Examining how students with visual impairments navigate accessible documents

(IRBNet number: 1068795-01)

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Accessing Higher Ground Conference

November 15, 2017

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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

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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

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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)

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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)

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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?

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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**

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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)*

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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)

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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)

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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 enraging technology to access electronic documents.

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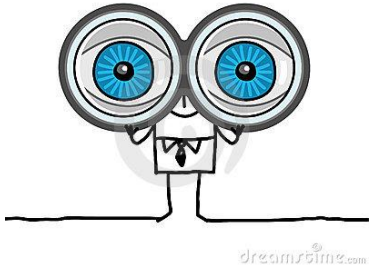
Procedures



- **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

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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)

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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

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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)

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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

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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)

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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

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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

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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)

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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)

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Useful Navigation Elements/Features (Headings)

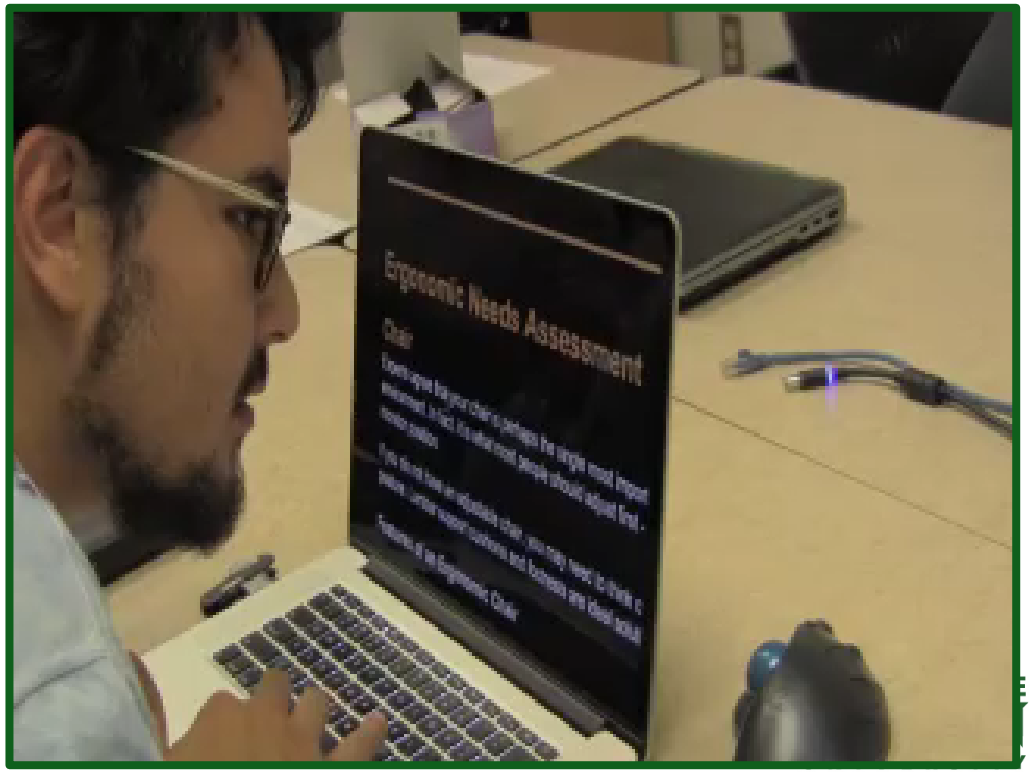
Observations

Navigation
- Visual Attention to Headers
- Hugging the left margin

Cognitive Overload
- Repeating the question

Coping
- Adjusting magnification

Obstacles
- Overlooking the *ErgoTip* graphic



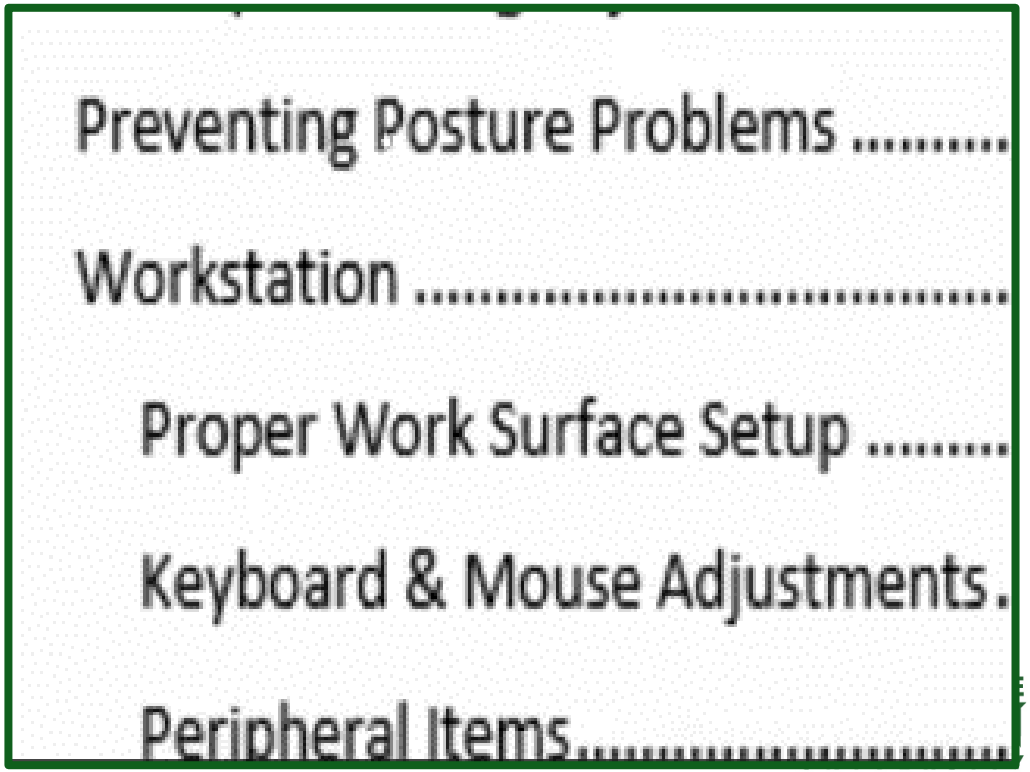
Useful Navigation Elements/Features (Table of Contents)

