Reaching & Teaching Students with a Wide Range of Abilities & Mathematical Skills

www.tinyurl.com/reaching-teaching

Created and Presented By:
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Objective: 6th-12th grade educators will gain practical ideas, activities, & lots of resources to teach math concepts to students of different learning styles and skill levels that focus on math standards, student engagement, instructional strategies, and curriculum connections which are **driven by IMSA's four attributes: competency-driven, inquiry-based, problem-centered, and integrative.**

The National Council of Teachers of Mathematics (NCTM) has stated:

A. All students should "have access to high-quality mathematics curriculum, effective teaching and learning, high expectations, and the support and resources needed to maximize their learning potential".
B. Access to high-quality mathematics teaching and learning should be equitable with:
   i. Focus on grade-level content
   ii. Effective teaching practices
   iii. Balance of conceptual & procedural mathematics knowledge
      - "Many students who are challenged by mathematics never 'get to' the more engaging mathematics…" https://www.nctm.org/uploadedFiles/Research_and_Advocacy/collections/Continuing_the_Journey/NCTM_NCSM_Continuing_the_Journey_Report-Fnl2.pdf

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1. Know the Common Core Math Standards
   A. Understand the Key Shifts in Implementing the Standards http://www.corestandards.org/other-resources/key-shifts-in-mathematics/
      a. Focus on Fewer topics (focus)
      b. Connect topics across grade levels (coherence)
      c. Promote conceptual understanding, procedural skills/fluency, & application equally (rigor)
   B. Identify essential standards & prior knowledge/skills required for grade level content AND potential learning gaps (potential areas of unfinished learning)
      - Before learning gaps can be addressed engagement gaps must be addressed

2. Find out what your students like, their experiences, & their strengths
   A. "Get to Know Your Students" Activities
      a. All About Me - https://docs.google.com/file/d/0B9wrRDdvdko-ZjYwZjIwMzctODYwNi00YmVjLWFlMzMtYzhkYWZmOGE3OGFh/edit?hl=en_US
      b. Scavenger Hunt - https://digitalcommons.imsa.edu/pfs_tr/33/
      c. Seating Challenge - https://www.edweek.org/teaching-learning/opinion-teaching-secrets-get-to-know-students-through-seating-challenges/2012/06
   B. Understand that have different learning styles (process) & different intelligences (content)
      a. Recognize & Determine Student Strengths & Learning Style
         - (Online) Multiple Intelligence Quiz - https://alis.alberta.ca/careerinsite/know-yourself/multiple-intelligences-quiz/
         - (Online) What intelligence are you? - https://www.verywellmind.com/what-kind-of-intelligence-do-you-have-3867398
         - (Paper) Learning Style Inventory - https://www.houghton.edu/wp-content/uploads/2021/03/learning-style-inventory.pdf
         - (Paper) Math Specific - Learning Style Inventory - https://www.tacomacc.edu/_attachments/academics-programs/learning_styles_preference_inventory.pdf
      b. Reflect on the "7 Ways of Learning & Teaching" (P12) & "7 ways of Teaching Math" (P14)
         - https://soar.suny.edu/bitstream/handle/20.500.12648/6205/ehd_theses/1239/fulltext%20%281%29.pdf?sequence=1&isAllowed=y

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3. Differentiate instruction, lessons, & activities to engage students & reach various styles of learners
   Examples:
   A. Integers
      i. Jumping/walking on a number line
      ii. Sports Team & Advantage
      iii. Manipulating Counters
         - By hand or w/ tech - https://s3-us-west-2.amazonaws.com/oervm/chipmodel/ChipModelOps.html
         - Other resources with counters - https://youtu.be/Yhoz1g35alw
      iv. Floats & Anchors
         Source: https://youtu.be/PQDYV2DXp8Y
      v. Games w/ tech (https://quizizz.com or www.blooket.com) or w/out tech such as Integer War w/ cards
      vi. *Integer War & Integer Racing
      vii. Catapult Basketball - https://twitter.com/teachers4steam/status/1186204434449227776
   B. Graphing
      i. Singing a song to plot a point (Shuffle on the Carpet = https://youtu.be/SrHBRtC5agw)
      ii. Walk this Way to plot a point or choreograph a dance to graph a line, etc. on a floor grid/coordinate plane
      iii. Create Art with Ordered Pairs – by hand or computer/machine
         - https://www.math-aids.com/Graphing/
         - https://twitter.com/teachers4steam/status/1509929415635050506/photo/1
      iv. Use Desmos as a checking tool or discovery tool when graphing
      v. Take/find & use images (Jpeg pictures or screenshots saved as a Jpeg with Paint) in Desmos
         - Linear Example – https://www.desmos.com/calculator/pt4im8eyrt
         - Quadratic Example - https://digitalcommons.imsa.edu/pfs_tr/9/
      vi. Build a Model
         - Remijan, K. W. (2016). The Zipline Rescue Challenge. STEAMed Magazine. 11-15. https://viewer.joomag.com/steamed-magazine-october2016/0560636001474562057?page=11
         - Remijan, K.W. (2020). Ziplines and Stunt Work). *Teacher Resources*. 2. https://digitalcommons.imsa.edu/pfs_tr/2
      vii. Interact with a Motion Detector - Walk this Way (Lines) or Play with Push Toys (Systems)
         - Remijan, K.W. (Jan/Feb 2019). STEAMing Up Linear Functions. Mathematics Teacher. 250-256.
         - Remijan, K.W. (2022). Playing with Push Toys and Technology: Solving a System of Linear Equations**.** Journal for Mathematics Education at Teachers College. 13(1), 31–33. https://doi.org/10.52214/jmetc.v13i1.9067
      viii. Have students take videos that relate to parabolic action, then utilize video software to collect data
         - Resource: https://physlets.org/tracker/ (How to use: https://youtu.be/mWZhZKvU9us)
      ix. Connect to other classes or cultures
         - Remijan, K. (2021). Flag Designs of African Countries: Enriching the Graphing of Linear Equations and Inequalities in Algebra. **The Lighthouse Almanac**. 12-19. http://bbamath.org/wp-content/uploads/2022/03/Lighthouse-Almanac_Vol4_Issue1.pdf

