Technology Tools to Build a More Accessible STEM Program: Student Engagement and Identity with Science
The U.S. Department of Education established the Center on Technology and Disability (CTD) to provide a wide range of assistive technology resources for states and districts, families, teachers, service providers, advocates, researchers, teacher training programs, disability organizations, and vendors.

The CTD website – www.ctdinsitute.org – has a resource library with more than 1,000 assistive technology-related materials; a webinar center with an active schedule of informational presentations, and extensive archive; and a learning center for those who want structured, in-depth modules.
Technology Tools to Build a More Accessible STEM Program: Student Engagement and Identity with Science

Use accessible technologies and authentic STEM experiences to encourage “STEM for All”

Mainstream technology tools with built-in accessibility features, and the availability of virtual reality, simulations, and augmented reality present new opportunities for students with disabilities to access and engage with STEM (science, technology, engineering, and math) content. This brief presents ways for educational leaders to incorporate accessible technologies and STEM tools with principles of Universal Design for Learning (UDL) to create STEM programs that are more accessible for students with disabilities to prepare them for a lifetime of scientific literacy and STEM-related careers.

Introduction

STEM education serves as the foundation of innovation in our society. Innovative products often derive from a problem or challenge that requires a unique solution, making it imperative that all students, including those with disabilities, have access to a rigorous STEM curriculum. Thanks to more accessible technologies and a concerted nationwide effort to address underrepresented populations in STEM fields, more individuals with disabilities are pursuing careers in science and engineering. However, many students with disabilities still lack access to a rigorous and accessible STEM curriculum, and may get the message that STEM careers are not for them. This situation places these students at a disadvantage given that STEM jobs are among the fastest growing and highest paid occupations, with STEM jobs expected to grow to more than 9 million by 2022.

In an increasingly complex world, all students need to be scientifically literate. While some students may go on to pursue advanced careers in the sciences, basic scientific literacy is critical for all students. They need to understand what it means to think like a scientist, and how to evaluate information that is called "scientific". Many of the careers of the future will require that students can collaborate and solve problems using STEM skills. Struggling students are no exception — they will need the same types of knowledge and skills, and often will require additional supports to be successful.

Research has shown that the most meaningful learning happens when students are engaged in authentic activities that ask them to think and behave like chemists, computer programmers, mathematicians, engineers or archeologists — that is, when they are engaged in activities that mirror the real-life tasks of STEM professionals. These activities might include the use of virtual environments and simulations, developing models of scientific phenomena, and using collaborative tools like Google

docs, video conferencing, and online communities. These types of activities can present new challenges for struggling students and those with disabilities.

Student engagement and identity with science

Perhaps one of the most important dimensions of science education for all students is their ability to engage with science and see themselves as scientists. Unfortunately, there has been a historic lack of diverse representation in STEM fields, which may deter student populations from exploring scientific interests. Identity, and perception of oneself as a scientist, are key elements of motivation and engagement with science content.

Even if students do not plan to pursue STEM careers, scientific literacy is still critical in enabling students to engage productively with scientific language and content in their daily lives. “The language and concepts of STEM are accessible to all, and there is a shared understanding of where STEM fits into all people’s lives, regardless of race or ethnicity, disability, language spoken, gender, neighborhood, or geographic location.”

An important element of both identity and engagement are authentic activities that encourage students’ active involvement in scientific inquiry. Project- and problem-based learning (PBL) is one way to give students an opportunity to try on the role of "scientist". As students work towards solving the central problem (or addressing a driving question), they become more engaged in the learning process, take more control over their own learning, and are more likely to see themselves as scientists.

Inquiry-based digital science curricula

Technologies that are based on scientific inquiry are more likely to contain a driving question or a project/problem-based design. These tools and curricula are becoming more common and popular as the technologies to support inquiry-based learning online are becoming more widely available.

Scenarios and immersive environments that let students practice being scientists

Scenario-based instructional technologies that provide authentic experiences, including using and manipulating data, producing scientific documents, and portraying the user as a scientist can help students engage in and envision themselves pursuing STEM careers. These can be simulations, such as a virtual laboratory, or immersive worlds that allow students to explore and learn progressively more complex tasks and topics. Simulations are perhaps the most widely available technology tools for science content at every grade level. They can range from incredibly complex virtual worlds that allow students to explore an ecosystem in depth, to more focused simulations focusing on a specific activity.

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E-learning opportunities with distance technology
There are many ways to use technology to bring scientists into your classroom. For example, students can visit official web pages, email questions, and participate in online discussion forums. New technology tools can also allow students to virtually participate in research with STEM professionals—posing questions, watching research activities, even helping with data collection in their hometowns as citizen scientists (i.e., helping to collect water samples to submit to a larger database or monitoring firefly populations). Research has shown that these types of interactions can support student learning in a variety of ways, such as engaging students, increasing participation in discussions, and encouraging the shared construction of knowledge.  

Many research organizations, museums, government agencies, and universities offer outreach programs to allow classes and students to engage in activities and discussions with scientists. Some programs even allow students to join scientific expeditions virtually through live streaming video and real-time chat. Using videos, data collection, virtual labs, simulations, and streaming satellite videos of scientists in the field, these types of projects enable students to participate in ongoing research, interact with STEM researchers, and engage in scientific discourse with their peers.

Implications for educators
To encourage students who have a difficult time imagining themselves as future STEM professionals, teachers can consider some of these approaches:

- Share examples of scientists from all backgrounds, of different races and ethnicities, and with disabilities.
- Identify games and simulations that can provide students with opportunities to model being scientists through their virtual activity.
- Identify programs or resources and technologies for aspiring scientists that can help students see the type of support they could receive.

Technology resources
EEK! Environmental Education for Kids — Get a Job
Resources and information are presented for elementary and middle school students about possible careers in environmental sciences.

EngineerGirl
The EngineerGirl website is part of a National Academy of Engineering project to bring national attention to the opportunity that engineering represents to all people at any age, but particularly to women and girls. Find resources and information to encourage young girls to consider careers in engineering.

Engineer Your Life
The Engineer Your Life Web site is the centerpiece of a national campaign designed to encourage young

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college-bound women to consider pursuing careers in engineering. Encourage your students to see themselves in STEM careers as they learn more about what life and work are like for engineers.

**JASON Learning**
This platform provides curriculum and resources that drop students (K-12) in simulated situations, where they must strategize to solve real-world problems. Students are provided with mentorship with leading STEM professionals.

**NASA's Scientist Chats & Ask a Scientist**
Engage with STEM professionals on a variety of topics, or ask a scientist in a particular field (e.g., astrobiology, astronomy, astrophysics, geology, lunar science, physics, etc.) your own question.

**STEMfinity**
Explore this webpage for a library of resources to support STEM instruction for students, K-12, as well as professional development for educators.

**We Choose the Moon**
Use this interactive simulation from the JFK Library and Museum celebrating the 40th anniversary of the Apollo lunar landing to encourage your students to learn more about the people and places involved in sending a mission to the moon, and to gain a personal perspective on the landing.
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