Closing the Factory: Productive Struggle And the New Math Model
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Superintendent, Howard-Winneshiek District, IA

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Superintendent, Freehold Township District, NJ

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From the 20th to the 21st Century: How Education Models Have Changed

John Carver,
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Howard-Winneshiek District
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@JohnCCarver
Our current school system is based on needs that no longer exist.
20th Century Model

Mathematics  Science  Social Studies  English
21st Century Model

- Multi-disciplinary (no silos!)
- 21\textsuperscript{st} Century STEM replaces 20\textsuperscript{th} century 3Rs
- Personalized
- Students learn in hands-on, project-based environments
- Learn at own pace
- Passions connected to professions

The goal is to develop critical thinking, **not** to memorize for rote tasks. **Not** tech for tech’s sake.
If the goal of your technology initiative is to put technology in the classroom

All you're going to get is technology in the classroom
Here is the Difference...

- **20th Century**: Time is constant and predictable, with no flexibility in learning.
- **20th Century**: 3 Rs – Reading, Writing, Arithmetic

- **21st Century**: Learning is constant and predictable, and time needs to be flexible.
- **21st Century**: STEM + Creativity and Imagination
How Do We Make This Change?
Project-Based Learning (PBL)

Making It Real
The Maker movement spurs students to rediscover the joy of creating

NEW: Urban Advocate now in ASBJ

7th grade DM student designed tractor & cultivator to print on 3-D printer. @PLTWorg #2020HowardWinn pic.twitter.com/ZdTuG2neas
“Students are the most valuable and least consulted education-policy experts in America.”
-A. Ripley, *The Atlantic*
The Administrator’s Guide to EdTech Purchasing

Download LearnBop’s free guide, created in partnership with Sup’t Carver:

go.learnbop.com/edtech-purchasing-guide
Join the Future Ready Movement

futurereadyschools.org/take-the-pledge
Busy Work or Home Learning?

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Dr. Edward Aldarelli
Principal, West Freehold School
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Schools vs. Factories
“That Worksheet Changed My Life!”

“That worksheet changed my life!”

(Said NO child EVER.)
The Goal of What We Do…

The goal of all that we do is to enhance learning.

There is abundant research about how children learn and factors that influence learning.

Research about the brain, motivation, persistence and student differences offer insights to how students’ learn – but very little about learning theory, child development is applied to homework.
Rigor and Quality

• Educational quality is often incorrectly correlated with rigor; and rigor, in turn is thought to be reflected by the quantity and difficulty of an assignment.

• Quality of task is more important than time required.

• Children are not vending machines: the belief that putting in more homework will get out more learning is false!

• Dewey, “…the value of what students do resides in its connection with a stimulation of greater thoughtfulness, not the greater strain it imposes.”
Research Update

Purposes of Homework Clarified

Impact on School Communities

Dr. Jeffrey Huguenin
Principal,
Catena School
@CatenaPrincipal
18,000

2012 Study “When Is Homework Worth the Time” by Robert H. Tai
- Professor at University of Virginia’s Curry School of Education
Studied transcripts and data from 18,000 High School 10th graders
Findings: No significant relationship between time spent on homework and grades.

Meta-analysis

2012 “Reforming Homework: Practices, Learning and Policies”
By Educational Psychologist Richard Walker, Sydney University, Australia

Findings: Concluded that homework does not significantly impact achievement and can even be detrimental.
What If Doctors Took the Same Approach to Surgery as We Do For Homework?

Surgery then...  Surgery now...
Times Change,
But Worksheets Haven’t!

Homework then... Worksheet

Homework now... Still a Worksheet!

Worksheet
Conditional sentences I & II
1. If it rains (rain) tomorrow, I will stay at home.
2. Tom would not be so fat if he didn’t (eat) so much chocolate.
3. Your teachers will help (help) you if you have problems.
4. If the children run (run) faster, they would catch the early train.
5. I wanted (ask) my parents if I (was) (be) you.
6. Ted has a very good chance to win the race. If he /win/ (win) it, he /will get/ (get) a prize.

Spelling

clapping running getting sitting stopping
tagged trapped shipped planned patted

Name: ___________________________

1. After the play, everyone was ________________ their hands.
2. The cars are ________________ at the red light.
3. My mom is ________________ on a chair.
What It Looks Like When It Starts to Change...

Mrs. Killian @MrsKillian1 · 3h
Recording our #teamhomework data on a collaborative #GoogleDoc! We even used our email #tryingsomethingnew

Homework. September 9, 2015
Teach someone at home to play Math Slap (x 2’s) and play two games use this countdown timer and the video before for help!

Sept. 9th Math Homework
9/9 Math Slap Homework x 2’s

Matter/Energy/Electricity/Magnetism

Bill Nye's Lab The Science Gu... 1
Properties of... 2
Solutions, L... 3
Elementary Science: Mat... 4
Solutions, L... 5
The Measurements Son... 6
How to read a ruler... 7
Standard Idea:... 8
Sept 28 short show 2011... 9
Kinder and 1... 10
Energy Guide for kids 11
The element song 12
Bill Nye The Science Gu... 13
Segment II

Personalization
Cognitive Engagement
Technology Applications

Dr. Edward Aldarelli
Principal, West
Freehold School
@WFSPrincipal
Guiding Principles for Homework Practices

- Personalization/Pre-Learning
- Higher Cognitive Assignments and Activities
  - Questioning/Feedback
  - Collaboration
Personalization
Ask Questions Instead of Solving Problems

Women of the Revolution

Mr. Aldarelli's Class

Generate three questions about this image from an American Revolutionary War Battle.

