SciTrain: Reducing Barriers to Learning by Teaching Universal Design Standards

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ABSTRACT – SciTrain, a project of Georgia Tech's Center for Assistive Technology & Environmental Access (CATEA), funded by the National Science Foundation Research in Disabilities Education program (www.nsf.gov/), aims to assist high school science, computer science, and mathematics teachers in providing the highest quality education to students with disabilities. The project includes research and instruction for teachers on how to make their coursework, classrooms, and labs more accessible. This training is delivered to K-12 teachers using web-based learning technology at http://www.catea.gatech.edu/scitrain/. SciTrain is focused on identifying barriers to learning faced by high school students with disabilities and presenting potential solutions that teachers can implement in the classroom. Specific SciTrain modules include material on vision impairments, hearing limitations, mobility impairments, learning disabilities, and ADHD. These solutions support teachers in helping students overcome these barriers as well as enriching the learning experience for students without disabilities. SciTrain also provides an introduction to the philosophy of universal design intended to enhance human capacity through technology & design, and to open opportunities in STEM fields to all.

I. INTRODUCTION

Funded by a grant from the National Science Foundation, SciTrain helps high school science, computing, and math teachers provide quality education for all students, including those with disabilities. The project includes research and instruction for teachers on how to make courses, classrooms and labs more accessible, developed from a review of NSF projects and promising practices in universal design and accessibility. Based on the results of teacher focus groups, this training is delivered to K-12 teachers in a "just-in-time" format - participants receive modular content on the web organized by disability type and by subject area, so they can refer to it easily when they find a student with a particular disability in their class or when they are teaching a specific kind of material.

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II. METHODOLOGY

SciTrain (www.catea.org/scitrain/) researchers began developing their training tools by reviewing the results of previous Georgia Tech initiatives and research partners.

Staff examined current literature and identified 147 articles and reports on promising practices and created annotations and abstracts. Outcomes and strategies from these projects were then compared with the results of a literature review of STEM accommodations for students with disabilities that was used to focus the research questions for SciTrain evaluation efforts. These 147 articles also formed the core of the searchable SciTrain Publications Database, available with annotations at www.catea.org/scitrain/kb/index.php, and the SciTrain Accommodations Database (www.catea.org/scitrain/accommodations/index.php) of assistive technology (AT) solutions. Finally, the data informed the creation of the Accessible Science, Math and Computer Science courses that are the heart of SciTrain training.

SciTrain then conducted a series of three in-person focus groups (n=18) with math and science teachers from an Atlanta area school district. Teachers participated in an evaluation of barriers to STEM education and promising practices to alleviate those barriers. At this time, SciTrain also created and published an extensive online survey of teacher's experiences with STEM barriers and accommodations, including perceived importance and difficulty implementing the solutions. The survey evaluated the responses of 266 STEM secondary school teachers in the public school systems of the state of Georgia. Results of the focus groups and online survey were applied to the prototype courses to focus resources where they were most needed.

In order to assess the real-world impact of the SciTrain courses, researchers conducted two semester-long longitudinal studies of the experiences of teachers who have completed the courses. In 2007-2008, 9 science and math teachers from an Atlanta area school system completed the study to note and assess the impact of SciTrain on their classrooms, laboratories and overall teaching effectiveness. The results of these longitudinal studies demonstrate the uses of SciTrain in the real-world setting and suggest areas of improvement and further development.

In order to assess SciTrain's primary impact statement "Students with disabilities are as engaged as students without disabilities," researchers conducted an Engagement Survey of general education teachers and partnered special needs teachers who have participated in the online training courses.

Researchers used selected material from two surveys: the High School Survey of Student Engagement and the National Survey of Student Engagement. The composite survey was administered to 379 teachers who met user criteria, with 73 responses. The results show that 86% of teachers who implemented techniques from SciTrain reported "moderately improved" or "greatly improved" engagement in their students with disabilities. There was no statistical difference between increase in engagement between students with disabilities and those without, perhaps indicating a broad applicability of the universally designed solutions contained within SciTrain. This hypothesis deserves further study.

III. RESULTS

The completed courses focus on distinct subject criteria (science, math, computer science) but each contains consistent modules of training, including extensive instruction on the uses of Universal Design principles to make learning accessible and more usable for all students and background on disability laws to assist teachers in making positive changes through their local and state administrations. Each course also contains specific modules on addressing the needs of students with vision impairments, hearing limitations, mobility impairments, learning disabilities, and ADHD. Each course includes approximately 8 hours of online training, and each has been developed to be accessible to all via the web, per WCAG standards.

SciTrain research reveals a need to provide teachers with training that encompasses:
1. Introductory information on disabilities and AT
2. Guidance in the creation of teaching plans that are adaptable to varying student needs and prevent duplication of effort
3. Classroom & laboratory accommodations that work together, as opposed to piecemeal efforts.
4. Information on disability laws and policies, to aid in procurement of resources
5. In-depth guidance for the most common/problematic disability types for STEM.

SciTrain focuses on the needs of those with severe vision, hearing and ADHD issues, per feedback regarding teacher needs. But because of the emphasis throughout the courses on Universal Design for Learning strategies, training can be readily applied to related and/or multiple disability issues, as well as improving learning for the general student population.

IV. CONCLUSION

SciTrain identifies barriers to learning faced by high school students with disabilities, and develops solutions to help students overcome these barriers through both disability-specific accommodations and the process of universal design for learning (UDL). UDL advocates that teachers use multiple means of representation to present information, and multiple means of expression to allow students to demonstrate what they have learned. This benefits all students, including different types of learners (visual, kinesthetic, linguistic), students who face non-disability related barriers (socioeconomic, ESL), and students with disabilities. In suggesting accommodations and teaching methodologies, SciTrain specifically focuses on students with vision impairments, hearing limitations, mobility impairments, learning disabilities, and ADHD. SciTrain is currently being extended into the university level through a Department of Education, Officer of Post-Secondary Education, grant project called SciTrain U (www.catea.gatech.edu/scitrainU/login.php).