Impact of Digitalization on Math Learning: Students with Visual Impairments
CSUN 2019

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Role of Technology in Today’s Schools

- Across grade levels and postsecondary settings
  - Online educational platforms
  - Online materials, videos, resources
  - Digital textbooks
  - Phones, tablets, and laptops
  - Apps
  - Tools
Current Challenges

- Accessibility of the following for students who are blind or visually impaired and the teachers who support them:
  - Online materials for mathematics, especially for students who read and write braille
  - Dynamic apps and programs currently used in schools
  - Online adaptive testing
  - Dynamic math visualization software
More Challenges

- Burden on teachers to find solutions without adequate funds, time, and other resources
- Transition from K-12 supports to post-secondary disability services
- Accessibility not always a focus when products are being designed or selected
- Lack of equitable access to math for students who are visually impaired, especially those who read/write braille
Examples of Low Tech Tools

- Draftsman/E.A.S.Y. Sketchpad
- Abacus
- Braillewriter
- Manipulatives
More Low Tech Tools

Hundreds chart
Graph board
Math Window
Compass
Protractor
Examples of High Tech

Talking graphing calculator
Accessible apps
Braille notetaker
Tablet
Advancements in Technology

- Writing mathematics using notetakers
- Translation software capable of converting print math to braille math and vice versa
- Affordable refreshable braille displays
Advancements cont.

- Screen-reading software that can correctly read math information that has been composed in MathML.
- Tablets that can easily enlarge print and graphics
- Accessible math-related websites
We Don’t Have It! Yet!

As late as 2015, DePountis et al. reported that “there is no multipurpose device or system that translates print to braille and Nemeth (or Nemeth into print), and allows for simultaneous visual and tactile viewing, or mathematical manipulation” (p. 143).
Now We Do!
Accessible Equation Editor

\[ x^2 + y^2 = 4 \]
Research Regarding Accessibility

➢ There is growing research that indicates students who are visually impaired benefit from apps and online materials that are accessible.
AnimalWatch Vi Suite

http://awvis.arizona.edu
www.aph.org
AnimalWatch Vi
Building Graphics Literacy

http://awvibgl.coe.arizona.edu/
Digital Textbooks

Digital versus Traditional: Secondary Students with Visual Impairments’ Perceptions of a Digital Algebra Textbook

Emily C. Bouck, Pei-Lin Weng, and Rajiv Satsangi

Findings

- Demographics: Algebra 1 class of 5 students
- Clear student preference for traditional textbooks
- However, the digital textbook was
  - Easy to understand
  - Easy to use
- Students
  - Wanted to learn more about technologies that would help them access algebra
  - Liked the Navigation aspect
- Teacher and aide
  - Supported and appeared to encourage the students’ preferences for traditional textbooks.
Success for All

Until new technology meets ALL students’ needs, teachers must be creative in finding solutions that provide access to the same material or comparable experiences for students who are visually impaired.
Possible Solutions

- Build in accessibility when designing products, websites, online tools, apps, etc.
- Support of research that leads to products that can be used by students in the math classroom
- Collaboration between developers of software and hardware that leads to
  - Multi-sensory access in mathematics
  - Multi-line and full page displays
  - Integration of braille and graphics within the same display
Professional Development

- Ongoing professional development for teachers of students with visual impairment
  - Opportunities for teachers and students to learn together
  - Methods for teachers to learn any new technology quickly and easily
  - Design with an intuitive approach to decrease the learning curve and lessen the need for extensive professional development
Up and Coming Technology

Drawing with the Graphiti™

Bristol Braille Canute: Multi-line refreshable braille
Team Work Past

In the words of Helen Keller, “Alone we can do so little; together we can do so much.”
Team Work Present

We believe you, the people we serve, and the people who stand behind our products create the real solutions together. Our customers support us, not for what we have done, but for what we can do together.

There is no one-size-fits all product ... but we are keeping choice and innovation alive.
Let’s hear from you!

Thank you for your attention.
Now it’s time for questions.