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Features of Successful NSF Alliances and Models of Virtual Learning Communities: A Framework for Developing a Virtual Academic Social Network for Supporting Deaf and Hard of Hearing Students in STEM Education

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FEATURES OF SUCCESSFUL NSF ALLIANCES AND MODELS OF VIRTUAL LEARNING COMMUNITIES: A FRAMEWORK FOR DEVELOPING A VIRTUAL ACADEMIC SOCIAL NETWORK FOR SUPPORTING DEAF AND HARD OF HEARING STUDENTS IN STEM EDUCATION

Introduction

We reviewed four of the NSF Alliances that focus on supporting students with disabilities who are interested in pursuing education and careers in STEM fields. Each of the four alliances is funded and functioning for at least one year. In addition, we reviewed two open source web sites that provide free outstanding educational materials that can be used to support student learning in STEM fields, and one program that provides cyber-based teaching, tutoring and mentoring/advising which has been functioning successfully for six years. It was felt that such a review would be useful in formulating our proposal for supporting students who are deaf or hard of hearing (D/HoH) in postsecondary education through a Deaf STEM virtual community alliance.

Alliances Reviewed

1. MIND Alliance for Minority Students with Disabilities in Science Technology, Engineering and Mathematics
(http://www.subr.edu/rehabilitation/mindallianceprogram.html)

Host institution: Hunter College, City University of New York and Southern University in Baton Rouge Louisiana.

Partners: in New York City Oberle of Manhattan community college and Newark New Jersey school district; in Baton Rouge Delgado community college Baton Rouge community college and the school districts of East Baton Rouge Parish's and Terrebornne.

Students served: minority students with disabilities.

Strategies: Student interventions, culturally sensitive student experiences, career assessment and counseling, Summer Institute programs, tutoring and mentoring and role modeling.

2. AccesSTEM: The Northwest Alliance for Students with Disabilities in Science Technology, Engineering and Mathematics -- Phase 2. http://www.washington.edu/doit/Stem/)

Host institution: University of Washington

Partners: Bellevue community college, Seattle Central community college, all high schools within the city of Seattle Public schools system.

Students served: Students with disabilities.

Strategies: Implement changes in partner postsecondary institutions to make programs more welcoming and accessible to students with disabilities; expand engagement with stakeholders such as pre-college STEM educators, disability services, veterans associations, projects that broaden participation in STEM and in industry career services -- welcoming and accessible to people with disabilities; implement evidence-based practices such as mentoring peer support and internships; expand online resource Center.

Over 300 students completed the program. 100% graduated from H.S. and a high percentage went on to postsecondary education, and 112 currently taking college courses. As of 2008 there are 45 AA, 83 BS, and 16 graduate degrees. 103 are in STEM fields.

3. Collaborative Research: Increasing Achievement and Transition Outcome in STEM Professions of Postsecondary Students with Disabilities; STEM Degrees and Careers for Ohioans with Disabilities. (http://nisonger.osu.edu/osaa/ ; http://www.wright.edu/osaa/)

Host institution: Ohio State University Research Foundation and Wright State.

Partners: Wright State University, the Ohio State University, Sinclair community college, Columbus State community college and numerous high schools in the Dayton and Columbus regions in Ohio.

Strategies: increase retention and graduation rates from 10% to 20% and transiting to postsecondary education in STEM using learning communities, mentoring, both electronically and internships, and individualized STEM advisement; increase graduation rates from STEM graduate programs by 5% per year by focusing on employment issues, learning communities, and industry internships.

4. EAST Alliance for Students with Disabilities in STEM – Phase 2 (http://eastalliance2.org/)

Host Institution: University of Southern Maine.

Partners: Southern Maine Community College, Central Maine Community College, Land Mark College, and four high schools: Portland Airing, Casco Bay, Portland High School, and Bonny Eagle High School.

