AC 2007-3044: A MULTIDISCIPLINARY GRADUATE PROGRAM IN TECHNOLOGY-BASED LEARNING WITH DISABILITY

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A Multidisciplinary Graduate Program in Technology-based Learning with Disability

Abstract

An interdisciplinary faculty team at Wright State University (WSU) has developed an innovative graduate program designed to provide a broad and comprehensive education, realistic work experiences, and opportunities for problem-centered research in the area of Learning with Disability (LWD). Faculty members from multiple colleges at the university are collaborating to train a unique cohort of graduate students capable of bridging the gaps between three main areas: a) biology of disability, b) assistive technology, and c) the pedagogy of individualized learning. Currently the program is offered as an interdisciplinary concentration within four of WSU's existing doctoral programs including Engineering, Computer Science and Engineering, Biomedical Sciences, and Human Factors/Industrial Organizational Psychology. The ultimate aim of the new LWD doctoral concentration is to educate professionals who can develop integrated approaches to problems that impact the lives and education of individuals with disabilities over multiple environments including home, school, work, and community.

Introduction

WSU is nationally recognized for serving the needs of students with disabilities. This reputation developed in part due to the university's accessible architecture as well as its historical emphasis on valuing diverse populations, particularly those from the "last minority". This commitment to equitable educational opportunities has enabled a significant number of students with profound physical disabilities (e.g. quadriplegia, cerebral palsy, muscular dystrophy, multiple sclerosis and including those with conditions requiring 24 hours a day life support) and those with sensory disabilities, learning disabilities, autism, and mental illness to complete degree programs in all majors including Science Technology Engineering Mathematics (STEM) disciplines. Some unique capabilities that WSU already has in place are:

Physical Support Services: including personal assistance with daily living activities, mobility for students with multiple impairments, and complete access to all areas of the campus via a highly equipped grid of underground tunnels and "talking signs".

Academic Support Services: comprehensive, individualized assistance programs for students with physical and learning disabilities, including assistive technology labs, sign language interpreters, note-takers, scribes, and test-taking accommodations.

Technology Center: textbooks and classroom materials in alternative formats that include audiocassette tapes, computer disks, Braille, and image enhancement.

Career and Vocational Support Services: assistance with career planning and development; opportunities for work site experiences, interviewing skills, requesting reasonable, on-the-job accommodations; assistance with career counseling and raised awareness about meeting the demands of a chosen occupation.

Culture of Acceptance: The barrier-free architecture and accessible academic programs have enabled WSU to attract a large number of students, staff and faculty with disabilities, totaling an academic community of well over 1000 individuals. In exit polls of graduating students, many students without disabilities comment that one of the most important lessons they learned on campus was to understand and accept people with disabilities. Concomitantly, disability acceptance has prompted many faculty (with no prior experience in this area) to explore accessible curriculum and to use the lens of disability to further their own area of scholarship.

Given this unique academic milieu, it was a natural process for a team of WSU faculty to collaborate in the design of this new program. The initial impetus for this collaboration originated among the STEM faculty; although further discussions are ongoing with the colleges of Liberal Arts, Business, and Nursing. The technology based Learning with Disability (LWD) program was conceived with several objectives in mind, namely, to provide a broad and comprehensive education, realistic work experiences, and opportunities for problem-centered research in the area of learning with disability. The intended goal was to train a unique cohort of doctoral students interested in the synergy among: biology of disability, design of assistive devices and instrumentations, human factors as related to technology and disability, and the associated pedagogical issues surrounding individualized learning. The program is offered as a concentration track within four of WSU's existing doctoral programs. In addition to required coursework and service engagement, students are expected to perform dissertation research at the confluence of the areas listed above. Master's degree studies are also provisioned, but the emphasis is placed on doctoral studies.

Program Philosophy and Goal

The key objective of the LWD program is to use interdisciplinary collaboration across doctoral programs at WSU in order to broaden the perspectives of students as they address learning with disability with an emphasis on education and employability within the STEM fields. Doctoral students who complete the LWD program will have a distinctive set of knowledge, skills, and dispositions with regard to the needs and strengths of persons with disabilities. This unique preparation will make possible professional opportunities in a multitude of areas related to, but potentially broader than their original disciplines (e.g. higher education, research and design of assistive technology, curriculum development and implementation, or consultation with federal and state rehabilitation agencies).

A unique characteristic of the program at Wright State is the opportunity for our students to interact with students who are challenged by physical and cognitive disabilities. This provides a context for connecting basic theory in biology and psychology to the everyday experiences of these students. It also provides a practical challenge to explore the opportunities afforded by advanced technologies to expand human capabilities through the design of multimodal interfaces and enhanced visualizations. Thus, theories in biology, psychology, engineering, and computer

science are put to the test against the everyday challenges and experiences of the community of students with disabilities. The goal is to promote theoretical perspectives that cross disciplinary-boundaries in order to comprehensively address the challenges of disabilities; and to develop both theoretically and empirically grounded approaches to design.

