

Increasing accessibility of college STEM courses through faculty development in Universal Design for Learning

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The University of Southern Maine (USM) has seen an increase in students with disabilities in recent years, and recognizes the requirement to modify its curricula, instruction, assessment, and environment to address the diverse needs of its changing population. Older students, veterans, students with disabilities, students for whom English is not their first language, transfer students, and others all bring special needs along with them to the first day of class, and retaining and educating these students means ensuring that courses are designed in a such a way that they are accessible to all students.

The EAST Alliance 2 for Science, Technology, Engineering, and Mathematics (STEM) Students with Disabilities at USM (EAST) (www.usm.maine.edu/east) conducted a program of faculty development in UDL that provided USM professors with training and tools to use in creating accessible courses for all their students. One professor summed up the need for this program: “I had no clue about universal design and really very little idea about the range of challenges facing students with disabilities — or even the range of disabilities. I suspect that many colleagues have a similar lack of appreciation for the challenges involved in adequately providing material for students with disabilities.” Recognizing that many professors experienced a similar lack of understanding of the effectiveness of Universal Design for Learning principles in ensuring that all students have an equal opportunity to succeed, EAST recruited sixteen STEM faculty members to participate in a five-year program of UDL education, implementation, evaluation, and dissemination.

PHASE 1: UDL EDUCATION

The UDL faculty cohort met in a series of forums geared toward providing education and information on UDL while creating a constructivist learning environment out of which further topics for investigation could emerge. Collective reading and discussion of the book *Universal Design in Higher Education* (Burgstahler, 2008) provided background information and sparked questions that informed further forums. The Director of USM’s Office of Support for Students with Disabilities (OSSD) presented a seminar on the mission of her office and their difficulties with the provision of all course materials in an accessible format. As a result of this presentation, two further seminars

were offered. The first was by Dr. Norman Coombs, a nationally recognized expert in accessibility teaching and advocacy, who broadened the faculty's perception of what it means to be blind in the world of higher education, and who demonstrated the means of making a universal, accessible PowerPoint presentation and then adapting it for a lecture, presentation, website, etc. The second seminar that resulted from the initial OSSD presentation was planned as a response to the faculty's request for more information on specific disabilities, and presented a neuropsychological perspective on students with Asperger's syndrome.

In addition to background information on disabilities and UDL, education was also provided on the role of technology in UDL and on adaptive technology. The key concept that technology broadens access by providing flexibility and multiple means of engagement but does not change the content of the curriculum, was reinforced by the faculty participants themselves. Four faculty members instructed their colleagues on the use of vodcasting, podcast/media server/compression issues, the digital pen, and implementing best practices for supporting all students.

PHASE 2: UDL IMPLEMENTATION

The evolving model of active learning by faculty proved to be powerful in keeping faculty engaged and committed. This high level of engagement was a major asset when the time came for implementation. Meeting together in a workshop format, faculty worked with a facilitator from the Center for Applied Special Teaching (CAST) in a guided exploration of brain research and its implication for differentiated instruction and classroom practices, as well as the strengths and weaknesses of various instructional media. Faculty conducted a UDL Redesign Challenge, for which they described an aspect of their course instruction/content that was particularly challenging for students, and shared suggestions for course adjustments guided by UDL principles.

Based on these explorations, faculty then used UDL principles to design, implement, and practice lessons, activities, labs, and revised syllabi. For instance, after examining many different examples of syllabi and evaluating them for adherence to UDL principles, faculty took on the assignment of redesigning their course syllabi to incorporate what they had learned regarding UDL. The following excerpts are taken from a Biology professor's report on the incorporation of UDL into the syllabus for his Introductory Neurobiology course, based on ideas from the Equity and Excellence in Higher Education (2008) project.

A professor of a Fundamentals of Environmental Science course described some of the UDL modifications he made to his methods of instruction as follows:

ESP 101 uses online tools to allow students to submit their work at convenient times outside of lecture. Lecture includes interactive electronic clickers and quizzes that allow students and I to assess where they are at in a real-time manner and to quickly address concepts that are difficult while allowing the lecture to quickly move through those materials that students tend to grasp more readily. Short videos (less than six minutes) are frequently used to illustrate key concepts and keep students engaged. Finally, I use hands-on exercises in class to allow students to work together and develop a learning community.

UDL Tip	Syllabus Modification Made
Present information in at least two formats.	Calendar for lectures and office hours added. Map of concepts added to illustrate the link between major themes of course.
Give students as many resources as possible.	Online textbook site added; Blackboard website added. Link to campus map added for site of lectures and OSSD. Website and contact info for OSSD and information about EAST added.
Provide lots of background information — but be brief.	Photo of instructor added. Sentence about my interests added to give context to the course.
Build in flexibility.	Weekly schedule calendar graphic added. Office hours added after class, Virtual office hours added. Email submission of homework added. For some assignments the option of a PowerPoint or audio presentation instead of a written piece has been added.
Go digital.	Course materials will all be posted on Blackboard website. This includes PowerPoints of lectures and additional papers. Syllabus will be emailed to all students. Added websites which have podcasts and webcasts which students can consult.
Less is more — don't overwhelm syllabus with details.	Need to trim down text in initial document and place some of it in a secondary document.

