# Appendix C
## Resulting Framework for Evaluating DIMs With Teacher-Generated Examples and Indicators

<table>
<thead>
<tr>
<th>Research-Informed Teaching Practices from Principles to Action: Ensuring Mathematical Success for All (NCTM, 2014)</th>
<th>Integration of Technology Use from RAT Framework (Hughes, Thomas, &amp; Scharber, 2006)</th>
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<tbody>
<tr>
<td><strong>Replacement</strong>&lt;br&gt;Description: “Involves technology used to replace and, in no way change established instructional practices, student learning processes, or content goals” (p. 2).</td>
<td><strong>Amplification</strong>&lt;br&gt;Description: “Use that amplified current instructional practices, student learning, or content goals. Increased efficiency and productivity are major effects” (p. 2).&lt;br&gt;<strong>Transformation</strong>&lt;br&gt;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).</td>
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<td><strong>1. Establish Mathematics Goals to Focus Learning</strong>&lt;br&gt;Description: <em>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).</em></td>
<td><strong>Replacement</strong>&lt;br&gt;- Display data, learning targets, and class information digitally&lt;br&gt;- Show students the &quot;plan&quot; for the week, including objectives and big picture&lt;br&gt;- Project goals and objectives with technology instead of posting them on the board or having students write them&lt;br&gt;Possible Technologies: Planbook.com&lt;br&gt;- Use videos to launch lessons&lt;br&gt;- Show students and teachers the learning goals&lt;br&gt;- Keep track of the progress of students on each slide to get closer to the learning target.&lt;br&gt;- State or explain the objective and goal for the lesson&lt;br&gt;Possible Technologies: CCSSM Look-For App&lt;br&gt;- Xtramath&lt;br&gt;- PowerPoint&lt;br&gt;- Keynote&lt;br&gt;- Educreations&lt;br&gt;- ShowMe&lt;br&gt;- The tool or device adds to or changes the goals of the learning&lt;br&gt;- Goals are updated or changed based on individual student progress&lt;br&gt;- Students assess themselves before, during, and after the lesson to guide instruction&lt;br&gt;- Have students look at lesson or objective and then write what they think they are learning that day&lt;br&gt;- Have students create their own goals&lt;br&gt;Possible Technologies: Google Form</td>
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<td><strong>2. Implement Tasks That Promote Reasoning and Problem Solving</strong>&lt;br&gt;Description: <em>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).</em></td>
<td><strong>Replacement</strong>&lt;br&gt;- PDF or static screen rendering of textbook pages or worksheets&lt;br&gt;Possible Technologies: Whiteboard App&lt;br&gt;- Online Computational Games or Skills&lt;br&gt;- Web tools to investigate and present solutions to tasks&lt;br&gt;Possible Technologies: Tiggly&lt;br&gt;- Osmos&lt;br&gt;- MathTwitterBlogosphere&lt;br&gt;- Interactive Whiteboard Apps&lt;br&gt;- LearnZillion&lt;br&gt;- Student investigates videos to launch lessons or presents problems&lt;br&gt;- Student leads video recording of work on device&lt;br&gt;- Use what was created with Whiteboard App to provoke students’ discussion&lt;br&gt;- Showing multiple strategies and errors for students to explain or reason&lt;br&gt;- Real world problems&lt;br&gt;- Allowing students to tinker&lt;br&gt;Possible Technologies: Desmos&lt;br&gt;- Dynamic Geometry Software&lt;br&gt;- Computer Algebra Systems&lt;br&gt;- Screencast Software&lt;br&gt;- Dan Meyer Videos</td>
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<td><strong>Possible Technologies:</strong> Planbook.com, Xtramath, PowerPoint, Keynote, Educreations, ShowMe, CCSSM Look-For App, Tiggly, Osmos, MathTwitterBlogosphere, Interactive Whiteboard Apps, LearnZillion, Desmos, Dynamic Geometry Software, Computer Algebra Systems, Screencast Software, Dan Meyer Videos</td>
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### 3. 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

### 4. 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
- Formative Assessment tools such as Clickers

**Possible Technologies:**
- 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

### 5. 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

**Possible Technologies:**
- Real-time summary data
- Ask questions
- Present math images to students to form questions

**Possible Technologies:**
- Clickers
- Discussion boards
- Plickers
- Wouldyourathermath.com

**Possible Technologies:**
- 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
6. 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

7. 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
  Challenge problems online
  Warm up task or brainteasers projected on screen
  Possible Technologies:
  - Desmos
  - Openmiddle.com
  - Visualpatterns.org
- Graduate 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 provide – user controlled scaffolding
  Gamification or games that could change individual pacing
  Possible Technologies:
  - Three Acts
  - Solve Me Mobiles

8. 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?