

# Exploratory Study: Examining how students with visual impairments navigate accessible documents

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# Statement of the Problem

## ***Legal***

- DOJ/OCR Compliance Reviews or Settlements ([Univ. of Montana](#), [Univ. of Phoenix](#), [CU-Boulder](#), [UC-Berkeley](#), [SCTCS](#), [Maricopa CC/Mesa CC](#), etc.)

## ***In-Practice (GMU)***

- Mixed success with current doc accessibility practices

## ***Research***

- Glacial Progress on Digital Accessibility article ([Inside Higher Ed](#))
- Identified 15 peer-reviewed articles (i.e., usability experiences of screen reader users)

# Background of the Problem (Practice)

## *Document Accessibility @ Mason*

- **Doc Accessibility Pilot (Fall 2014)**
  - 5 faculty/staff
  - 87 documents (PDF, PPT, Word)
  - 1,100+ pages
- **Online Course Accessibility Reviews (since May 2015)**
  - Over 100 online courses reviewed



# Background of the Problem cont.

- **Result (Pilot):** Increased support for faculty teaching students with VI
  - Identification
  - Training 2-3 weeks before courses start
- **Problems continue...**
  - Timely access
  - Online vs. F2F (faculty adoption)



# Purpose of this Study

- a) Identify how students with visual impairments navigate electronic documents (i.e., Word, PDF)
- b) Identify what structural elements/features students with visual impairments find most useful when navigating electronic documents (i.e., Word, PDF)

# Research Questions

- RQ1:** What strategies do individuals with visual impairments use to navigate Word and PDF documents?
- RQ2:** What structural elements/features do individuals with visual impairments find useful when navigating Word and PDF documents?
- RQ3:** What coping strategies do individuals use when encountering inaccessible Word and PDF documents?

# Significance of the Research

Results of this research could:

- Help higher education institutions **implement...**
  - **More effective training practices** for instructional/teaching faculty
  - **More effective training/support practices** for students with visual impairments
- Help **define what an accessible document is** (i.e., perspective of the institution vs. perspective of the student with the visual impairment)
- Assist higher education institutions with **ensuring timely delivery of accessible documents**

# Literature Review

Identified 16 articles (15 peer-reviewed)...

- *Focus on web accessibility (10)*
- *Focus on course accessibility (2)*
- *Focus on accessibility of web-based platforms/tools (2)*
- *Focus on document accessibility (2)*



# Literature Review (Highlights)

- **Studies highlighting document accessibility**
  - Glacial Progress on Digital Accessibility article ([Inside Higher Ed](#))
- **Studies highlighting web-browsing strategies for screen reader users**
  - Emphasis on frustrations of users with visual impairment, coping tactics, browsing strategies (web-focused)
  - Applied some methodology to user experiences with Word and PDF documents (e.g., **# of participants**, demographic data, audio/video recordings, observations, interviews)

# Research Design

- **Exploratory Qualitative Study**
  - Aim to understand how individuals with visual impairments experience & interact with accessible electronic documents (Word & PDF)
  - Phenomenology is interested in the individual experiences of people.
  - Findings derived from phenomenology are an understanding of a phenomenon as seen through the eyes of those who have experienced it. (Patton, 2002)
- **Structure**
  - Direct observations (Yin, 2011)
  - Semi-structured interviews (Fontana & Frey, 1998)

# Setting and Participants

- **Setting**

- 4-year research university in the Commonwealth of Virginia

- **Recruitment of Participants**

- Purposeful sampling (Creswell & Clark, 2011)
- Potential participants were gathered from existing clients receiving accessible text services from the Assistive Technology Initiative (ATI)
- Primarily contacted through email.

- **Criteria for Participants**

- Students actively enrolled at George Mason University
- Receiving accessible text services due to a visual impairment
- Must use screen reading and or screen enlarging technology to access electronic documents.