PHASE 3: REFLECTION/FEEDBACK

An integral part of sustaining change in teaching practice is reflection and feedback. Faculty observed each other's courses, recorded their observations, and met to discuss how UDL was being incorporated into classroom instruction. Working with Education Development Center, Inc. and CAST, EAST developed a Faculty Universal Design for Learning Observation Tool which gathered data about whether and how an observed course session offered opportunities for students to experience ideas and information in multiple ways, to express their comprehension in multiple ways, and to have multiple opportunities for engagement. Faculty also completed a self-reflection called Faculty Course Redesign Reflection in which they described changes made to courses, what aspects of courses reflect principles of universal design, the perceived impact of the lesson on students, and impact on their teaching practice in general.

To collect feedback, faculty administered a questionnaire to students at the end of each course. The College Student Feedback Survey provided formative feedback to faculty about accessibility of their STEM courses and documented the accessibility features that these courses incorporated.

All of these evaluation instruments, as well as Faculty Pre- and Post-Surveys (Education Development Center, Inc., 2009), are available online.

Professors were provided with a small amount of funding to use for purchasing technology to help them address individual issues that were identified through the evaluation process. A Computer Science professor who learned that she was difficult to understand was able to purchase an amplification system. She reflected,

“I am working in particular on improving my vocalization...which I have learned can be helpful to students who are hard of hearing.”

PHASE 4: DISSEMINATION

Over the course of the training, the faculty realized the strong value of technology as a means of providing universal accessibility to information; consequently they developed a website, blogs, vodcasts, and a technology showcase. One of these, featuring use of a digital pen in Chemistry class (Stasko, 2010), can be viewed online.

It was planned that in years four and five, each of the participating faculty would mentor at least two colleagues from their department through a two-year UDL Education/UDL Implementation cycle. This model would result in an ongoing loop of dissemination of Universal Design for Learning throughout the university community. In addition, a rubric for use in evaluating syllabi and courses, a collection of model syllabi and UDL lessons, training in adding captioning to videos, and a monthly brown bag lunch series for sharing of tools and strategies were anticipated. Unfortunately, funding for this phase of the project was eliminated.

IMPACT

The sixteen faculty members who participated in EAST’s program for professional development in UDL were responsible for seventy courses and six hundred students, including eighteen in Engineering and Technology, fourteen in Natural Sciences, thirteen in Biology, ten in Mathematics, seven in Chemistry, five in the Humanities, and three in Physical Sciences. The legacy of UDL improvements to courses is being carried on by the faculty who shared in the creation of the UDL education and implementation program.

When asked to describe the key idea they learned through the professional development sessions, sixty-two percent of the faculty cited the benefits of incorporating universal design into their courses. All faculty members reported that they made changes in the design of their courses as a result of participating in professional development in UDL. Sixty-four percent reported that they now provide information in multiple formats, and forty-three percent reported incorporating interactive media.

The following quotes illustrate faculty members’ responses:

I try and think strategically about what I want the students to be learning, and develop different opportunities for the students to engage and display competence. I try and bring in a lot of models and tactile work, more simulations and practical demonstrations, and less equation work.

I have sought after and/or created information resources that provide information in multiple formats. Slide shows have text outlines to go along with them. Images in lecture slide shows have descriptive text for screen readers.

When asked what impact the changes in their courses had on students, thirty-six percent of the faculty reported more student engagement, thirty-six percent felt it was too early to detect changes, twenty-nine percent reported positive student feedback, and fourteen percent observed more student self-sufficiency. The following quotes are representative of faculty members’ responses:

I think it has had a big impact on all students primarily because it has had a big impact on me and how I think about my teaching and my teaching goals.

I cannot tell yet. It changes with every class. But the students respond to the opportunity to express their knowledge in different ways positively, and (hopefully) this helps them stay engaged and active in the learning.

The course now allows students to learn all the material at their own pace and in a more accessible manner. All the new features were designed to be more useful to any student.

CONCLUSION

This program has proven successful in educating college faculty on utilizing UDL to address the needs of a rapidly changing student population. Involving professors in a constructivist approach is an excellent way to overcome their natural reluctance to embrace change and assistive technology. Collaborating with peers is, by definition, a collegial approach that respects the different places that individuals might be on the road to making their courses universally accessible. As one long-time professor phrased it, professional development in UDL “has had a transformative impact on nearly all aspects of my teaching.”

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