Accessibility in STEM

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Who are these people?

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Even More

Meta Science News
My Message

STEM fields need more people with disabilities because their expertise and perspectives spark innovation.
ITEST Interest

Whatever learning environment is examined, the ITEST program is particularly interested in broadening the participation of students within populations currently underrepresented in STEM-related fields, including women, ethnic minorities, English language learners, veterans, students with disabilities, and socioeconomically disadvantaged students.
Outline

• Who are they?
• Innovations driven by accessibility
• Barriers
• Removing barriers
Who are they?

- 1 billion people world-wide
- 15% of the world’s population
Disabilities

- Vision
  - Blind
  - Low-Vision
  - Color Blind
- Hearing
  - Deaf
  - Hard of Hearing
- Speech
  - Ability to speak
  - Stuttering
- Mobility
  - Ability to walk
  - Ability to use limbs
- Cognition
  - Dyslexia
  - Memory loss
- Emotional
  - bipolar
- Multiple
  - Deaf-blindness
World Health Organization

- Disability is thus not just a health problem.
- Overcoming the difficulties faced by people with disabilities requires interventions to remove environmental and social barriers.
Disability in K-12

- **Individuals with Disabilities Education Act (IDEA)**
  - Individual Education Plan (IEP)
  - 6.4 million in 2010 (13%)

- **Section 504 – Rehabilitation Act**
  - Provisions for accommodations
  - 1 million more (my estimate based in Washington State)

- **Total 15%**
# IDEA Demographics

<table>
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<th>Category</th>
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<tbody>
<tr>
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<tr>
<td>Learning</td>
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<tr>
<td>Hearing</td>
<td>80,000</td>
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<tr>
<td>Mobility</td>
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<tr>
<td>Vision</td>
<td>30,000</td>
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</table>

NCES Table 204.30
Outline

• Who are they
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• Barriers
• Removing barriers
Accessibility Innovations Matter

Innovations for Disability → Solutions for Everyone

- Telephone
- Personal texting
- Speech recognition
- Personal video chat
The Telephone

- The telephone was invented by A.G. Bell in his efforts “of devising methods of exhibiting the vibrations of sound optically, for use in teaching the deaf and dumb.” (Fay, American Annals of the Deaf, 1887)
Texting

TTY 1950s

TTY with modem 1970s
Robert H. Weitbrecht

Invented the acoustic modem in the 1960s so that he could use the telephone through a TTY.
History of the TTY

Author: Harry Lang
TTY 1980s - 2005

Telecommunications Device for the Deaf (TDD)
E-Mail / Instant Messaging

Sidekick

Blackberry
Speech Recognition for Hands
Free Access

Ray Kurzweil introduced the first commercial large-vocabulary speech recognition software in 1987.

Sang-Mook Lee
Speech for Eyes Free Access

Apple Siri
“Picturephone” demonstrated by AT&T at the 1964 World’s Fair

› Required too much bandwidth for phone system
› Deaf world excited then disappointed
Video Phone

Set top box
Sorenson 2002

Purple 2010
Ubiquitous Video Phone

Skype

Google Hangouts
Mobile Video Phones

Facetime for the iPhone 2011

Skype Mobile 2012
My Message

Disability and technology innovation are intertwined
Outline

• Who are they
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Barriers

- Attitudinal
- Physical
Historical Attitudes

• Exclusion
• Accommodations
  – Reactive add-ons
• Universal Design
  – Proactive
Examples of Accommodations

• Extra time on tests
• Proctored exams
• Materials in alternative format
• Alternative assignments
• Moving to accessible classroom
• Sign language interpreter
• Note taker
Examples of Universal Design

- Multiple ways of assessment
- Multiple explanations of concepts
- Clear expectations
- Scaffolding
- Worked examples
- Captioned videos
- Accessible web pages
- Just good teaching
UNIVERSAL DESIGN IN HIGHER EDUCATION
From Principles to Practice
Second Edition
Edited by Sheryl E. Burgstahler
Foreword by Michael K. Young
Block Based Languages
Raina’s Technology

- Power wheelchair
- Joy Stick
- Large Monitor
- AAC Device
- Key Guard
Outline

• Who are they
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Teacher Attitudes

- Compliance vs. Welcoming
- Low bar vs. high bar
VISION DISABILITIES
Screen Reader for Blind Students

• Allows non-visual access to screens
Braille

- Braille Translation
  - Duxbury
  - Braille 2000

- Braille Printers
Braille Displays

Notetakers

Large Display

Small Braille I/O
Tactile Graphics

Embosser

Swell paper
Built-in Magnification

- Window magnifier
- Apple zoom
Internal Magnification

ZoomText
External Magnification

IPEVO VZ-1 HD
LEARNING DISABILITIES
Note Taking Technology

Livescribe Smartpen
Speech Output

Dragon NaturallySpeaking
Students at a school collected information from classmates in grades one, three, five, and seven, weighing both the students and their backpacks.

Attribute Description

**Name:** First name of student

**Gender:** Gender of student

**Grade:** Grade level of student

**BodyWeight:** Weight of student, in pounds

**PackWeight:** Weight of student's backpack, in pounds
Equation Editor

\[ a = \left( \frac{b}{c} \right)^x + \cdots \]
Accessibility is Becoming Mainstream

- VoiceOver for iOS
- Talkback for Android
- Narrator for Windows
- Ctrl+ for Browsers
Acknowledgements

Access Computing

Access CS10K

NSF

Any opinions, findings, and conclusions or recommendations expressed in this material are mine and do not necessarily reflect the views of the NSF.

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My Message

STEM fields need more people with disabilities because their expertise and perspectives spark innovation.

We can make it happen!!