Equal Access: Making your Department Accessible to Students with Disabilities

Richard Ladner

Blind Scientists and Engineers

Kent Cullers, Ph.D. Physics
Cary Supalo Grad Student Chemistry
Geerat Vermeij, Ph.D. Evolutionary Biologist
Blind Scientists and Engineers

Bill Gerrey
Electrical Engineering
Inventor

Imke Durre, Ph.D.
Atmospheric Science

William Skawinski
Professor, Chemistry

Blind Scientists and Engineers

H. David Wohlers
Professor, Chemistry

TV Raman
Computer Science
Google

Victor Wong
EE Grad Student
Blind Scientists and Engineers

Chieko Asakawa
Computer Scientist
IBM

Hideji Nagaoka
Computer Scientist
Tsukuba U. of Tech

Katsuhito Yamaguchi
Physics
Nihon University

Sangyun Hahn
Ph.D. Student
CSE

Zach Lattin
Math Major
UW Students
Plan for Today

- Introductions (10 minutes)
- Keys to Success (20 minutes)  
  - Richard Ladner
- Case Studies (10 minutes)  
  - Sangyun Hahn  
  - Christian Vogler
- AccessComputing Alliance (15 minutes)
- Working in small groups (30 minutes)  
  - Review Department Accessibility Checklist

Some Basic Facts

- 9% of the population in school, ages 14-21, have disabilities.
- 13% of undergraduate IT majors have disabilities.
- 5% of graduate IT majors have disabilities.
- .8% of IT doctorates have disabilities.  
  - E.g. From 1999-2004 there were 53 in the US.
- 5% of employed IT scientists and engineers have disabilities.  
  - As people age, the percentage of disabled in that age group grows.
Keys to Success

- Policy
- Attitudes
- Access Technology
- AccessComputing Alliance

Public Policy

- Public Law 94 -142 (1975) - Education of All Handicapped Children Act
  - Renamed IDEA in 2004 for Individuals with Disabilities Education Act
  - All disabled children are entitled to equal access to education
  - This law may explain why the percentage of disabled students in IT at the undergraduate level appears so high.
University Policy

• Disabled student services office is well supported
• Promotional videos should be captioned
• No discrimination in hiring because of disability
• Web pages shall be accessible to screen readers

Departmental Access

• Significant images should have alternate text using alt, title, or longDesc attributes in HTML of departmental homepages.
  – Alternate text enables screen readers to describe images for blind users.
• Summary of results
  – 157 departments from Taulbee report
  – 41 were at least 90% compliant
  – 26 were 0% compliant
  – 55% of all images on CS department homepages have alternative text.
Attitudes

• From a faculty member on the admissions committee for blind applicant.
  – “It is going to be too hard for someone who is blind to get a Ph.D.”

• From a faculty member who was assigned blind TA.
  – “I don’t want him as a TA. I would have to do too much work for him.”
“I believe that engineering is a highly creative profession. Research tells us that creativity does not spring from nothing; it is grounded in our life experiences, and hence limited by those experiences. Lacking diversity on an engineering team, we limit the set of solutions that will be considered and we may not find the best, the elegant solution.”

Access Technology

- Examples
  - Screen readers
  - Math readers
  - Alternative input devices
  - Computer Aided Real Time Captioning (CART)
  - Tactile graphics

- Computer Science plays a big role in the development of these technologies.
Access to Text Books

Text

Let's use this procedure to solve the application presented at the beginning of the lesson.

1. Let $x$ be the number of ears of corn.
2. Let $y$ be the number of ears of all $F_{n}$.

[Diagram]

The steps are:
1. Multiply $x$ and $y$.
2. Add $x$ and $y$.
3. Subtract $y$ and $x$.
4. Divide $y$ by $x$.

The result is $z = x + y - y + y = x + y$.

[Diagram]

In certain circumstances, the method of linear programming is not effective. Consider the graph of $y = 2x$ on the right.

