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|  | **Integration of Technology Use from Replacement-Amplification-Transformation (RAT) Framework****(Hughes, Thomas, & Scharber, 2006)** |
| **Replacement**Description: “Involves technology used to replace and, in no way change established instructional practices, student learning processes, or content goals” (p. 2). | **Amplification**Description: “Use that amplified current instructional practices, student learning, or content goals. Increased efficiency and productivity are major effects” (p. 2). | **Transformation**Description: Through comparison with pencil/paper or something that is newly possible, “Use that transforms the instructional method, the students’ learning processes, and/or the actual subject matter” (p. 3). |
| **Research-Informed Teaching Practices from Principles to Action: Ensuring Mathematical Success for All (NCTM, 2014)** | 1. **Establish Mathematics Goals to Focus Learning**

Description:  *Establish clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions (p. 10).* | * Display data, learning targets, and class information digitally
* Show students the “plan” for the week, including objectives and big picture
* Project goals and objectives with technology instead of posting them on the board or having students write them

Possible Technologies:* Planbook.com
 | * Use videos to launch lessons
* Show students and teachers the learning goals
* Keep track of the progress of students on each slide to get closer to the learning target.
* State or explain the objective and goal for the lesson

Possible Technologies:* CCSSM Look-For App
* Xtramath
* PowerPoint
* Keynote
* Educreations
* ShowMe
 | * The tool or device adds to or changes the goals of the learning
* Goals are updated or changed based on individual student progress
* Students assess themselves before, during, and after the lesson to guide instruction
* Have students look at lesson or objective and then write what they think they are learning that day
* Have students create their own goals

Possible Technologies:* Google Form
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| 1. **Implement Tasks That Promote Reasoning and Problem Solving**

Description: *Engage students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies (p. 10).* | * PDF or static screen rendering of textbook pages or worksheets

Possible Technologies:* Whiteboard App
* Online Computational Games or Skills
 | * Web tools to investigate and present solutions to tasks
* Teacher shows instructional video that explains concept being taught

Possible Technologies:* Tiggly
* Osmos
* MathTwitterBlogosphere
* Interactive Whiteboard Apps
* LearnZillion
 | * Student investigates videos to launch lessons or presents problems
* Student leads video recording of work on device
* Use what was created with Whiteboard App to provoke students’ discussion
* Showing multiple strategies and errors for students to explain or reason about
* Real world problems
* Allowing students to tinker

Possible Technologies:* Desmos
* Dynamic Geometry Software
* Computer Algebra Systems
* Screencast Software
* Dan Meyer Videos
 |
| 1. **Use and Connect Mathematical Representations**

Description: *Engage students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving (p. 10).* | * Have access to virtual forms of student materials or teacher instructional materials
* Students explain their thinking by projecting manipulatives
* Use document camera or Smartboard instead of writing on white board

Possible Technologies:* Virtual Manipulatives
 | * Connecting a mathematical concept to a technological tool
* Share access and collaboration
* Show a visual to help explain a concept

Possible Technologies:* SolveMe Mobile
* Pieces Basic
* Algebra Tiles
* Touch Counts
* Braining Camp
* Osmo
* Google Image and Video
* Tiggly
 | * The tool allows for student to explore and/or discover relationships independently or in small groups
* Write over pictures taken
* Multiple representation comparison through student explanations
* Present the concept and have students interact with it

Possible Technologies:* Desmos
* Dynamic Geometry Software
* Computer Algebra System
* NearPod
* PearDeck
* Screencast Software
 |
| 1. **Facilitate Meaningful Mathematical Discourse**

Description: *Facilitate discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments (p. 10).* | * Launch images and maybe videos to set the context for problems
* Use discussion boards especially in online environments
* Build taken-as-shared understanding using student questions

Possible Technologies:* Formative Assessment tools such as Clickers
 | * Orchestrate discussions using digital photos of student work
* Access to other student thinking in a gallery walk
* Students to comment and give feedback to others
* Digital tools to help scribe student thinking
* Build taken-as-shared understanding using student questions
* Access student responses quickly

