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## Class Document

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**Making biology laboratories effective learning environments for students with disabilities: a national model at Wright State University for undergraduate instructors and grades 7-12 school teachers  
Funded by National Science Foundation Grant (Division of Undergraduate Education/Course and Curriculum Development 9661710 Michele Wheatly, Timothy Wood, Patricia R. Renick, Jeffrey Vernooy,**

The purpose of this short communication is to inform readers of the journal about an innovative NSF funded project at Wright State University aimed at "Creating Laboratory Access for Students in Science", commonly referred to as the "CLASS Project". The project, now in its second year and under the leadership of Michele Wheatly (Chair of Biological Sciences), represents a collaboration between academic units (Tim Wood, Biological Sciences and Patricia Renick, Teacher Education) and student services (Jeff Vernooy, Director of Office of Disability Services).

*Introduction*

Individuals with physical disabilities are significantly underrepresented in mainstream science. Until recently the enterprise of science has involved "hands-on" experimental work and students with physical disabilities have been largely excluded from participating in laboratory science. Their experience in grades 7-12 has typically been limited to watching other students or aides as they perform experiments or, even worse, being exempted from the lab requirement altogether. Under-preparedness in grade school science places entering undergraduates at a disadvantage upon entering college where most are directed away from science and into fields such as rehabilitation, counseling and education.

In recent years technology has greatly changed the way that science is done. First there are many adaptive technologies that enable people with disabilities to participate in science. Second scientific computing (for example bioinformatics/structural biology/biological modeling) is emerging as an approach that has opened up scientific research to individuals with disabilities. For example today in the field of molecular biology many researchers never wear a lab coat, mix reagents or run gels; instead they analyze DNA sequences on a computer. Theoretically there is nothing to stop a quadriplegic person, able to operate a head pointer, from similarly participating in molecular research. This is an extreme example but proves the point that most laboratory experiences can be appropriately adapted so that students with disabilities can obtain a comparable learning experience and participate fully in science. Thus science is moving from a "hands-on" to a "minds on" approach.

Wright State University (WSU) has a long history in providing services and curriculum for students with physical disabilities. The campus was constructed in 1967 to be entirely barrier free with the result that there is a higher proportion of students with physical disabilities at WSU compared with more traditional campuses. About 10 years ago the Department of Biological Sciences began offering an adaptive laboratory section for the required General Education Introductory Biology class. Our staff began to explore the challenge of providing students with disabilities with an equivalent learning environment. For example: How do you teach the elements of microscopy to a student who is blind? How could a student in a wheelchair participate in a field trip?

As we developed appropriate accommodations, our laboratory coordinator would attend professional meetings of her peers and would pose the question "What adaptations are you exploring at your institution to meet the needs of students with disabilities?" Sadly we learned that very few institutions are doing much in this area of curriculum development. Yet following the ADA act, students with

disabilities are appearing on college campuses and are expecting to receive reasonable accommodations as they take science courses.

The purpose of this NSF grant is to further develop resources for the laboratory education of students with disabilities at WSU and to share them through outreach with educators and high school students with disabilities. The resources include a Source Book that will be a desk reference manual for all science educators, as well as human resources. By training science educators we hope to systemically reform the laboratory science education of students nationwide. By improving the preparedness of students with disabilities in laboratory research, we intend to increase their representation at all levels in the scientific professions. Although this initiative began in Biological Sciences, the techniques and accommodations could be easily applied in any physical or natural science.

Further impetus for providing resources for the laboratory education of students with disabilities comes from the inclusive climate of public education. More and more educators are concerned with adapting for and accommodating students with disabilities. Unfortunately, these educators do not have these important strategies or suggestions for adapting laboratory experiences within easy reach. By providing the opportunity to "educate" educators in this fashion we hope to further this systemic change by providing educator participants with a model and an introduction to creating laboratory experiences for all their students.

#### *Specific Goals of the Project in Year 1 (1998)*

1. To convene a Resource Development Group that will:
2. Continue to develop adaptive laboratories for General Education classes at WSU.
3. Create a Source Book for science education of students with disabilities
4. Plan and execute the first residential Summer CLASS Workshop for educators and students with disabilities.

#### *Outcomes of the Project in Year 1*

1. The Resource Development Group was formulated and has worked through retreat, weekly meetings and activities of working groups. Members are listed with affiliation and project responsibility

Dr. Michele Wheatly, Chair and Professor of Biology (Project Director, oversight of project)

Dr. Tim Wood, Professor of Biology (Project Coordinator, writer of Source Book)

Dr. Linda Ramey, Assistant Professor of Biology/Education (Project Coordinator, Workshop Facilitator for educators)\* replaced in year 02 by Dr. Patricia R. Renick (Assistant Professor of Teacher Education/Special Education Program)

Ms. Lisa Taschenberger, Administrative Assistant (promoted in year 02 to Workshop Instructor)

Ms. Marcie Wendeln, Biology Lab Manager (Project Consultant, runs adaptive laboratory during academic year and summer workshop)

Mr. Jeff Vernooy, Associate Director of Disability Services (Project Consultant, Disability Issues) promoted to Director of ODS in year 2.

