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Communication

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ConfChem Conference on Interactive Visualizations for Chemistry Teaching and Learning: The Cutting Edge—Educational Innovation, Disability Law, and Civil Rights

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Supporting Information

ABSTRACT: This communication summarizes one of the invited papers to the Interactive Visualizations for Chemistry Teaching and Learning ACS CHED Committee on Computers in Chemical Education online ConfChem held from May 8 to June 4, 2015. Mr. Paul Grossman, Chief Regional Attorney (retired), Office of Civil Rights, United States Department of Education, succinctly places the development of American disability rights protections and principles within the broader context of race, sex, and national origin civil rights laws in the United States. Starting with the Emancipation Proclamation and ending with the revolutionary changes in education heralded by technology, Mr. Grossman's guide provides a background to understanding the modern evolution of disability law and how it relates to accessibility in education. The resulting discussion included resources for learning about how to make education technology accessible, the use of screen readers for reading chemistry content, how to design interactive simulations with accessibility in mind, and experiences of students with disabilities and their teachers.

KEYWORDS: *Elementary/Middle School Science, High School/Introductory Chemistry, First-Year Undergraduate/General, Computer-Based Learning, Internet/Web-Based Learning, Multimedia-Based Learning, Minorities in Chemistry, Professional Development*

Starting with the goal of walking readers through civil rights history as it pertains to disability law, one guiding question is posed: "What do the educational civil rights of a few Cantonese-speaking children in Chinatown San Francisco have to do with your job?" As background, an overview of six stages of disability law and their connection to our classrooms is outlined.

- Stage 1: The Emancipation Proclamation, and the connection to wounded warriors.
- Stage 2: Desegregation through *Brown v. Board of Education*, and the segregation of accessibility resources on campuses.
- Stage 3: Disparate Treatment through *McDonnell Douglas Corporation v. Green* and measures of equality, and how this relates to equal opportunities for learning.
- Stage 4: "Unnecessary Headwinds" (or Disparate Impact) through *Griggs v. Duke Power*, and online educational materials.
- Stage 5: "Identical treatment is not always equal treatment" through *Lau v. Nichols*, and reasonable accommodation and assistive technology.
- Stage 6: The carryover of disability rights from the digital world—through *Center for Independence v. Bloomberg*—into the brick and mortar world, and the future of disability rights in education.

What emerges is a clear sense of the expansion of disability rights over time. Our community is called upon to act together and join those paving the way for truly equal access to education, including the development of accessible educational materials.

■ CONFCHEM DISCUSSION

This paper was discussed May 29–June 4, during the Spring 2015 ConfChem online conference, *Interactive Visualizations for Chemistry Teaching and Learning*. This conference was hosted by the ACS DivCHED Committee on Computers in Chemical Education (CCCE).[1] The discussion (included in the Supporting Information) focused on understanding the needs and experiences of students with disabilities, assistive technology and how it makes chemistry content accessible to students, and best practices for developing accessible learning materials.

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NEEDS AND EXPERIENCES OF STUDENTS WITH DISABILITIES

The discussion started with two key questions: How do we know if our materials are inaccessible? If they are, how do we correct this? In response, inclusive design[2] was brought up, particularly the ideas that everything can be made more accessible, and that increasing the accessibility of materials can be thought of as adding affordances (e.g., video captioning, lecture recordings, assistive technology readable lecture notes) that can benefit all students, including those with disabilities.

Participants also wanted to know more about the needs and experiences of students with disabilities to understand how to implement useful changes. Some faculty shared their own experiences. Some faculty had never known of having a student with a disability in their classes and were concerned about being prepared; others shared their successful experiences having a visually impaired student and receiving support from their disability services center. Providing accommodations for lab activities seemed particularly challenging, with concern voiced regarding ways to provide independent access to hands-on experiences.

ASSISTIVE TECHNOLOGY AND CHEMISTRY CONTENT

The discussion also included questions on where to find out more information regarding assistive technologies and accessible digital content, and whether assistive technologies can provide access to chemistry content (e.g., can screen readers read chemical formulas and reactions equations?). In response, suggestions included:

- Visiting the campus disability services office to learn about on-campus resources
- Trying out a screen reader (free ones include Voiceover[3] for Mac, and NVDA[4] for PCs)
- Reviewing the DIAGRAM Center's Image Description Guidelines[5]
- Checking out the World Wide Web Consortium[6] and WebAIM[7] Web sites for more resources

BEST PRACTICES FOR DEVELOPING ACCESSIBLE LEARNING MATERIALS

Regarding interactive simulations, there were questions regarding resources for learning about technical implementation and best practices. Resources such as the Web Content Accessibility Guidelines (WCAG 2.0),[8] and WebAIM[7] were suggested, as well as attending conferences such as Association on Higher Education and Disability (AHEAD) conferences[9] or virtual conferences on accessible technology (e.g., ref 10). Other resources include the American Chemical Society's manual for teaching students with disabilities.[11] It was also noted that in the case of interactive content, such as interactive visualizations, there are not common standards established. There are current efforts to develop these standards,[12] and the community is invited to participate.

In conclusion, some final comments were shared expressing appreciation for the enthusiasm demonstrated during the discussion, and excitement about the potential advancements in accessible STEM content. Suggestions for finding further answers to participants' questions include talking with

- Scientists with disabilities, to begin to understand more about their experiences and what adaptations they have needed and developed
- Experts in making complex materials (in other domains) more accessible
- Experts in accessible technology

ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available on the ACS Publications website at DOI: 10.1021/acs.jchemed.5b00777.

Full text of the original paper and associated discussions from the ConfChem Conference (PDF)

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Notes

The authors declare no competing financial interest.

§Paul D. Grossman, J.D., now retired, served as Chief Civil Rights Attorney for the U.S. Department of Education, Office for Civil Rights, in San Francisco, California.

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