Observations

Navigation
- Table of Contents

Coping
- Counting Pages

Obstacles
- TOC links were not identified in a different color

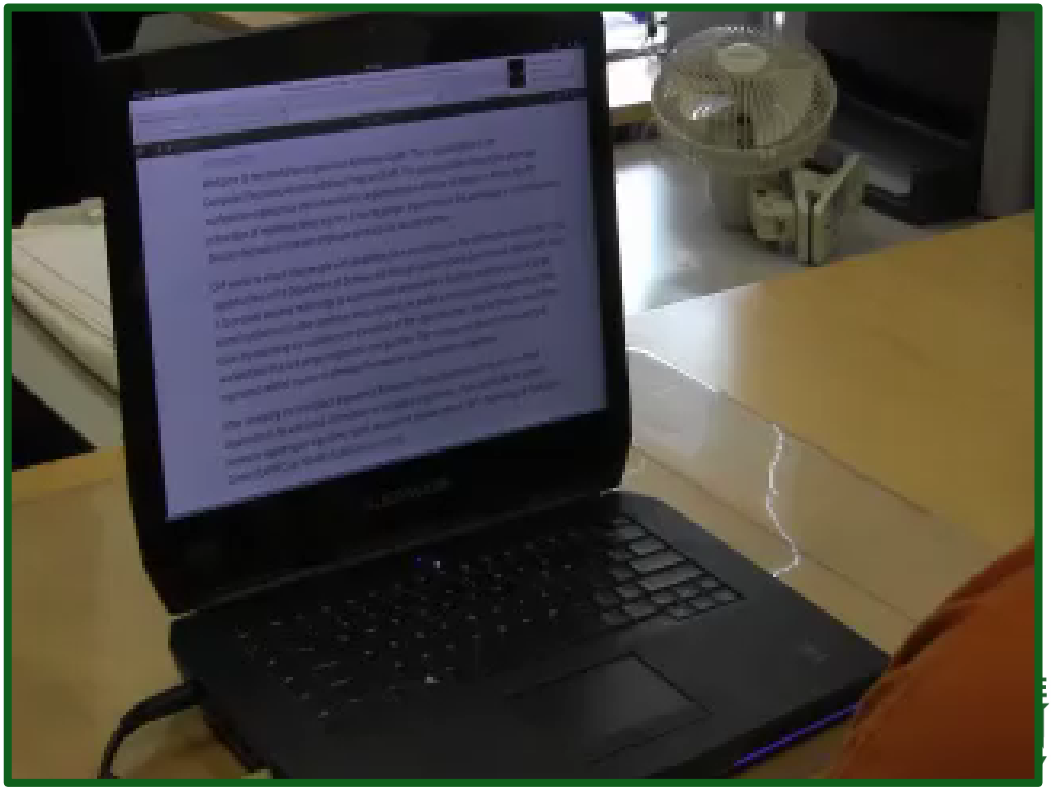


Useful Navigation Elements/Features (Table of Contents)

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)

