

ONLINE CHEMISTRY TEXTBOOK: USABILITY AND VERSATILITY



CHALLENGE

In 2016, a major publishing company ("EdBook"), needed to create an accessible chemistry book in HTML5 format, to be available for online and computer-based learning. EdBook, one of the largest educational publishers in the country, had already undertaken several major projects to provide its books, media, and educational tools in accessible formats. Chemistry, however, was proving to be a challenging subject to make accessible.

STEM subjects like chemistry are the most difficult materials to convert into accessible form, due to the need for perfect technical accuracy. For online learning, where many blind and visually impaired students use audiobooks, an added concern is the concise translation of extremely complex visual information. While standardized schema like MathML (a markup language that enables accurate rendering of accessible electronic math) provide useful tools, experienced subject matter experts are still needed to perform the actual work.

For chemistry and related subjects, a further problem is that chemical notation is distinct from mathematics notation. Since MathML is designed primarily for math, it's not really ideal for building a chemistry book. For example, MathML doesn't have reserved symbols for chemical bonds, and other symbols, like the "yields" arrow in chemical equations, are misread by many readers as math symbols. There is currently no standardized chemistry equivalent of MathML; ChemML is a potential option, but is not broadly accepted at the moment.

SOLUTION

Rather than use a non-standardized format, SeeWriteHear decided to build the chemistry content in MathML. However, we still wanted to provide chemistry-specific audio functionality, to make the book easier to read and understand. The book would be perfectly usable (albeit inconveniently) without such a feature, but we wanted to make the learning experience as smooth and unambiguous as possible.

Our solution was to build a custom add-on for MathML containing chemistry-specific markup, audio, and graphics. We also added new symbols to the World Wide Web Consortium (W3C) HTML5 spec to provide functionality for chemistry symbols like double bonds.

The add-on, when used with the SeeWriteHear reading software, enabled proper recognition and output of chemistry notation, so that the student would hear equations with the correct chemistry terms. For example, rather than having to try to interpret "O equal sign O," the student would hear "O double bond O." Furthermore, the add-on did not affect the core functionality of the book itself; the book was fully compatible with any HTML5 reading software, lacking only the enhanced chemistry-specific audio when used outside the SeeWriteHear software.

For the book's many graphics and images, we created new accessible versions, capable of being scaled, contrast-adjusted, and downloaded and printed as tactile graphics. The finalized book content was fully reviewed by SeeWriteHear's editorial staff, including a blind Chemistry PhD.

RESULT

The final EdBook Chemistry online textbook is now in full use at EdBook and distributed to schools across the country. By default, the SeeWriteHear reader is used, giving EdBook clients an accessible online chemistry course that correctly identifies and vocalizes chemistry symbols. The book is an example of integrated accessibility in software; students of all ability types use the same textbook, and simply turn on features specific to their needs (such as audio or large print). This ensures that regardless of individual situation, students in the same class can collaborate and discuss the class materials together.

Several other organizations have ordered similar material based on the MathML add-ons created for this project. SeeWriteHear is developing additional add-ons for MathML for other STEM subjects and for use with the SeeWriteHear reader software.