# Procedures



- **Direct Observations**
  - Participants used their personal laptops and AT software.
  - Accessible Word & PDF documents were placed on the desktop
  - Questions from the observation protocol were read to the participant orally
  - Participants asked to answer the questions verbally.
- **Semi-structured Interviews**
  - Completed directly following the observations

# Observation Protocol

- **Protocol consisted of 12 questions/tasks (*link to documents*)**
  - 5 related to the [Word document](#) (syllabus)
  - 7 related to the [PDF document](#) (article)
- **Sample questions/tasks**
  - How often are you required to login to this online class per week?
  - In the course Schedule, what is listed as the topic of Module 2? (Table)
  - Using the information provided in this guide, how would you define Ergonomics in 1- 3 sentences?
  - What is the “Ergo Tip” given under Keyboard & Mouse Adjustments? (Image)

# Semi-structured Interviews.

- Conducted following the observation protocol activities.
- **Questions Explored:**
  - Comfort Level with Word & PDF
  - Strategies for exploring documents
  - Common frustrations experienced/barriers to access
  - Strategies for overcoming frustrations/barriers



# Participant Demographics

Pseudonym	Gender/Age	Level of Vision	Education	Experience w/ AT	AT Used
B1	Female 25-34	Blind	Undergrad	5/10 Self taught	JAWS on Windows
B2	Male 18-24	Blind	Undergrad	10/10 Self taught	Linux – ORCA screen reader
B3	Female 35-44	Blind	Masters	6/10 10-20 hours of training (vendor)	ZoomText with Narrator
B4	Male 35-44	Blind	Ph.D	8/10 <10 hours of training (vendor)	JAWS on Windows
L1	Male 25-34	Low Vision	Masters	7/10 Self taught	Zoom on Mac & ZabaWare Reader
L2	Female 25-34	Low Vision	Undergrad	9/10 30 – 40 hours of training (TVI & vendor)	ZoomText on Windows
L3	Male 35-44	Low Vision	Undergrad	8/10 20-30 hours of training (Voc Rehab)	Windows Magnify

# Data Analysis Methods

## Qualitative

- Constant Comparative Analysis (Corbin & Strauss, 1990)
- Summative Content Analysis (Hsieh & Shannon, 2005)



# Data Sources

- *Step 1: Direct Observations* (Yin, 2011)
  - Observations were completed using an observation protocol.
  - Observations were recorded for data analysis:
    - **Digital Video Camera** – allowed for audio and video of the computer as well as keyboard and mouse interactions
    - **Screen Recording Software** – recorded what was occurring on the screen.
- *Step 2: Semi-structured interviews* (Fontana & Frey, 1998)
  - Interviews were transcribed for data analysis

# Summary Matrix

Research Question	Participants	Measures /Instruments	Data	Data Analysis
RQ1, RQ2, & RQ3	Observations & Interviews 7 participants (4 blind students, 3 low vision students)	Qualitative: Observation Protocol, Interview Protocol (Semi-structured interviews)	Qualitative: Videos, Interview transcripts	Qualitative: Constant Comparative analysis (Interviews)  Summative Content Analysis (Final)

# Validity

- *Member Checking* (Cho & Trent, 2006; Maxwell, 2013)
  - Follow-up after semi-structured interviews
- *Interrater reliability* (Armstrong, Gosling, Weinman, & Marteau, 1997)
  - Identification and agreement on observation and transcript analysis (codes)
- *Triangulation* (Cho & Trent, 2006)
  - Video observations, Semi-structured interviews, Member Checking

*Core Themes and Sample Clips*



# **RESULTS/DISCUSSION**

# Findings – Summative Content Analysis

Themes	Occurences
Useful navigation elements/features*	50
Barriers to Access/Frustrations*	33
Strategies for navigating electronic documents*	27
Coping strategies*	25
Format-specific (Technical)	20
AT-specific issues/challenges	13
Training-specific issues/challenges	10
Format-specific (Perceptual)	10
Cognitive Overload	9

\* - Top 4 themes highlighted in next few slides

# Useful Navigation Elements/Features (Expressed & Observed)

- **Blind & LV**

- Headings/Section breaks
- Table of Contents
- Page numbers within the document
- Images that do not rely on alternative text
- Search/Find features
- Page layout (no columns)
- Bookmarks

- **LV Only**

- Left margin (LV)
- White/blank space (LV)
- Different color hyperlinks (LV)
- Font style/color (LV)
- Bulleted/numbered list items (LV)
- Mouse-specific – i.e., change in cursor shape/size (LV)



# Useful Navigation Elements/Features (Commonly Used)

- **Blind & LV**

- **Headings/Section breaks\***
- **Table of Contents\***
- **Page numbers within the document**
- Images that do not rely on alternative text
- **Search/Find features**
- Page layout (no columns)
- Bookmarks

