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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 |
| 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 |
| 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 |
| 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? |