Teaching Mathematics to Deaf Students

PEN International Visitors from Vietnam

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Introductions and Communication
Our Approach

• What does it mean to learn and use mathematics? Mathematics, language, communication, and thinking cannot be separated

• Mathematics education is an advocacy and human rights issue

• We remain optimistic about the ability of our students to succeed!
Today’s Topics

• The written and unwritten curriculum
• Research, perceptions and issues
• Calculator use
• Discussing and modeling effective teaching and communication strategies
The Unwritten Curriculum

• Problem solving, reasoning, reasonableness of results
• Divergent (flexible) thinking
• Language and communication
• Symbol use and meaning
• Models, diagrams, sketching
• Study skills and use of a text
• Active learning and writing in mathematics
• Positive attitude toward learning, including persistence
• Technology, calculators
• Metacognition
Research, Perceptions, and Issues

• Your students’ difficulties are not unique.
Research, Perceptions, and Issues

- Deaf students may not be skilled at:
  - Monitoring their own understanding
  - Recognizing what they do not know
  - Understanding the whole is the sum of the parts
  - Relating new material to existing knowledge
Research, Perceptions, and Issues

• Deaf students may not be skilled at:
  – Transferring and applying what they know
  – Sorting important from unimportant information
  – Knowing when to ask for help and what questions to ask
  – Reading and expressing ideas in writing
  – Making inferences
Research, Perceptions, and Issues

• Deaf students may not be skilled at:
  – Sketching the salient points of a situation
  – Example: Drawing a car rather than indicating where it is going.

• Students may lack persistence and resilience, especially related to problem solving
Research, Perceptions, and Issues

• Incidental learning and interaction with others may be lacking
• Experiential diversity critical for learning may be lacking
• Who will address these deficits, if not us?
Assessment and Evaluation

• Assessment of student learning can be difficult because of language factors:
  – Students may not read well
  – Students may not be able to communicate all they know
  – We might assume students know more (or less) than they really do
Use of Calculators at NTID

• Required for parts of all NTID math courses
• Prohibited for parts of most math courses
  – All courses have ‘basic facts’
• Types of calculators required
  – Simple 2-line scientific calculator
    • TI-30XS Multiview
  – Graphing calculator
    • TI 84 Plus
Why We Use Calculators

• To develop and reinforce concepts
• To introduce advanced concepts to students with learning gaps
• To investigate a hypothesis using trial and error
• To motivate students
• To check work
Why We Like the TI-30XS Multiview

• 4-line capability
• Editing features
• “Math print”
• Variable storage capabilities
• Retrieval of ‘history’
• Available Smartview software
Effective use of Technology and Visual Materials

• Wait time and eye gaze
• Taking notes
• Visibility of writing surfaces
• Acoustical distractions minimized
• Visual distractions minimized; deaf students may be more easily distracted
• Furniture arranged for visibility
Effective Teaching
Strategy #1: Emphasize Language

• Reinforce the language of instruction at all times

• Make connections between the language of mathematics, sign language, symbols, technology and the Vietnamese language

• Discuss vocabulary/sign selection
  – Math vocabulary including multiple meanings (Ex: “degree”)
  – Everyday vocabulary in a mathematical context (Ex: “case”, “right”)
  – Non-technical vocabulary
  – Leave vocabulary in plain sight during and after lessons
Effective Teaching
Strategy #1: Emphasize Language

• Use questions to summarize. Encourage communication.
  – What did we study yesterday (or today)?
  – Which homework problem was difficult? Why was it difficult?
  – Why does the sign for (XXX) make sense?
  – How do you explain (XXX) to a friend?
  – What comparisons can be made between two given quantities?
Effective Teaching
Strategy # 2: Encourage Sketching

• Sketches give students a frame of reference and illustrate their thinking

• As instructors model sketching, students can see what is the essence of a problem
Effective Teaching Strategy # 3: Improving Retention of Knowledge

• Use a spiral approach
• Introduce new topics with a mention of what they learned previously
• Prod with clues when students ‘forget’
• Calculators can help
Characteristics of Better Mathematics Classes

• Sufficient wait time
  – Questions/Answers
  – Processing visuals

• Appropriate visuals

• Communication and student engagement

• Emphasizing connections to foster transfer of knowledge

• Use of technology