The scholarly thrust of the LWD program consists of three interrelated research efforts in the areas of:

i. The basic nature of human performance (as viewed through the lens of disability): including basic molecular and physiological processes associated with human abilities and disabilities; basic computational processes in terms of information processing and control; functional assessment of human performance and skill development.

ii. The study of human-machine interactions (to inform assistive technologies): including human-machine interaction (HMI) including language technology, multi-modal interfaces, virtual environments/collaboration technology, and prosthetic (replacement) or orthotic (assistive) sensory and motor technology.

iii. Pedagogy (theory behind the science of learning that will transform training-systems development and universal access to learning): including the benefit that different technologies and instructional modalities will confer upon students with disabilities and other students who learn more effectively in alternative formats/modes of delivery.

The intention of the program is that during his/her graduate research project, each student will study, design, or create experiences for people with disabilities that will empower them to overcome existing obstacles or barriers in their lives and learning. The findings are expected to broadly impact learning among students.

Overall Program Structure

LWD was initially created as a concentration among four of WSU's existing Ph.D. programs: BioMedical Sciences (BMS), Engineering (Eng), Computer Science and Engineering (CSE), and Human Factors and Industrial/Organizational Psychology (HF/IO). While these programs reflect different methodological and theoretical traditions, there are many potential points of overlapping interest and intersection that favor an interdisciplinary approach. For example, there is broad interest in aspects of visual perception. These interests include work on basic models of macular degeneration (BMS), psychological studies of human motion perception (HF/IO), computational models of depth perception (CSE), and the development of prosthetic devices (Eng), all leading to research on the design of pedagogies for teaching STEM students with visual impairments.

Students' learning outcomes are shaped by a curriculum that combines a thorough discipline-specific training with interdisciplinary studies and research experience in assistive methods, tools and technologies. To ensure that all graduates have the opportunity to develop a deep understanding of all dimensions of disability, its consequences, and possible interventions, the curriculum includes a mandatory practicum at one of the partnering organizations, such as the local rehabilitation center, the Goodwill/Easter Seals foundation or the county Mental Retardation/Developmental Disability facility.

Faculty members from the four participating doctoral programs have developed the interdisciplinary required coursework. The courses are divided into three components: 1) Required core courses within the primary doctoral program; 2) Elective courses and; 3) The Learning with Disability core courses as outlined below. At least 16 (quarter) hours must be completed from the LWD menu. This intentionally prescribed program of study assures adequate preparation in the primary discipline as well as the concentration, and still leaves enough flexibility for the student to further specialize in a preferred area. To date the following courses have been developed:

LWD 710 – Physiology of Disability (4 hours): This core course introduces the student to the neurophysiological and neuroanatomical basis of commonly encountered physical disabilities, including disorders of cognition (learning disorders), impaired mobility (neuromuscular disorders) and sensory deprivation (vision, hearing). It is cross listed as P&B 710 in Neuroscience, Cell Biology and Physiology, and as BMS 874 in Biomedical Sciences.

LWD 720 – Science of Learning (4 hours): Survey of research and theory on the fundamental processes of human cognition, with emphasis on learning and skill development. Basic research is critically evaluated relative to the experiences of everyday life and the implications for the design and use of training systems. This course is cross-listed as PSY886 in the Psychology Department.

LWD 730 – Accommodations and Adaptations for Persons with Disabilities in School, Work, and the Community (4 hours): An exploration of how persons with physical, cognitive, and/or sensory disabilities can be accommodated to facilitate productive participation in inclusive school settings, home, work and community environments. It is cross-listed as EDS 730 in the Teacher Education Department.

LWD 740 – Assistive Technology (4 hours): Survey of existing software/hardware, human factors and needs assessment; alternative keyboards, speech output devices, word prediction programs, and other adaptive technology devices; factors that promote effective communication and collaboration with individuals, parents, school, and community personnel in a culturally responsive program. The course is cross-listed as BME 742 in Biomedical Engineering.

LWD 750 – Multimodal Interface Design (4 hours): Alternative modes of representing and manipulating information are considered in relation to the limitations and opportunities for exploration and learning. Considerations include opportunities to compensate for sensory disabilities through multimodal interfaces and/or through the use of alternative modalities. Also, considered are opportunities to compensate for motor disabilities by providing alternative means for interaction and manipulation of information.

LWD 790 – Practicum (5 hours): The goal is to provide opportunities for the students to have contact with a broad spectrum of individuals with disabilities in a variety of settings such as public schools, rehabilitation centers, vocational training centers, sheltered workshops, and hospitals. The student will be required to spend a minimum of ten hours per week for the quarter. This contact should assist the students in framing basic research questions that address the practical experiences of persons with disabilities.

