Four Effective Mathematics Practices: Adaptations for All Learning Environments

Kansas MTSS & Alignment

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Referencing the *Promising practices and approach to support remote learning*, which promising practice are you **already** employing?

a) Providing opportunities for real-time interactions
b) Facilitating and sharing feedback
c) Connecting curriculum to students' experiences through project-based learning
d) Engaging and motivating through games that embed learning content
e) Offering resources to students and families on how to explore content on their own

Which promising practice do you **plan** to employ when/if eLearning resumes?

a) Providing opportunities for real-time interactions
b) Facilitating and sharing feedback
c) Connecting curriculum to students' experiences through project-based learning
d) Engaging and motivating through games that embed learning content
e) Offering resources to students and families on how to explore content on their own

Transitioning in and out of eLearning

Agenda

- **Build and Maintain a Consistent Approach**
- Video Instruction
- Increase Interactions
- Interventions

Build and Maintain a Consistent Approach

- "Rules and routines keep your class running smoothly so that you have more time for teaching academics" (NEA)
- Classroom routines help students build expectations and reduce off-task behavior (Savage, 1999; Vaughn, Bos, & Schumm, 2000)
- For eLearning, maintain a schedule similar to or close as possible to the face-to-face
  - Helps all stakeholders know what is happening and when
  - Aids transitions from in-person to eLearning formats

Daily Class Schedule

React. Thumbs up or down.
Would keeping the schedules the same or similar help the students in your district?

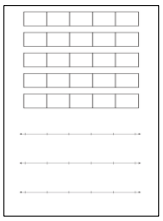
Times	Activities
7:50-8:10	Morning Meeting
8:10-9:10	Mathematics
9:10-9:30	Recess
9:30-10:30	Specials (Art, Music, PE)
10:30-11:30	Science/Social Studies
11:30-12:00	Lunch
12:00-12:30	Recess
12:30-1:30	Reading Groups
1:30-2:00	Flex / Intervention Time
2:00-2:30	Mindfulness

Log-on Times	Activities
7:50	Morning Meeting
8:10	Mathematics
9:10	Recess
9:30	Specials (Art, Music, PE)
10:30	Science/Social Studies
11:30	Lunch
12:00	Recess
12:30	Reading Groups
1:30	Flex / Intervention Time
2:00	Mindfulness

Communication

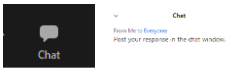
React. Thumbs up or down.
Would keeping the schedules the same or similar help the students in your district?

- Implement "Explicit directions, responses to frequently asked questions, and links to quality educational resources can help ease anxiety that students and families might experience while learning remotely" (REL-MA, 2020)
- Have updates on activities, student performance, and any technical supports needed.
- If you are using a graphic organizer, supply it to families ahead of time.



Question / Poll

- What are some challenges to building a consistent approach with eLearning and how have you tackled them?



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Video Instruction

- Show students how to solve mathematics problems.
- Share your thinking aloud and incorporate opportunities for students to ask and answer questions during the instruction.
- This can be more difficult through eLearning but there are advantages as well.
  https://www.youtube.com/watch?v=UumqgceaLX0 example with PreCalc through Jeremy Klassen

What helps students who struggle?

"Studies showed that when faced with multistep problems, students frequently attempted to solve the problems by randomly combining numbers instead of implementing a solution strategy step by step. **The process of encouraging students to verbalize their thinking—by talking, writing, or drawing the steps they used in solving a problem—was consistently effective"** (NCTM Research Brief p. 2).

Meta-analytic reports highlight the need for explicit instruction

React. Thumbs up or down.
Do you teach new or difficult math content using explicit instruction?

