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