- **LV Only**

- **Left margin (LV)\***
- **White/blank space (LV)\***
- **Different color hyperlinks (LV)**
- Font style/color (LV)
- Bulleted/numbered list items (LV)
- Mouse-specific – i.e., change in cursor shape/size (LV)



# Useful Navigation Elements/Features (Headings)

## Observations

### Navigation

- Visual Attention to Headers
- Hugging the left margin

### Cognitive Overload

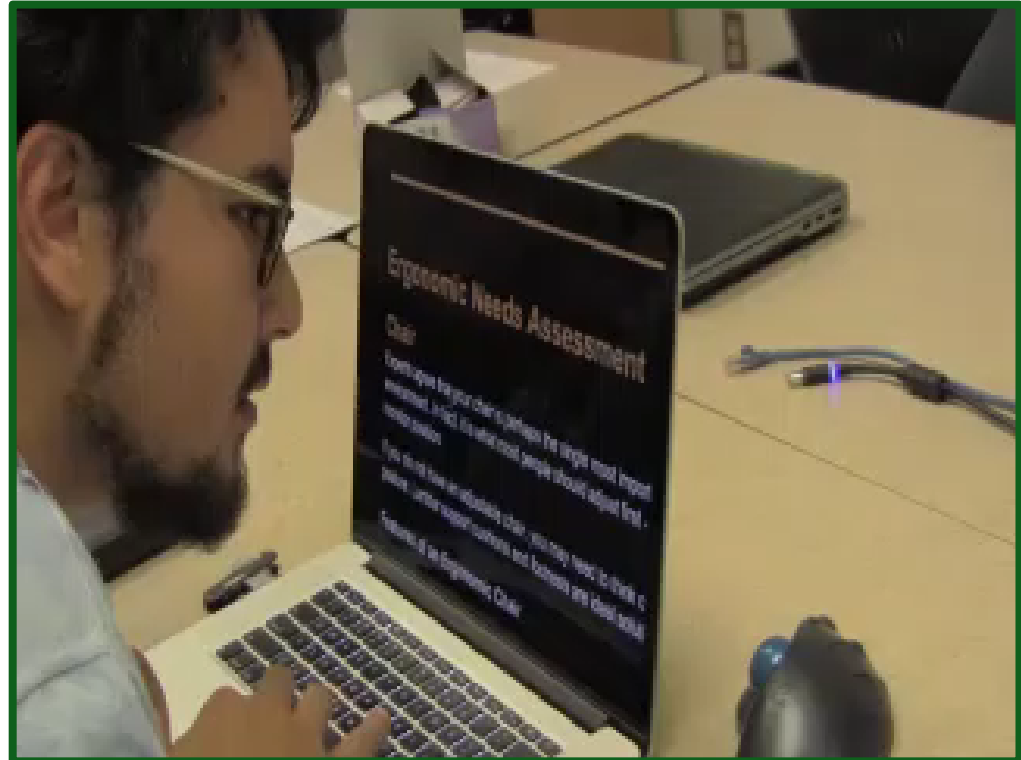
- Repeating the question

### Coping

- Adjusting magnification

### Obstacles

- Overlooking the *ErgoTip* graphic







# Useful Navigation Elements/Features (Table of Contents/LV)

## Observations

### Navigation

- Table of Contents

### Coping

- Counting Pages

### Obstacles

- TOC links were not identified in a different color

Preventing Posture Problems .....

Workstation .....

Proper Work Surface Setup .....

Keyboard & Mouse Adjustments.