1. Let $a$ be the number of ears of corn.
2. Let $b$ be the number of ears of all $F_{n}$.

[Diagram]
The constraints do not define a region with any points in common in Quadrant I. When the constraints of a linear programming problem cannot be satisfied simultaneously, then infeasibility is said to occur. This may mean that the constraints have been formulated incorrectly, certain requirements need to be changed, or that additional resources are required before the problem can be solved.

Text Translation

Text Image

Optical Character Recognition (OCR)

Text

The constraints do not define a region with any points in common in Quadrant I. When the constraints of a linear programming problem cannot be satisfied simultaneously, then infeasibility is said to occur. This may mean that the constraints have been formulated incorrectly, certain requirements need to be changed, or that additional resources are required before the problem can be solved.

Braille Translation (Duxbury)

Speech Synthesis (JAWS)

Math

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Braille

Speech
Math Translation

Math Image

\begin{eqnarray*}
P(0,0) = 396(0) + 270(0) = 0 \\
P(15,0) = 396(15) + 270(0) = 5940 \\
P(15,5) = 396(15) + 270(5) = 7290 \\
P(0,20) = 396(0) + 270(20) = 5400
\end{eqnarray*}

LaTeX

\begin{eqnarray*}
P(0,0) = 396(0) + 270(0) = 0 \\
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\end{eqnarray*}

Braille Translation (Duxbury)

\begin{eqnarray*}
p(0,0) \leftrightarrow 396(0) + 270(0) \leftrightarrow 0 \\
p(15,0) \leftrightarrow 396(15) + 270(0) \leftrightarrow 5940 \\
p(15,5) \leftrightarrow 396(15) + 270(5) \leftrightarrow 7290 \\
p(0,20) \leftrightarrow 396(0) + 270(20) \leftrightarrow 5400
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Nemeth Code

\begin{eqnarray*}
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p(0,20) \leftrightarrow 396(0) + 270(20) \leftrightarrow 5400
\end{eqnarray*}

Math Translation Examples

\[ \sum_{i=0}^{\infty} x^i = \frac{1}{1-x} \]

\[ \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

\text{LaTeX}

\begin{eqnarray*}
\sum_{i=0}^{\infty} x^i \rightarrow \frac{1}{1-x} \\
\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \rightarrow \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\end{eqnarray*}

\text{Nemeth Code}

\begin{eqnarray*}
\sum_{i=0}^{\infty} x^i \leftrightarrow \frac{1}{1-x} \\
\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \leftrightarrow \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\end{eqnarray*}
Graphic Translation

location file

pure graphic

text image

Automating the Process

• CS contributions
  – Machine learning
  – Computational geometry algorithms
  – Computer vision
  – Optimization algorithms
• Example
  – 1,080 figures
  – 6.5 minutes per figure
Case Studies

• Christian Vogler – Deaf Computer Scientist
  – Research Scientist, Gallaudet University
• Sangyun Hahn – Blind Computer Scientist
  – Ph.D. Candidate, University of Washington

The goal is to increase the participation of people with disabilities in computing fields.
  – NSF BPC funded
  – Co-directors Sheryl Burgstahler and Richard Ladner
  – Based at the University of Washington
  – Partners from industry, organizations, other universities
  – www.washington.edu/accesscomputing
Activities for Students

• College transition & bridge programs
• Tutoring
• Internships
• e-mentoring

Activities for Departments

• Communities of Practice (CoPs).
• Capacity-Building Institutes of stakeholders/gatekeepers.
• Computing Department Accessibility Checklist
Nationwide Resource

- AccessComputing Knowledge Base of FAQs, case studies, promising practices
- Multimedia training.
- Articles in scholarly journals & other periodicals.
- Workshops and tutorials at conferences.

Collaborate

- Work with us to make your department accessible
- Refer students with disabilities in your departments to us for mentoring, internships & other complimentary support
- Contribute questions, promising practices to Knowledge Base
- www.washington.edu/accesscomputing
Activity

• Review the Department Accessibility Checklist
  – How is your department doing?
  – What should be added?
  – What should be reworded?

Thank You

www.washington.edu/accesscomputing