Strategies: refine steps for success, targeted stem learning experiences for high school students, and providing academic support and research experiences for undergraduate students. High school interventions include field base science research institutes for juniors and seniors, college credit course work in math for high school seniors, professional development for high school math and science and special education teachers. The focus is on institutions in southern Maine and sharing a model of national post secondary education with external audiences. The staffs report several different programs that have been established and have been in use for some time. Most of these programs involve students, either high school or post secondary students, participating in a variety of hands-on scientific work at a variety of institutions. These institutions can be research facilities such as the Jackson Lab in Bar Harbor Maine or they can be educational institutions.

Goals of the Alliances

The stated goals of each of the alliances are similar. **1.** Increase involvement of high school students with disabilities and transition them to STEM majors in postsecondary education; **2.** Increase retention and graduation rates for associates, baccalaureate and graduate degrees for STEM students with disabilities; **3.** Increase

successful entry rates for STEM graduates of postsecondary educational institutions into STEM graduate programs and/or employment and careers in STEM fields.

Where the alliances differ from one another is in the populations they serve. An alliance may focus on students with disabilities without focusing on any one specific disability, or focus on serving minority students with disabilities. Some alliances cover the spectrum from secondary to postsecondary education and into graduate school or the workforce. Other alliances focus specifically on postsecondary education.

Services provided by the alliances are similar also. These services can be the provision of appropriate access services, appropriate support services such mentoring, tutoring and advising, establishment of summer science camps for hands on research, and working with faculty/staff of the various schools to improve their ability to work with students with disabilities and enhance their sensitivity to students needs. Where they differ in services provided is in their focus on either summer camps where students are exposed to various types of research experiences including experiences working in groups to solve problems or in other cases, the alliance might focus on providing support and access services to students who are in STEM programs at the level of associate degree, baccalaureate degree or graduate degree. Although each alliance speaks of transition to graduate school or to the work force it was difficult to find specific information on how transitions are enhanced and what would be required to make transitions smooth. There are references to academic advising or individual advising covering a multitude of areas such as personal counseling, information on how to become more integrated into the educational environment or becoming independent lifelong learners. There is no indication as to how extensively these services are being provided. For example, are they being provided for both classroom instruction and informal learning environments, including participating in campus activities and student organizations?

The Northwest AccessSTEM Alliance, together with DO-IT, has published extensively and listed many different topics for research derived best practices for accommodating students with disabilities, sharing promising practices with K-12 teachers, postsecondary educators, and employers to make classrooms and employment

opportunities in science, technology and mathematics accessible. They have disseminated numerous publications related to high school, college and graduate students about how to develop communities of learners. They also have many descriptions of opportunities for students with disabilities on post secondary campuses, and success stories encouraging other students to pursue educational opportunities. Additionally, they have produced many publications related to faculty and employees to help them develop the- skills and attitudes of evidence-based practices employed by DO_IT projects, all of which incorporate principles of Universal Design and create academic environments that maximize the learning of students with a wide range of abilities and disabilities .

Our proposal differs from the other Alliances in three ways. First, our proposal is focused on students who are deaf or hard of hearing in postsecondary education. Second**,** we propose to develop a model that could be replicated across the entire country, while the other alliances work with colleges and high schools within their geographic area. Third**,** we are proposing to deliver all services remotely using a cyber infrastructure while other Alliances mostly deliver support and access services in the more traditional ways (9).

Other Models for Virtual Support

An increasing number of sites are coming on line that could serve as models and resource centers for implementing remote provision of access and support services. One such site is located in Seoul, South Korea called the Cyber Home Learning System (CHLS) (5). The objective of the CHLS is to supplement classroom instruction with materials students could use on their own; either at school or at home with the support of cyberteachers, cybertutors and on line counselors. The establishment of the national program was driven by a need to provide additional educational services for students who live in isolated rural areas or students who could not afford to hire personal tutors. The goal was to level the playing field for students who were underserved and under prepared and their wealthier and more advantaged peers.

Because teachers have a limited amount of time in the classroom, the cyber learningsystem provides an extended amount of time with more individualized content and more personal interaction between the student and the teachers. CHLS provides

material for grades 4 through 10 and covers major subjects such as social studies, mathematics, science, and English. Demonstrations and animations, as well as video clips involving real teachers, can be viewed in real-time or replayed later. The students can also request extra practice problems. Students receive feedback on the areas they have mastered, practice questions are corrected immediately and students will receive feedback on their improvement or need to improve. Teachers have access to a pool of exercises and problems so that the cyberteacher can work one-on-one with students or give online lectures to an entire class in real-time. Students also interact among themselves and in a sense they develop a virtual learning community.