- Feedback and Formative Assessment
- Modeling and Guided Practice
- Multiple Means of Representation
- Questioning Techniques
- Setting Objectives and Learning
- Summarizing *(Hattie, 2012)*

- "Instruction during the intervention should be explicit and systematic. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review" *(Gersten et al, 2009).*

Comparison between four elementary curriculum

- Agodini et al (2009, 2010) found that the two highest performing 1st grade student scores came from the two curriculum that emphasize components of explicit instruction, such as procedural facility.
- "After one year (by the end of 1st grade), students taught with [ExplicitInstructionCurriculum1] and [ExplicitInstructionCurriculum2] made greater gains in achievement" (Agodini & Harris, 2013, p. 1).
- "After two years (by the end of 2nd grade), [ConstructivistCurriculum] students continued to lag behind [ExplicitInstructionCurriculum 1 and 2], while [StandardsFocusedBasalCurriculum] students caught up…" (Agodini & Harris, 2013, p. 1).

Agodini and Harris (2014) follow-up data

- "The average study teacher agrees fairly strongly with constructivist instruction. The average value of the five items that constitute the constructivist scale indicates that the average study teacher's view toward this instructional approach lies between 'agree' and 'strongly agree'" (p. 13).
- Surprisingly, they found that teachers who favored constructivist teaching had lower effects with a constructivist math program than teachers with a balanced or explicit instruction belief.
- In the constructivist program, teachers with higher content knowledge were linked to scores not significantly different than those in higher performing curricula
- Additionally, the most constructivist math program had significantly lower scores across the participating programs.

16 Elements of Explicit Instruction (Archer & Hughes, 2011)

Elements 1-8

1) Focus instruction on critical content
2) Sequence skills logically
3) Task analyze complex skills into smaller steps
4) Design focused lessons
5) Set the expectation to start the lesson
6) Review prior skills
7) Demonstrate stepwise instructions
8) Use clear and concise language

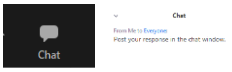
16 Elements of Explicit Instruction (Archer & Hughes, 2011)

Elements 9-16

9) Provide examples and nonexamples
10) Provide students guided practice
11) Require frequent responses
12) Monitor student performance closely
13) Provide immediate feedback (corrective or affirmation)
14) Deliver instruction at a brisk pace
15) Connect information across lessons and content
16) Provide abundant time for practice and cumulative review

Question / Poll

- Describe some challenges to videoing your instruction and provide some tips to improving recorded instruction.



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Increase Interactions

"Explicit directions, responses to frequently asked questions, and links to quality educational resources can help ease anxiety that students and families might experience while learning remotely" (REL-MA, 2020)

Incorporate opportunities for engagement

- 5-15 minute intervals
- Ask and answer questions
- Assessments

Use Stop-Check

- Fractions division example
- Have blanks to be completed.
- Fade modeling
- Ask students why
- Record student responses

Start with models

75 - 48 = ?

a) **E**xpanded notation 70 + 5
- 40 - 8

c) calculate **T**ens 30

d) calculate **O**nes 30 - 3

e) calculate **T**otal 30 - 3 = 27

Modeling is Important

A) 71	B) 34	C) 95	D) 46
- 14	- 16	- 58	- 17
70 + 1	30 + 4	90 + 5	40 + 6
- 10 - 4	- 10 - 6	- 50 - 8	-10 - 7
60 - 3	20 - 2	40 - 3	30 - 1
57	18	37	29

E T O T

Consider Faded Teacher Input

React. Thumbs up or down. Could this work in both your in-person and eLearning classes?

My turn | Students fill in blanks | and more | and more

A) 71	B) 34	C) 95	D) 46
- 14	- 16	- 58	- 17
70 + 1	30 + 4	90 + 5	40 + 6
- 10 - 4	- 10 - 5	- 50 – 8	- 10 - 7
60 - 3	20 - 2	40 – 3	30 - 1
= 57	= 18	= 37	= 29

E T O T

Independent Practice

I) 61 − 24

J) 74 − 45

K) 84 − 37

L) 33 − 19

M) 46 − 31

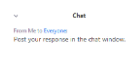
N) 52 − 25

Recording Advice

	Expanded Notation	Tens	Ones	Total (Difference)	Answer
Mike	√	√	√	√	√
Tarek	√	X	√	√	X
Miguel	√	√	√	√	√
Manuel	√	√	X	X	X
Jose	na	na	na	na	na
Pam	√	X	√	√	X
Michele	√	√	√	√	√
Brandon	√	√	√	√	√
Stan	X	√	√	√	X

Question / Poll

- How well do your students engage during online instruction and what have you done to improve participation?