As in other doctoral programs, students form their supervisory committee while completing coursework; participants in the LWD program, however, are required to have a cross-disciplinary team from multiple departments.

An oversight committee, consisting of the Dean of the School of Graduate Studies and directors of the four participating doctoral programs, insures that interdisciplinary nature of all dissertations are preserved.

Experiences to Date and Lessons Learned

The planning for the LWD program began in early 2004 by a group of faculty with demonstrated commitment to learning with disability. The academic program received faculty approval in winter of 2005 and was launched in January of 2006. A proposal, submitted to the National Science Foundation's Integrative Graduate Education and Research Traineeship (IGERT), was funded in 2005. With a total funding of $3 million over a period of five years, the grant provides fellowships for individuals who are interested in pursuing doctoral studies in this area.

In its first year, the program attracted a large pool of applicants, from which six were chosen for admission to the appropriate doctoral degree programs. The core LWD courses are interspersed over the fall, winter and spring quarters. The plan is that each of the courses will be offered at least once per academic year.

Reflection on the first year of the LWD program reveals multiple lessons that will guide our work in the future:

- Inconsistent preparation of students. One of the earliest lessons learned was the dilemma posed by the significant differences among participating students with respect to their readiness for specific core courses. Students are products of their undergraduate disciplines; interdisciplinary work is a challenge because it attempts to educate students with wide disparities of preparation within an academic discipline. For example, topics discussed in the first LWD course, Physiology of Disability, were basic for students who had completed undergraduate majors in biological or premedical sciences but were deemed too advanced for students in the Engineering/HF/IO domains who may have only taken introductory biology in their respective majors. The faculty member teaching the course was required to more fully analyze the essential components of the content and then develop ways to differentiate instruction to meet the individual needs of students. Although problematic in the first week of the class, this presented an ideal case for team-based learning and eventually resulted in a stronger bond among participating students. Students learned to appreciate one another's areas of expertise and the value of cooperative group learning. Interestingly, the experience proved to be a model for best practice in teaching students with disabilities in inclusive classrooms.
- Intersection between theory and practice. A second lesson that clarified the usefulness of our LWD philosophy was the reaction of many of the students to their LWD 730 (Accommodations and Adaptations for Persons with Disabilities in School, Work, and the Community) course. This course emphasizes the realities of living and working with disability from a personal perspective. One of the course requirements is for students to interact with individuals who have severe disabilities and with the agencies that serve them. This experience helped students to appreciate the skills and barriers that are a part of the everyday lives of individuals with disabilities. Several of the students commented on the difficulty they had at first in reflecting on their experiences. They were used to examining issues from a particular paradigmatic, perhaps clinical, perspective and the change in outlook offered new challenges and, eventually, new rewards. Students were

challenged to think about their own reactions to and attitudes toward people with disabilities and to confront potential biases of which they had been unaware until now. They were rewarded with the knowledge that they could potentially have a major impact on the lives of people with disabilities. Many of the LWD students experienced an epiphany in this course: for the first time they fully understood the potential value of their respective disciplines to real people. For example, instead of speculating about assistive technology and equipment design in the abstract, they now had specific individuals and situations to anchor their dialogue, adding relevancy and meaning to their study.

- Interdisciplinary research. There is a definite need to engage faculty in interdisciplinary research. Forming interdisciplinary supervisory committees is antithetical to "business as usual" and is presenting our faculty with a stimulating challenge. If IGERT fellows are required to engage in interdisciplinary efforts, it behooves the faculty to do the same. The learning from such endeavors will benefit all.
- Work space. Due to the service engagement requirement, we have established a design studio (hang space) for the fellows to work on projects.
- Sense of community. We also have required students to participate as a cohort in some regional conferences on disability. These activities have built a sense of community within the LWD concentration.

Conclusions

The new LWD doctoral concentration, aims to educate professionals who can develop integrated approaches to problems that impact the lives and education of individuals with disabilities. In addition, the broader impact of designing solutions for individuals with disabilities creates a healthy tension between the "basic" and "applied" STEM disciplines. The practical problem of designing more effective educational systems provides an important "test" for basic theories of human disabilities, human performance, information processing, learning, and pedagogy. This helps keep basic research from locking into paradigmatic assumptions that are inconsistent with the realities of life. However, the dialogue between basic and applied scientists also can help those attracted to the challenge of practical problems gain deeper appreciation for the value of theory and sound methodologies. These basic theories can sometimes be the most effective bridges for generalizations across disciplines and across the basic/applied gulf. Our hope is that the opportunity to challenge theory against the demands of designing practical solutions that enhance human potential may attract some students to graduate education who otherwise would not be interested. The emphasis on solving a pressing societal problem may be particularly attractive to students from minority groups and women, as well as to individuals, who have disabilities themselves.

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