CHLS is in the fifth year of operation. Approximately, 65% of the country's 5 million students in grades four through 10 have enrolled in CHLS and half of the students it serves are from small rural schools and low income families. This was the priority targets for the Korean officials. Obviously, this system is not perfect and not all the students who sign up for online services persist in the CHLS program. However, 80% of the participants have reported improvement in their performance and increased confidence in them. One of the reasons this program is so effective, according to one teacher, is that students had the option to always log on and access the materials at any time. Therefore, the online CHLS is both synchronous and asynchronous (5).

A second excellent source of educational material for use in a virtual learning environment is the Monterey Institute for Technology and Education (MITE) (http://www.montereyinstitute.org/.

This is a public website that provides high quality online educational resources and guidance. The materials are available at no cost for individual use through the website and the content is an Open Educational Resource (0ER). MITE consists of three different programs: 1. The National Repository of Online Courses (http://www.montereyinstitute.org/nroc/); 2. Online Course Evaluation Project (http://www.montereyinstitute.org/macarthur/); and 3. The MacArthur Foundation Series on Digital Media and Learning (http://www.montereyinstitute.org/macarthur/).

The NROC is a high quality online source of content in STEM programs for high school, advanced placement and higher education. The OCEP functions as a worldwide search engine for the best online courses for high school and college. And the DML studies the diverse disciplines to develop new understanding of the impact of digital media on youth. Taken together MITE is an excellent source for accessible and quality learning material for both formal and informal environments.

A third excellent site is *The Science Prize for Online Resources in Education* (SPORE). This project was established in 2008 by the journal *Science* and the American Association for the Advancement of Science (AAAS). (6). Starting in 2009, 12 SPORE prizes were awarded annually for the best websites that can promote science education from approximately 100 entries submitted each year. The first one appeared in January, 2010 (7). These websites cover diverse subjects, ranging from astronomy, chemistry and physics, to geology, and biology. The 36 sites are also diverse in their target audiences. Many sites target students ranging from elementary through graduate school, where as others focus on the general public. The sites include videos, animations, real-world datasets, and/or teaching materials. Many other collections of science education websites that have been developed, although valuable resources, contain so many entrants that they become overwhelming and difficult to use. This website has avoided that problem by limiting additions to 12 websites per year, which makes it easier for student learning and for support of teachers (6).

The NSF supported alliances provide excellent information on how to support people with disabilities in STEM programs, and how elementary schools, high schools, and post secondary schools can interact in a positive and effective way with people with disabilities. These alliances reviewed above work with individuals over a wide spectrum of disabilities. Based on several years of experience working in STEM programs and making them accessible and supportive for people with special needs, they have produced research derived information on best practices in supporting people with disabilities and how to transition students to the next level of education or to enter a career in STEM. In addition, members of the alliances have worked extensively with faculty and

administrators at a wide variety of postsecondary education institutions as well as students and teachers in secondary education.

Although we did not specifically review The Midwest Alliance, we are well aware of its activity and successes (8). This Alliance works with people with a variety disabilities. Their geographical focus is on Illinois, Iowa and Wisconsin in which they explore academic and career possibilities in STEM. Much of their work is done using free camp experiences in the summer for high school students, providing hands-on experience and providing important information about the transition process from high school to higher education to parents, students, and academic professionals. They also run nonresidential camps where they teach students how to use a number of different kinds of software related to computer assisted design technologies. The Alliance has been very successful in providing educational opportunities and transition strategies for people with disabilities that have led to success in higher education as well as in securing and maintaining excellent positions, both in academia, business and in other work environments.

The information and insights gained from review of the Alliances and the three web sites has proven very helpful in developing our proposal and will continue to inform and guides us as we implement the Cyberinfrastructure for supporting deaf and hard of hearing students in STEM disciplines. (9).

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