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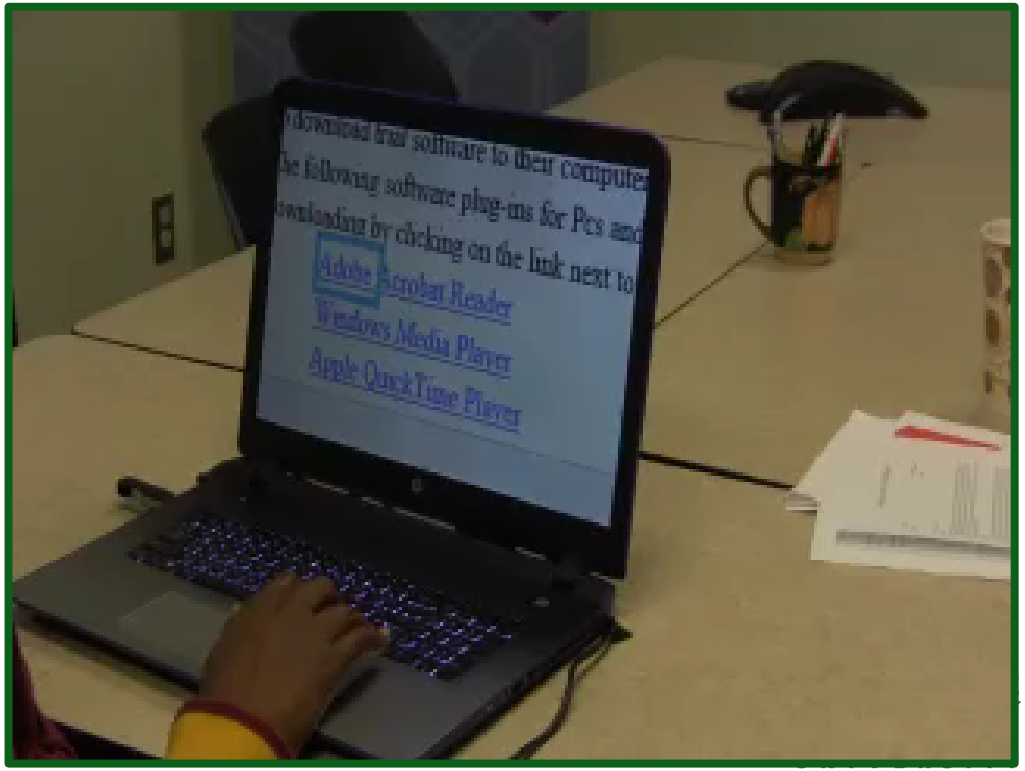
Strategies for Navigation (Arrow Keys)

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)

Observations

Navigation
- Table of Contents
- Up and down arrow

Cognitive Overload
- Repeat the question

Barriers to Access (Technology)

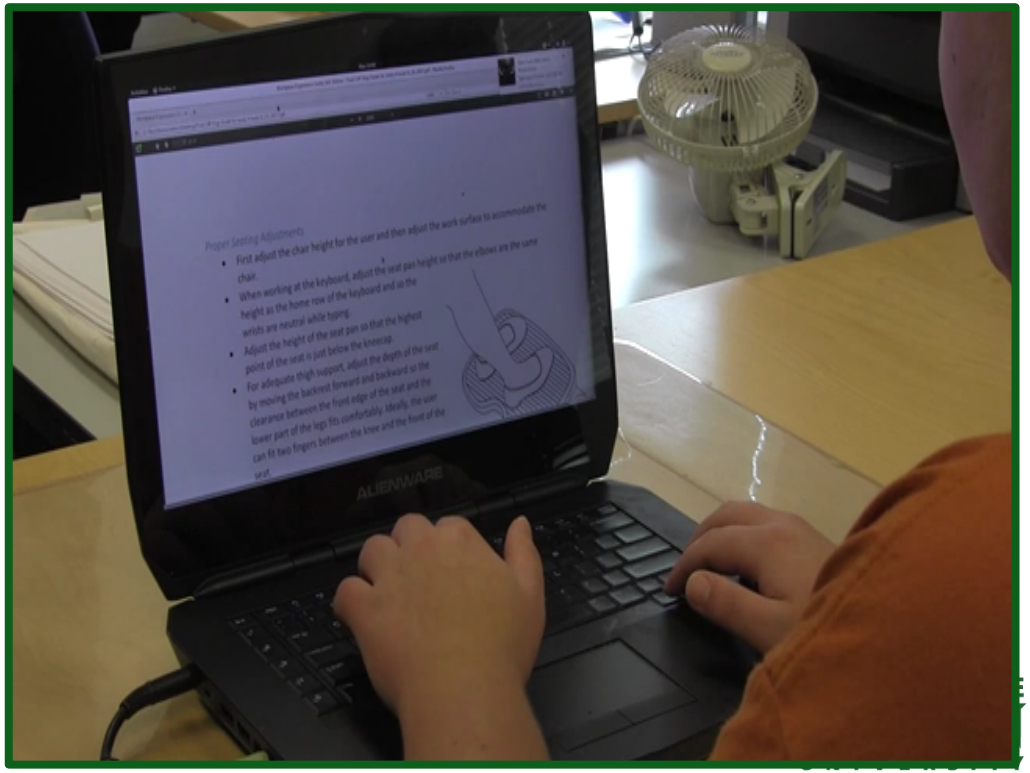
Observations

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.)

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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 (If applicable)

- **Faculty training**
  - Basic document design
  - Build into existing faculty training resources/supports
  - Features to avoid (e.g., columns, images without surrounding context/captions, image-only PDFs)

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Future Implications

- **Build on user-specific training**
  - Make it specific to their AT
  - Document design expectations

- **Raise awareness of existing support resources**
  - Incoming students/faculty
  - Refresher training for existing students/faculty
  - Give them coping strategies

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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

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Questions?

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