

STEM DESCRIPTIVE VIDEO: DRAWING WITH WORDS



CHALLENGE

Online and multimedia teaching tools have become a central part of many school programs in the US, creating new barriers for students with disabilities, particularly blind and visually impaired (B/VI) students. In 2014, a large educational publisher ("EducaTech"), faced the need to bring its entire library of classroom videos into compliance with federal accessibility requirements. This included the requirement to add audio description to a large number of math and science videos with complex equations, diagrams, and laboratory procedures.

The project required extremely high levels of pedagogical accuracy; it was imperative that blind and deaf students be able to achieve their learning goals via EducaTech's multimedia content in the same way as sighted and hearing students. This requirement precluded automated or general-purpose audio descriptions, and necessitated subject-matter experts with experience in teaching STEM content to students with disabilities. With a limited timeline and budget, EducaTech needed to find a way to effectively communicate images that, in many cases, literally defied description.

SOLUTION

To add full descriptive audio to EducaTech's STEM videos, SeeWriteHear implemented several techniques not commonly used in standard audio description (such as the sort found on DVDs for movies or TV shows). For the advanced math videos, clarity and consistency was vital. Some equations were extremely lengthy and complex. Solving the latter problem involved using MathSpeak, a highly structured and unambiguous system of reading math aloud. Based on MathML (a math-specific computer markup language), MathSpeak ensured that equations like $\frac{1}{x} + 1$ and $\frac{1}{x+1}$ would not both be read, ambiguously, as "one over x plus one."

The concern with length of equations (and the resulting need for extremely detailed descriptions) was solved via several measures. First, rather than use traditional audio description, which is limited to fitting in descriptions in silent areas of the video, SeeWriteHear re-edited each video to add pauses to the original audio, allowing the

insertion of long descriptions at the exact points necessary for natural information flow and ease of comprehension. Pausing for description also enabled accurate and comprehensive descriptions material from other STEM subjects, including lab work, chemical processes, and technical diagrams. Students

EducaTech's online video player app was also redesigned to incorporate accessibility features. Keyboard-controlled navigation allowed quick rewinding and review for students needing to hear a section of an equation or problem again. Students could select captioning and audio described versions of each video, and switch back and forth during playback as needed. Downloadable text transcripts made both the original audio as well as the complete descriptions available to Braille displays and screen readers, greatly speeding information access by students more comfortable with those methods of computer interface.

Finally, to ensure perfect consistency in pronunciation and cadence, a custom-tailored synthetic voice was used to read each math construct. The machine voice was edited into the audio alongside the human narrator (who narrated all other descriptions, like pictures and drawings), allowing listeners to speed up the audio for faster "reading" without losing comprehensibility.

Each video was reviewed by editors with experience in math and STEM education, either as part of their profession (e.g, engineers and chemists) or as their primary competency (e.g., math teachers). For all of EducaTech's upcoming video projects, SeeWriteHear provided recommendations for building in accessibility from the ground up, enabling EducaTech to plan future curricula around broad audiences of all abilities.

RESULT

EducaTech continues to provide SeeWriteHear's captioning and descriptive audio content to classrooms throughout the United States. Internally, EducaTech has consulted with SeeWriteHear to create a dedicated accessible media production group and accessibility training programs for its various curriculum developers, with the goal of making accessibility an integral part of all new programs.

Although adoption of fully audio-described educational videos remains slow in the publishing industry and other public-serving sectors, there is significant impetus for these organizations to become more proactive in their accessibility accommodations. Legal challenges to inadequate access are on the rise, as is the number of blind and deaf students pursuing education and careers in STEM fields. The most efficient means of providing these students with a clear path to their goals is to ensure that all educational content, not just paper texts, is equally available to everyone.