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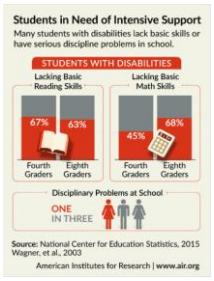
Interventions

- Small groups for intervention
- Multiple Representations and CRA



Small groups

- Set-up small groups and breakout rooms for interventions.
- Small groups can also be used to extensions of work.
  "Relating academic content to meaningful real-world problems can help students find relevance in their learning and foster creative thinking to develop their own solutions" (REL-MA, 2020)
- Have students work in groups to review and apply mathematics skills that have been learning.

CRA (or CVA) as effective instruction
(Gersten et al, 2009; NMP, 2008; Riccomini & Witzel, 2010; Witzel, 2005)

Concrete to Representational to Abstract Sequence of Instruction (CRA)

- Concrete (expeditious use of manipulatives)
- Visual Representations (pictorial)
- Abstract procedures

Excellent for teaching accuracy and understanding

Example: http://engage.ucf.edu/v/p/2wKBsbB

Concrete – Representational – Abstract sequence of instruction (CRA)

- CRA (or CVA) is highly impactful for students to build mathematics reasoning and procedural understanding.
  - Single Digit computation (Peterson, Mercer, & O'Shea, 1988)
  - Multi-digit multiplication (Flores & Milton, 2020)
  - Fraction Computation (Hughes, Riccomini, & Witzel, 2018)
  - Algebra, single variable (Maccini & Ruhl, 2000)
  - Algebra, multiple variable (Witzel, 2005; Witzel, Mercer, & Miller, 2003)
- However, a growing area of research shows promise for VRA (Bouck et al, 2018).

IES Practice Guide Recommendations

#	IES - RtI Math Panel Recommendation
1	Screen ALL students to identify those who need interventions
2	Intervention instructional materials for students should focus on whole numbers (K-5) and rational numbers (4-8)
3	Intervention instruction should be explicit and systematic.
4	Teach common underlying structures to word problems
5	Include visual representations of mathematical ideas
6	Devote at least 10 minutes to fluent fact retrieval
7	Monitor progress of those receiving intervention as well as those at-risk
8	Include motivational strategies in Tier 2 and Tier 3 interventions

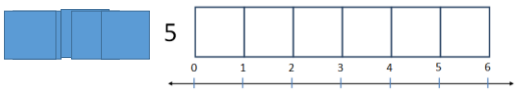
Teach each CRA lesson to mastery

- Model and guide students in their use of manipulative objects and pictorial representations.
- Teach students step by step gradually introducing mathematical vocabulary. Allow students to name or invent their stepwise procedures within instruction.
- Move from concrete to representational to abstract learning levels only after students show accuracy without hesitations in manipulations or drawings.
- Assess each level of learning according to stepwise procedures. Take account of students who created different procedures.

The Importance of Number Lines

- Geary and his colleagues (2011) followed children from kindergarten to 10th grade
- 177 students in 12 different elementary schools
- "… first graders who understood the number line and how to place numbers on the line and who knew some basic facts showed faster growth in math skills than their counterparts over the next five years" (Science Daily, 2011).

Number Line Progression
Count to five using blocks (Witzel, 2013)



Number Line Progressions

Is red greater than or less than green?
Is A greater than or less than B?

A

B

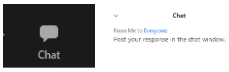
CVA - Examples

Sample virtual manipulative tools

- https://www.didax.com/math/virtual-manipulatives.html
- https://toytheater.com/category/teacher-tools/virtual-manipulatives/
- https://mathigon.org/polypad

Question / Poll

- Provide some links to excellent instructional ideas.



Thank you

"Unless someone like you cares a whole awful lot, Nothing is going to get better. It's not."

Theodor Seuss Geisel