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4. Implement scaffolding strategies to provide the support that students need to achieve understanding
   - Build on prior knowledge or prior experiences
     - Understand what students know & where they have areas of unfinished learning
     - https://achievethecore.org/peersandpedagogy/addressing-unfinished-learning-context-grade-level-work/
   - Decrease difficulty in calculations, and focus on the thinking involved in the process or give students a simpler version of problems before more complex
     - Ex – 5% of $6 rather than 7.25% of $9.88 (https://bit.ly/3BjgM50)
   - Use visual aids - https://youtu.be/TJ0Z7dSi5dQ?t=1295
     - Diagrams
       - Ex – Quadrilateral Family Tree
       - Manipulatives (concrete manipulatives, representative with pics, and abstract with symbols)
   - Question to guide student thinking - https://create-abilities.com/math-tasks-guiding-questions/
   - Think out lout - https://www.oneontacsd.org/Downloads/below-grade-level-students-research-based-practices.pdf
   - Provide students a worked example - https://ies.ed.gov/ncee/wwc/docs/practiceguide/wwc_algebra_040715.pdf
   - Error Detection & Correction
     - Printed Problem, Exit Slips, Whiteboards, Surface Pro Projection
   - Address unfinished learning - https://achievethecore.org/peersandpedagogy/addressing-unfinished-learning-context-grade-level-work/
   - Utilize collaberative learning groups (see #5)
   - Provide access to video-based lessons/examples via Screen-cast-o-Matic
     - FREE Software – https://screencast-o-matic.com/
       - Video & PDF Directions - https://digitalcommons.imsa.edu/covideos_19_webinars/6/
     - Edit video using https://www.nchsoftware.com/videopad/index.html

5. Utilize Collaborative Learning Groups
   - Form visibly random groups
     - Reference: https://robertkaplinsky.com/you-must-read-building-thinking-classrooms-in-mathematics-by-peter-liljedahl/
     - Random Group Generator Resource - https://www.classtools.net/random-group-generator/
   - Provide students specific roles/tasks Reader/Recorder/Reporter/Roamer to achieve a common goal (**3** or 4)
   - Suggestions
     - Have room arranged with students enter w/ colors or numbers on ceiling & groups projected on screen
     - Have students use a vertical surface (whiteboard or big paper w/ 1 marker)
       - Research from Peter Liljedahl
         - ✓ "Building Thinking Classrooms" Online Book Study led by the Illinois Council of Teachers of Mathematics – Next session is 11-3-22 (PD hours included) – Info/register @ www.ictm.org/
         - ✓ Keynote Speaker for the Illinois Council of Teachers of Mathematics Conference on 10-29-22. Info/register @ https://ictm.memberclicks.net/annual-conference

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6. Incorporate Quality Problems that Incorporate Wonder & Engagement

- Consider 3 key attributes (Peter Liljedahl - (https://robertkaplinsky.com/you-must-read-building-thinking-classrooms-in-mathematics-by-peter-liljedahl/)
  a. Low-floor task – anyone can get started with the problem
  b. High-ceiling Task – enough complexity to keep students engaged
  c. Open-Middle – One answer with multiple ways to solve the problem
    - Resource by Robert Kaplinsky: https://www.openmiddle.com/
- Promote problem-solving & discussion (Joan Boaler @: www.youcubed.org/week-inspirational-math/)
    - Number Sense, Patterns/Generalization, Shape, Space/Measures, Data Science, Probability/Stats
- Integrate videos
  - Video stories
    - http://www.graphingstories.com/
- Pose Interesting Questions
  - Reference: www.citizenmath.com (Search "free lessons")
  - Utilize Three Act-Tasks
    - Resources by Graham Fletcher - https://gfletchy.com/3-act-lessons/
    - Dan Meyer – https://blog.mrmeyer.com/ (Ex @ https://threeacts.mrmeyer.com/25billionapps/)
    - IMSA additional PD available - lherlehy@imsa.edu (PD Title: Three-Act Math Tasks)
- Connect to other Subjects, Real-Life Connections, & Potential Careers
  - History & Culture (Flags) – Replicating flags using ratios & area or equations
    - Remijan, K. (2021). Flag Designs of African Countries: Enriching the Graphing of Linear Equations and Inequalities in Algebra. **The Lighthouse Almanac**. 12-19. http://bbamath.org/wp-content/uploads/2022/03/Lighthouse-Almanac_Vol4_Issue1.pdf
  - Crash Reconstruction – Collecting data & solving equations
    - Remijan, K.W. (Nov 22, 2017). *Building Mathematical Skills and Community Relationships Through Crash Reconstruction.* **ASCD Express.** https://www.ascd.org/el/articles/building-mathematical-skills-and-community-relationships-through-crash-reconstruction
  - Machining – Graphing ordered pairs & writing a computer program
    - Remijan, K.W. (September 2018). Cultivating the Machining Field by Planting Seeds in the Mathematics Classroom. The Record. 24-27. https://ntma.org/resources/the_record/
  - Construction Connections, CTE Classes, & Careers – Fractions, Scale, Area, Proportions, Functions, …
    - Math & Construction – https://digitalcommons.imsa.edu/pfs_pr/59/

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