Mr. Steve Simon, Director of Disability Services (Project Consultant, Disability Issues) retired at end of year 1

Mr. Bruce Traub, Undergraduate with a disability (construction of web site, and workshop teaching assistant) replaced in year 02 by Ms. Catherine Vance (Undergraduate with a disability)

Ms. Audrey Hatch, Doctoral Student, Oregon State Univ (Workshop Instructor); replaced in year 02 by Lisa Taschenberger

Dr. Sharon Joseph, Director of Special Education in Montgomery County (Liaison with regional special education teachers)

Ms. Vicki Adkins, Assistant Director of Disability Services (coordination of physical support services for the students with disabilities accepted into the Summer Workshop)

Ms. Katherine Myers, Adaptive Technology Specialist (coordination of purchase and training with adaptive technology)

Ms. Jennifer Weil, Doctoral Student (Disability Studies) at Syracuse University (CLASS educator participant in year 01, Workshop instructor in year 02)

## *2. Refine our General Education Adaptive Labs*

Throughout year 01 we continuously assessed and refined and our general education labs with input from undergraduates with disabilities. Upon completion of the lab a GTA would poll students about their ease in performing certain routine tasks. At the end of each quarter a document was produced detailing the adaptations for each lab along with assessment by students with disabilities and recommendation for improvement. This exercise emphasized that students with disabilities can and should be involved in designing and implementing the adaptations that they require.

## *3. Create the Source Book for Science Educators*

The first draft of the Source Book was completed for review at the workshop. A second draft is being edited. The Source Book is not discipline specific and can be applied to any physical or natural science.

## *4. Plan and execute the first Summer CLASS Workshop*

The first summer workshop took place June 15-26, 1998 . Seven educators formed the first cadre. They were recruited through mailings to universities, colleges and school systems and through advertisements in publications of professional associations. Two were from other states, the remainder were from Ohio. Two were experienced school science teachers. One was an experienced special

educator. One was a university professor. One was a preservice teacher; two others were recently qualified teachers. During the first week these educators received instruction on disability awareness, adaptive technology and familiarized themselves with the biology laboratory exercises planned for week 2.

In the second week educators were joined by 6 students with disabilities, recruited from the State of Ohio. Students were recruited through mailings to regional schools. In May an orientation day was held for students and their families in an attempt to assess their personal care/adaptive technology needs so that infrastructure could be in place at the start of the workshop. One student was hearing impaired; five others had varying degrees of cerebral palsy. Paired together, educators and students explored laboratory exercises and computer applications that cover the major conceptual issues in biology. Educators used these experiences to discover the process that enables any lab exercise to be appropriately adapted for a specific disability. Meeting after the lab for debriefing, educators discussed the issues relating to certain kinds of exercises for individuals with specific disabilities. At the workshop educators developed an Action Plan for incorporating these adaptations in their own classroom/institution. The students learned that adaptations can be employed so that they can fully participate in laboratory science, broadening their career horizons and improving their attitude towards choosing a career in science. The residential nature of the workshop also enhanced their independent living skills.

#### *Project Website*

An interactive web site was established enabling applicants to submit materials electronically to address: <http://biology.wright.edu/labgrant/index.html>

#### *Presentations*

The CLASS project was presented to the scientific community at the following professional meetings

Southwestern Ohio Council for Higher Education

Association for the Education of Teachers of Science

Association of Biological Laboratory Educators

#### *Assessment and Evaluation*

The adaptive lab section of General Education has been assessed by students with disabilities for an entire academic year. A pre/post test created by Dr. Greg Stefanich was administered to educators before and after the workshop. This instrument assesses their attitudes and preparedness to deal with students with physical disabilities. Educators and student workshop participants completed a workshop evaluation. The Source Book was evaluated by the workshop educators. A National Visiting Committee appointed by the National Science Foundation reviewed the overall progress on the project through an on-site visit during the second week of the workshop. This committee included the following individuals:

Dr. Edward Keller, West Virginia University

Dr. Joseph Pelliccia, National Science Foundation

Dr. Greg Stefanich, University of N. Iowa

Dr. David Wohlers, Truman University

*Projecting to Year 02*

As we enter the second year of the project our refined goals are:

1. To field-test and revise the Source Book for publication and dissemination
2. To compile the first adaptive lab manual for Biology
3. To plan, organize and execute the second workshop to include a wider range of disabilities.
5. To make presentations at professional meetings and to publish journal articles on the project
6. To demonstrate the effectiveness of the materials/workshop through assessment tools. This will include comparison of pre/post tests and follow-up with the workshop participants from 1998.
7. To begin initial discussions with colleagues from Chemistry, Physics, Geological Sciences and Mathematics in order to broaden the purview of this project for renewal of funding.

Updates on this project will be forthcoming. If you have interest in joining us for the workshop (either as an educator or student) or you care to review our materials please visit our website (address above) or contact us at the following addresses:

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