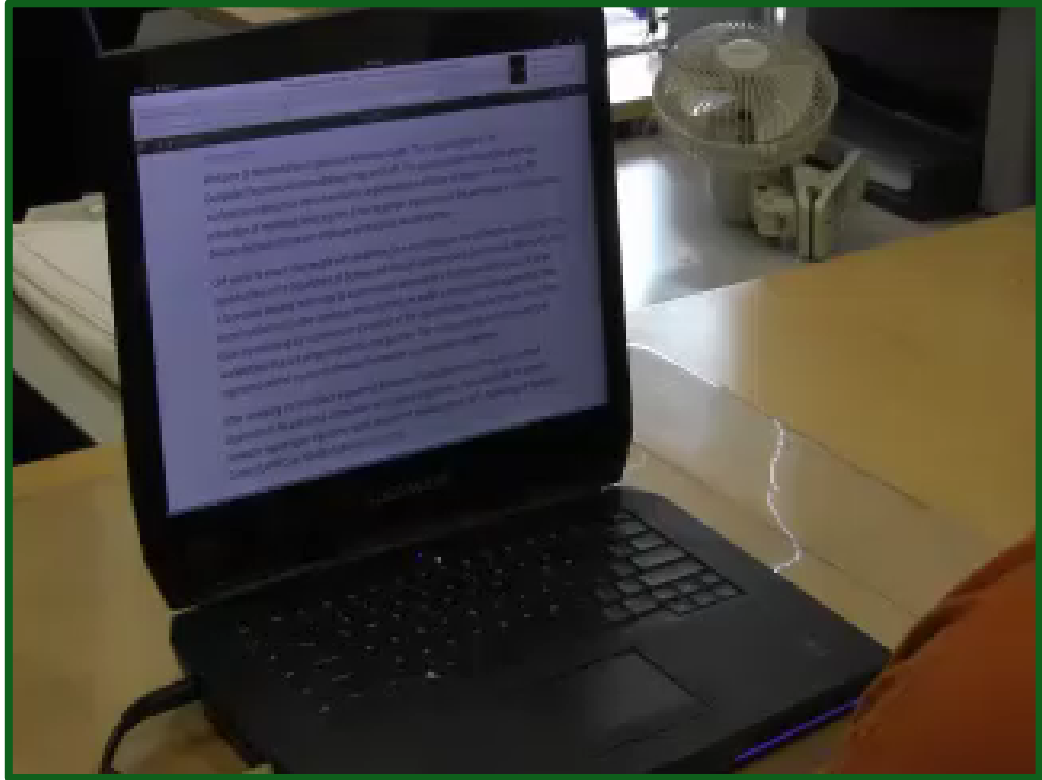
Peripheral Items.....

# Useful Navigation Elements/Features (Table of Contents/Blind)

## Observations

### Navigation

- Table of Contents (links identified by screen reader)



# Strategies for Navigation

- **Blind & LV**

- Use of arrow keys (Blind & LV)
- Minimal keyboard shortcuts (top of page, page up, page down, find/search) – (Blind & LV)
- Use of Table of Contents (Blind & LV)
- Search/Find features (Blind & LV)
- *Skimming* – i.e., Listening to first few words of each sentence (Blind)