3 RESPONSES

1. **Respondent**
   What weapons were used during the Revolutionary War?
   What role did women play during the war?
   How did weaponry affect the outcome of the war?
   
   0 0 3 MONTHS AGO

2. **Respondent**
   Why was a woman helping with the cannon?
   When did this take place?
   Where did this take place?
   
   0 0 3 MONTHS AGO

3. **Respondent**
   Why are the men looking at her?
   Her husband just died - why is she worried about fighting the war?
   How on earth does she man the cannon in this picture?

learnbop
Feedback & Collaboration

Kaizena

Please let me know what you think of the opening paragraph.

0:11
3 months ago

0:10
3 months ago

Try to come up with a lead that grabs the reader's attention - maybe a quote?

3 months ago

Write your message here...

A

POST COMMENT

Writing Sample.pdf

October 19th, 2021, 9:30 am

Maui Uncle was a high school math teacher in Hawaii. But now that he retired, he can go commercial fishing in the Pacific once more often. Last summer, when in some parts he could only get his boat ready before the end of August, every day he worked until finally his 25ft boat was ready to fish.

Though it got rough for most of the time, I had fun fishing with Chancellor King and Peter (Pope) Salmon. We'd at least be fishing for whiting, watching the fish get caught! Commercial fishing is fishing is very different from fishing with fishing poles. It's like morning rain, and there's about 12.8 times fishing with fishing poles. While most boats caught 1-2, we caught about 15-20, and you can sell the salmon if you want but we decided to keep them.

The scenery of the boat is like a wild animal, the salty spray depending on you on the boat who seats in the cabin and...
“Homework in the best classrooms is not checked; it is shared!”
- Martin Haberman

Dr. Ross Kasun @FTSupt_Kasun
Mr. Ed Aldarelli @WFSPrincipal
Dr. Jeff Huguenin @CatenaPrincipal
Orchestrating Productive Struggle in Math

Cindy Bryant  Director of Learning, LearnBop
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Famous Folks Who Struggled

Steve Jobs
The Beatles
Walt Disney
Michael Jordan
Oprah Winfrey
Albert Einstein
Support Productive Struggle (Effort)

NCTM, *Principles to Action* – Effective Teaching Practice 7

Productive Persistence = Tenacity + Good Strategies

Carnegie Foundation

The effort to make sense of something, to figure something out that is not immediately apparent.

Hiebert & Grouws, 2007

Opportunities for delving more deeply into understanding the mathematical structure of problems and relationships among mathematical ideas, instead of simply seeking correct solutions.

NCTM, *Principles to Actions*

Effortful practice that goes beyond passive reading, listening, or watching – that builds useful, lasting understanding and skill.

Hiebert & Grouws, 2007
For deeper learning to take place, struggle is not optional – it’s neurologically required.

Author, Daniel Coyle

*The Talent Code*
Firing and optimizing circuits grows myelin!

- Targeted mistake-focused practice
- Myelin turns narrow alleys into broad lightning-fast super highways.
Students’ Speak: Productive vs. Unproductive Struggle

A. I know my struggle is _______ when I make progress/learn from my mistakes.

B. I know when it was _______ when I don’t remember it the next day.

C. When I’m _________, I’m moving backwards or not moving at all. Or it’s a continuous loop.

D. _________
   When you finish you feel great. Slowly learning but you feel great.

E. ________________
   • Feel inclined to give up
   • Becoming stressed
   • Don’t see any progress
   • Unfocused
### Productive Beliefs

Mathematics ability is a function of opportunity, experience, and effort – not innate intelligence. Mathematics teaching and learning cultivate mathematics abilities. All students are capable of participating and achieving in mathematics, and all deserve support to achieve at higher levels.

Effective mathematics instruction leverages students’ culture, condition, and language to support and enhance mathematics learning.

Effective teaching practices (e.g., engaging students with challenging tasks, discourse, and open-ended problem solving) have the potential to open up greater opportunities for higher order thinking and for raising the mathematics achievement for all students, including poor and low-income students.
### The teacher:
- creates a climate that supports mathematical thinking and communication.
- responds in a way that keeps the focus on thinking and reasoning rather than only getting the right answer.

### Teacher praises students for:
- The strategies they use.
- The specific work they do.
- Persistence and effort.

### The students:
- grow accustomed to explaining their ideas, questioning solutions that don’t make sense to them.
- are not afraid to take risks and know that it is acceptable to struggle with some ideas and to make mistakes.
- recognize that mistakes are a means to learning, not an end.
<table>
<thead>
<tr>
<th>Mathematical Tasks</th>
<th>Problem Solving Strategies</th>
<th>Mathematical Tools</th>
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<tbody>
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<td>No decision a teacher makes has a greater impact on students’ opportunities to learn and on their perceptions about what mathematics is than the selection or creation of the tasks with which they engage students in studying mathematics (Lappan and Briars, 1995).</td>
<td>Allowing students to approach solving problems in different ways using different strategies helps them to better understand mathematics, develop mathematical fluency, and see mathematics as worthwhile and doable. Doing so sets the stage for transferring conceptual knowledge to new situations (Many, Fyfe, Lewis, &amp; Mitchell, 1996).</td>
<td>Effective teachers know that using a variety of mathematical tools shapes the way students think and helps build conceptual understanding of the hows and whys of mathematics (Fuson et. Al. 1992).</td>
</tr>
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“Inexperienced problem solvers don’t know what to do when they don’t know what to do.

“Experienced problem solvers do know what to do when they don’t know what to do.”
Resources

- https://www.youcubed.org/
- http://illuminations.nctm.org
Thank You!

Questions & Answers with LearnBop

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