Possible Technologies:* Screencast Software
* Educreations
* VoiceThread
* Plickers
 | * Shared student workspaces
* Collaborative environments with many “hands” on the work
* Get at relationships and different representations
* Have students discuss answers and why they got them
* Collaboratively work out the problem and explain/justify answers

Possible Technologies:* Google Docs
* Groupboard
* Mathematical Tools
* Plickers
* Interactive Whiteboard App
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| 1. **Pose Purposeful Questions**

Description: *Use purposeful questions to assess and advance students’ reasoning and sense making about important mathematical ideas and relationships (p. 10).* | * Using a virtual version of asking questions
* Video of modeling effective questions
* Posting on document camera or Smartboard

Possible Technologies:* Edmodo
* Socrative
* #mtbos Scavenger Hunt
* Online Webquest
* Project Sentence Stems
 | * Real-time summary data
* Ask questions
* Present math images to students to form questions

Possible Technologies:* Clickers
* Discussion boards
* Plickers
* Wouldyourathermath.com
 | * User-controlled scaffolding
* Advancing students based on thinking and reasoning
* Students pose purposeful questions and decide which questions have value
* Interactive presentations
* Supports for students to develop questions
* Allow students to ask questions they were not able to ask without the technology
* Show pictures and have students develop questions

Possible Technologies:* Three Act Math
* Gletchy.com
* Dan Meyer’s blog
* Nearpod
* PearDeck
* 101 Questions
* GeoGebra
* TinkerPlots
* Number Talk Images
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| 1. **Build Procedural Fluency from Conceptual Understanding**

Description: *Build fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems (p. 10).* | * Individual manipulatives to see number partners

Possible Technologies:* Virtual Manipulatives
* Drill and Practice Apps
* Base 10 Block App
* XtraMath
* Math Playground
* Quizlet
* IXL
 | * Include a variety of models and representations with accompanying facts
* Teacher use manipulatives to show student work or to manipulate blocks in more than one way

Possible Technologies:* Base 10 Block App
* Llama Drama
* Todo math
 | * Students procedural fluency leads to discussion of properties
* Allow students to lead discussions about their processes or to new concepts
* Show and discuss different student strategies to see how they relate, different, or have errors
* Use sliders with mathematical tools
* Students are the teacher – record themselves doing a problem and explaining it to others

Possible Technologies:* Base 10 Block App
* Braining Camp
* Ten-frame Fill
* GeoGebra
* Desmos
 |
| 1. **Support Productive Struggle in Learning Mathematics**

Description: *Consistently provide students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships (p. 10).* | * Allows students to interact with a problem
* Challenging problems online
* Warm up task or brainteasers projected on screen

Possible Technologies:* Desmos
* Openmiddle.com
* Visualpatterns.org
 | * Gradual release of guiding information
* Support for individual and group work for all levels
* Allow predictions, conjectures, and discussions

Possible Technologies:* SolveMe Mobiles
* Number Puzzles – Which One Doesn’t Belong?
* Video Brainteasers
* Three Act Math
 | * Tools that give different levels of “hints” depending on how much information is provided – user controlled scaffolding
* Gamification or games that could change individual pacing

Possible Technologies:* Three Acts
* Solve Me Mobiles
 |
| 1. **Elicit and Use Evidence of Student Thinking**

Description: *Use evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning (p. 10).* | * Use of tablet as personal whiteboard
* Replace paper and pencil time tests

Possible Technologies:* Drill and Skill Apps
 | * Immediate student feedback

Possible Technologies:* Clickers
* Teachers dashboards associated with textbooks
 | * Students create own prompts
* Allows you to change instruction in the moment or during the lesson for whole group individually
* Students discuss mistakes
* Students justify their reasoning

Possible Technologies:* ActivePrompt
* Screencast Software
* Would you rather/Which one doesn’t belong?
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