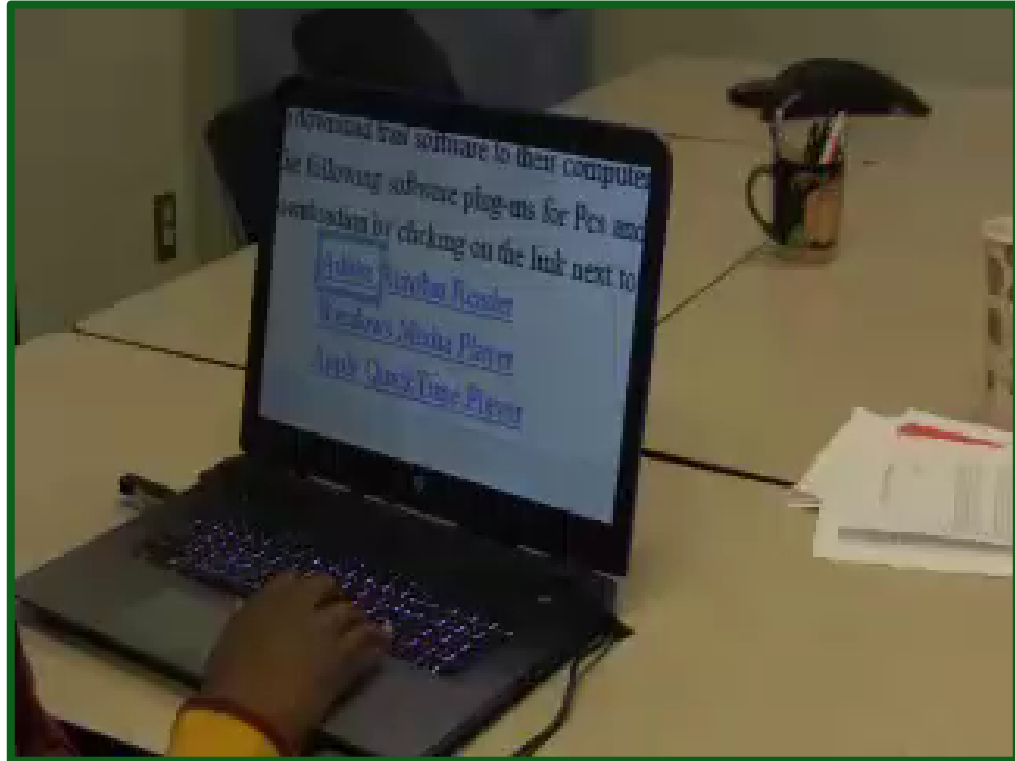
- **LV Only**

- Mouse (LV)
- “Hugging” left margin (LV)
- Skimming for structural elements (headings, white space, indentations, images) (LV)

# Strategies for Navigation (Arrow Keys)

## Observations

- Up and down arrow navigation
- Attention to Headers
- Hugging the left margin
- Cognitive Overload – i.e., asking for the question



# Barriers to Access (Alternative Text)

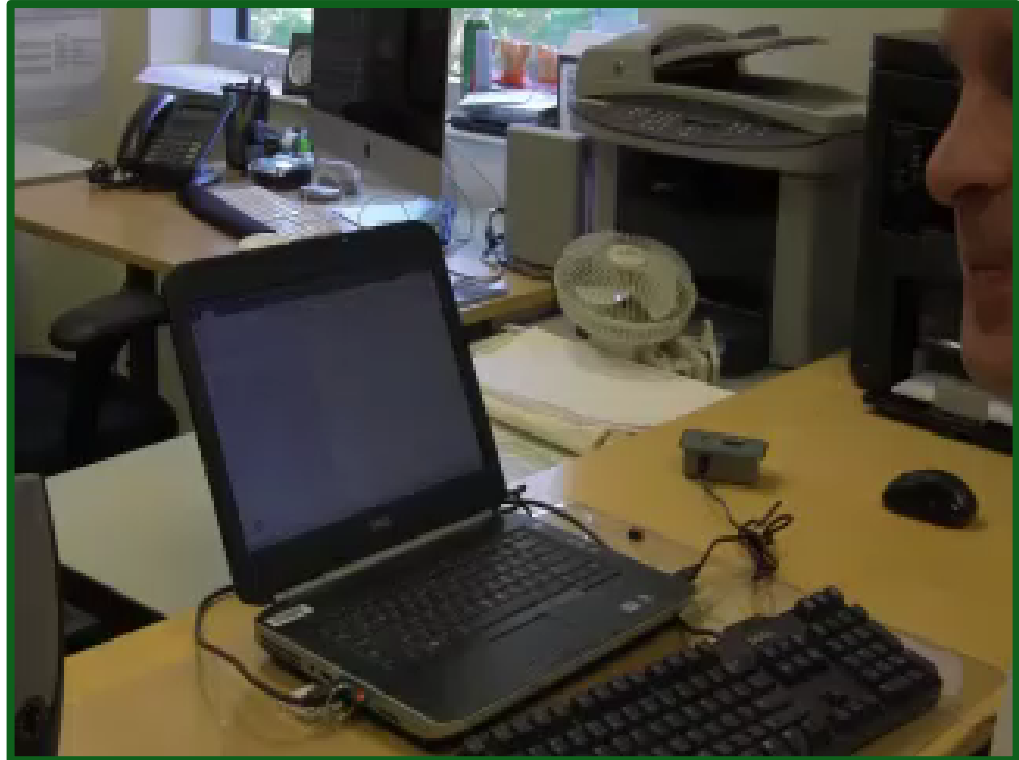
## Observations

### Navigation & Coping

- Use of Search Feature (Grading)
- Attention to Headers
- Up and down arrow

### Obstacles

- Grading scale is a graphic
- Alt-text not reading in Word using up and down arrow
- Lack of knowledge of alt-text



