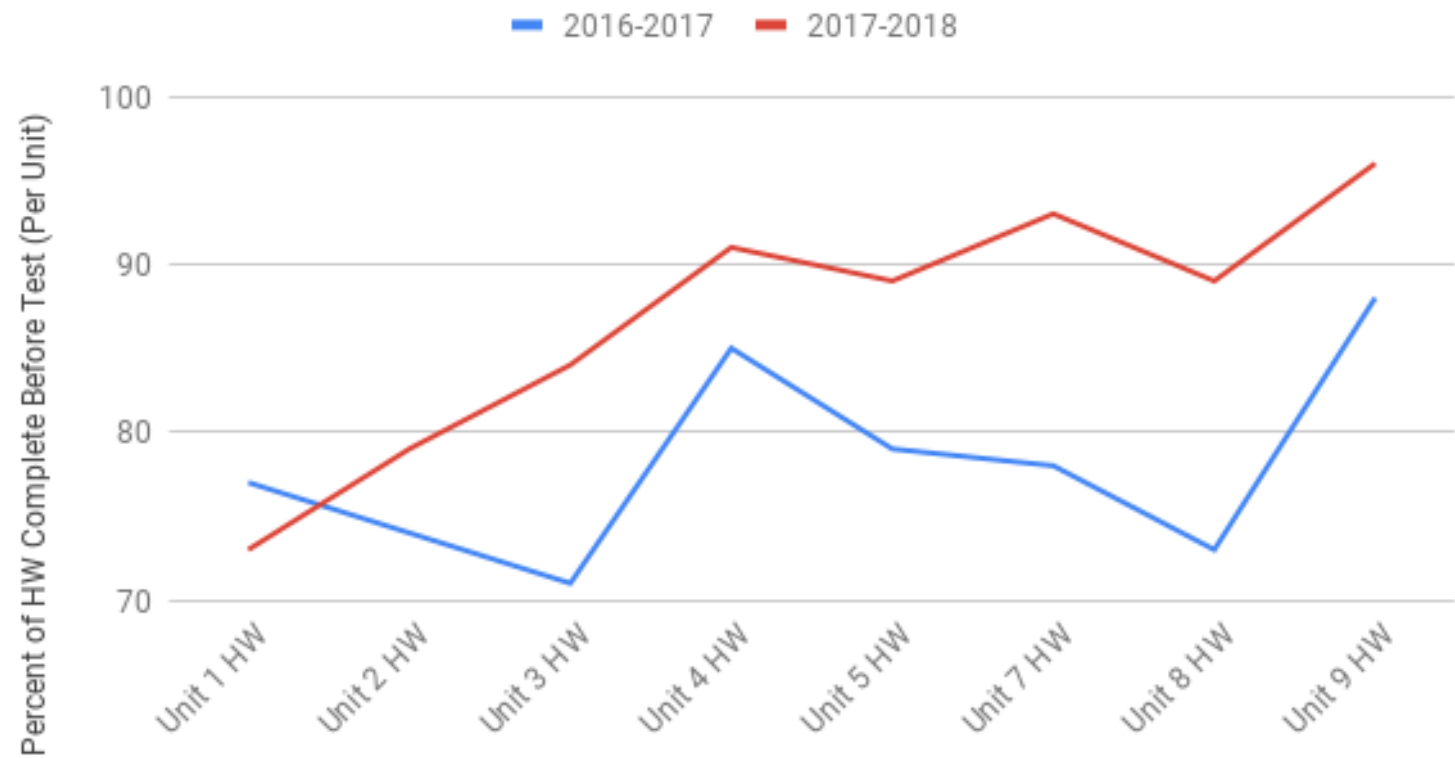


Summer of 2017...We Did It! No More Required Homework!*

*With a few exceptions...