# Barriers to Access (Technology/User #1)

## Observations

### Navigation

- Table of Contents
- Up and down arrow

### Cognitive Overload

- Repeat the question



# Barriers to Access (Technology/User #2)

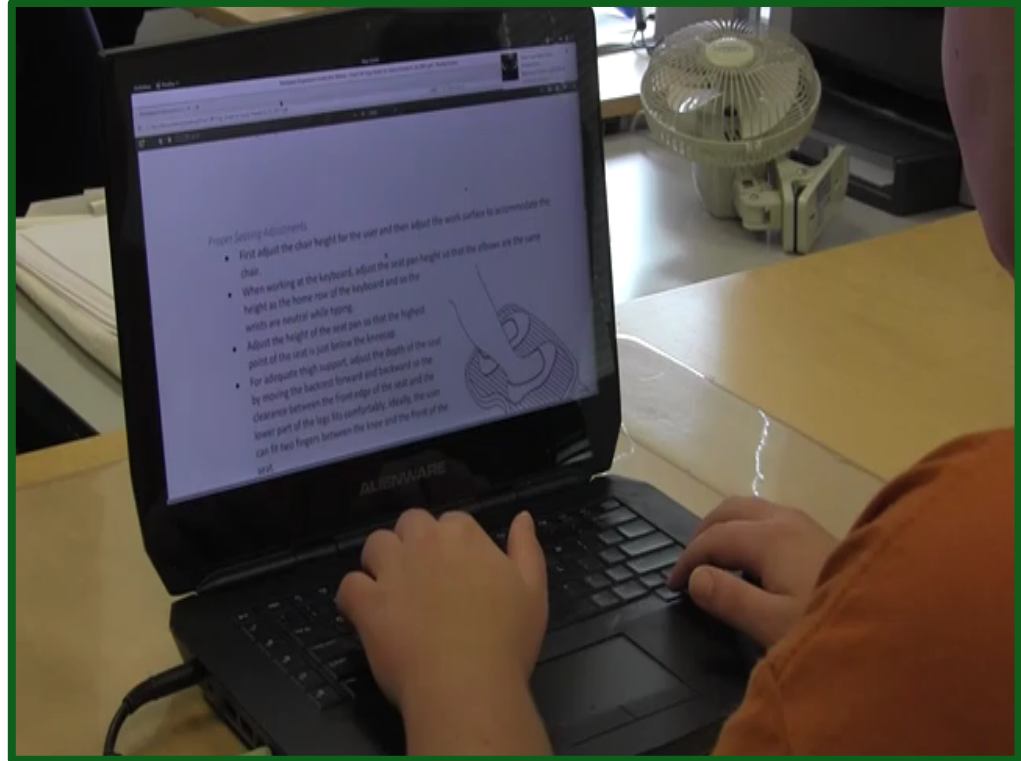
## Observations

### Navigation

- Table of Contents
- Up and down arrow

### AT-Specific challenges

- Both users are advanced, technology is the difference.



# Coping Strategies

- Contact help -- faculty, DS, or ATI
- Use more advanced Jaws keyboard commands
- Self-remediation
  - using OCR, alternative databases/document sources)
  - changing fonts, colors, copy and paste into another document
  - Increase magnification
  - print document to view (CCTV, reading glasses, mobile apps, etc.)



*Practical and Future*



# **IMPLICATIONS**

# Practical Implications

- **From an *authoring* standpoint (DSS or accessibility office)**
  - Define “*What is an accessible document*”
    - Does it include meaningful hyperlink text? TOC? Headings? Etc...
    - Context around images, not just alt text
  - Note to user (user-specific training)
    - Identify features that are available in document
    - Identify AT-specific keystrokes for those features
- **Faculty training**
  - Basic document design
    - Features to avoid (e.g., columns, images without surrounding context/captions, image-only PDFs)
  - Build into existing faculty training resources/supports
    - Online supports, OCDI trainings

# ATI-Specific Implications

- **Build on user-specific training**
  - Accessible Text Priority Levels (AL1, AL2, AL3)
    - Posted on ATI website
    - Communicated in email notices to student
- **Increased accessibility support for faculty/staff**
  - Document Accessibility Pilot during FY18
  - Assisted with remediation strategies (i.e., prioritizing structural elements like headings, tables, lists, etc.)

# Limitations of this study

- **Working relationship with likely participants**
  - Potential influence on interview responses and observations
  - Anxiety (observations)
- **Representative sample**
  - Limited sample size
  - Cannot generalize to larger population of students with visual impairments
    - Can, however, address institution-specific issues

# Questions?



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