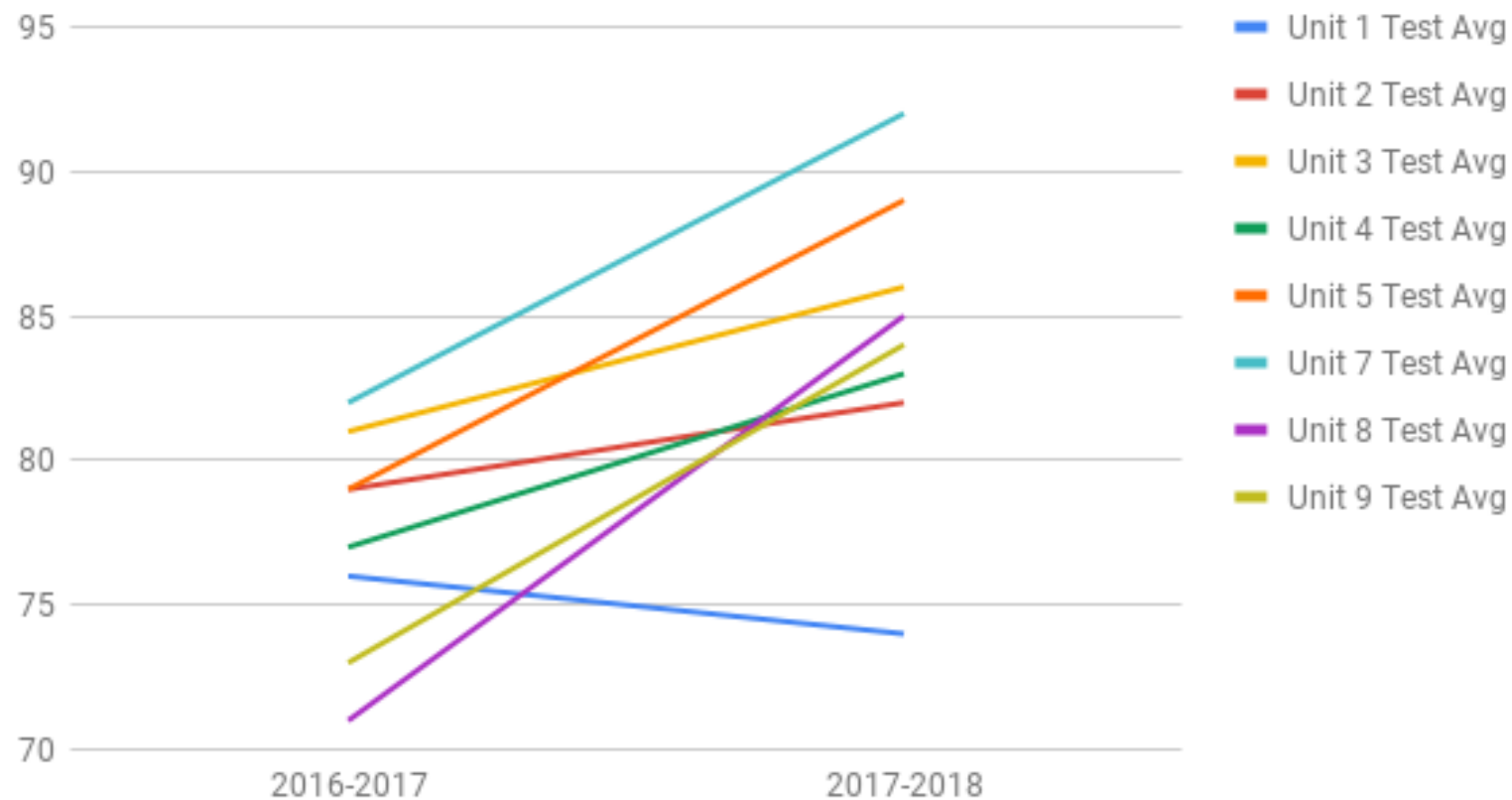
- Key assignments (a handful over the year)
- Projects
- Unfinished classwork
- To retake assessments

Homework Completion Rates, 2016-2017 and 2017-2018





Average Algebra 1 Test Scores Comparison





Erwin's Comparison

2016-2017

Homework “graded” - Checked if completed and gave them up to 5 points for it EACH day. Answers were always posted and students checked for accuracy.

Homework: 20% of the final grade

Class Year Average: 81.29

7 out of 61 students repeated course: 11.5%
(2 F's, 1 D's, 3 D+'s, 1 C-)

2017-2018

Practice assigned but not graded. Answers were always posted and students checked for accuracy. Usually provide digital practice w/ immediate feedback.

Only grade quizzes and tests

Class Year Average: 83.15

8 out of 68 students repeated course: 11.8%
(1 F's, 4 D's, 2 D+'s, 1 C-)



Student Quotes on Homework...

nothing, at first i was hesatent about it but it is working for me really well.

It is a lot less stressful

Less pressure and stress

It helps with pressure knowing I have a little time to complete it.

less stress

Even though I always do the homework anyway, even when it is not required, it takes a LOT of stress off, and I feel like I can do the homeworks more easilly and with less pressure than ever before. I feel like I even usually get more answers right this way, because I'm not super super pressured to get everything correctly because it won't be graded. Looking at the answers really helps too, because I can see things that I don't understand and try to figure them out.

there is no pressure, if I don't understand something I feel more comfortable and confident to go to you, knowing it won't impact my grade

Slackers fall behind with little incentive to work harder. Similarly, hard workers may feel their effort has little worth. Those who didn't understand the lesson can slip through the cracks for a while, and they may fall behind and not get the extra help they need.

I can do the homework without the stress of being wrong

Gives more trust in students

Which homework strategy is best?

- What will benefit all of your students?
- What do you have time to curate?
- What do you have time to check?
- What feedback can you give?
- What feedback will your students get?
- Will you get pushback from parents?
- Will you get pushback from your school?

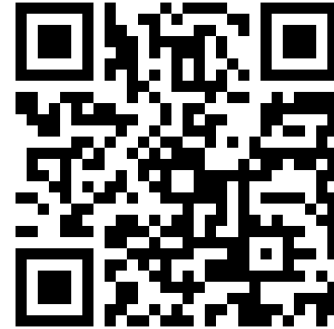
Call to Action: Create your own homework philosophy

Take a few minutes, talk to a neighbor, and think about/make notes about how you may change your homework. What can you do...

... next week?

... next semester?

... next year?



If you'd like, you can share ideas on this padlet:

https://padlet.com/ethan62/RethinkMathHW_NCTM19

and/or on Twitter: #RethinkMathHW