

ISLAND

2011

2nd Annual Independence Science Learning a New Direction Conference on Disability

Purdue University
Friday, October 28 & 29, 2011

West Lafayette Campus
Memorial University
East & West Faculty Lounges

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Conference Mission

The IsLAND conference on Disability serves to inform and connect educators and future educators to the latest assistive technology, while exploring alternative teaching methods and simple access solutions for learning. Multi-sensory and hands-on approaches are emphasized during this conference in order to generate elevated student interest in classroom material and, thus, improve concept development. Symposium topics also include factors that contribute to Science, Technology, Engineering, and Mathematics (STEM) underrepresentation and strategies for increasing representation among students with disabilities.

Schedule of Presentations

-Friday, October 28-

- 9:00 am Introduction
- 9:05 am The revolution of STEM education for students who are blind or have low vision. Presenter: Dr. Cary A. Supalo: Purdue University, West Lafayette, Indiana.
- 9:20 am Increasing stem representation of blind and visually impaired students through hands-on science experiences. Presenters: Mick Isaacson and Dr. Lyle L. Lloyd: Purdue University, West Lafayette, Indiana.
- 9:45 am Audemes and STEM education for the blind and visually impaired
Presenters: Steve Mannheimer, Mexhid Ferati, Davide Bolchini and Mathew Palakal, School of Informatics, Indiana University and Purdue University at Indianapolis, (IUPUI), Indianapolis, Indiana.
- 10:10 am Break.
- 10:30 am Tactile Pictures - Cheap Fast & Easy. Presenter: Amelia Dickerson, University of Colorado, Boulder, Colorado.
- 10:55 am Teaching Physical Science to Students who are Visually Impaired and Blind: Lab modifications and classroom techniques that work. Presenter: Alan Roth, Indiana School for the Blind and Visually Impaired, Indianapolis, Indiana.

- 11:20 AM: Teaching Biology to Students who are Blind or Visually Impaired: Lab Adaptations and Tactile Diagrams to help Students Learn. Presenter: Becky Heck, Indiana School for the Blind and Visually Impaired: Indianapolis, Indiana.
- 11:45 am CyberTouch™: a System for Freehand Raised-Line Drawing, Erasing, Communication and Reproduction. Presenter: Michael Rosen*, PhD; Michael Coleman*, PhD; Joshua Coffee, BS**; Keegan Brown**, BS; and Akie Hashimoto**, BS University of Vermont, Burlington, Vermont
- 12:10 pm Lunch Break.
- 1:40 pm A Moodle-based Accessible On-Line Algebra Course for Visually Impaired Students. Presenter: David Schleppenbach, GH LLC, Lafayette, Indiana.
- 2:05 pm Emerging Best Practices to Support Transition of Students with Disabilities to College and Persistence in STEM Majors. Presenters: Clark Shingledecker, Ph.D., Brittany Boyne, and Jennifer Barga: Wright State University, Dayton, Ohio.
- 2:30 pm Chemistry and Students with Blindness: Chemical Equations. Presenters: Amy L. Micklos Lewis and Dr. George M. Bodner: Purdue University, West Lafayette, Indiana.
- 2:55 pm Break.
- 3:25 pm Making Geoscience Education Accessible for Students who are Blind and Visually Impaired. Presenter: Gina Ceylan: University of Missouri: Columbia, Missouri.

- 3:50 pm Promotion of Active Participation of Students with Disabilities in Biomedical Laboratory Research. Presenter: Dr. Brad Duerstock, Institute for Accessible Science, Purdue University, West Lafayette, Indiana.
- 4:15 pm Using G.W. Micro Products, Such As Window Eyes, to Access the Science Laboratory. Presenter: Drew Markley, Training Specialist at GW Micro, Fort Wayne, Indiana.
- 4:35 pm Comparison of Phonetic-based, Braille-based, and Stroke-base keyboard input of Written Chinese. Presenters: Xuyang Cao, Ludong University. Wenjing Zheng, Indiana University, Bloomington, Indiana.
- 4:55 pm Discussion

Poster Presentations

Hand-gesture Recognition for Users with Mobility Impairments

Enriched open field facilitates exercise and social interaction in two strains of *Cavia porcellus*

Teacher Workshops

-Saturday, October 29-

9:00am-10:45am: Text-to-speech (TTS) with computer interfaces to access data collection in the science laboratory.

11:15am-1:00am: Low-tech methods to adapt science lecture and laboratory concepts for non-visual learners.

IsLAND 2011 - Abstracts

The Revolution of STEM Education for Students Who Are Blind or Have Low Vision, Presenter: Cary A. Supalo

This presentation will discuss what is currently being done to educate students with blindness or low vision (BLV) in Science, Technology, Engineering, and Mathematics (STEM) related courses, what technologies are available today, and future directions that need to be tackled. The importance of collaborations and partnerships between educational researchers and access technology developers is critical to the optimization of technological and/or methodological breakthroughs for persons with BLV in STEM courses. Further, the need for training modules on new and innovative technologies must also be developed and disseminated worldwide to optimize maximum benefits to the BLV community. These efforts will empower persons with BLV to consider career opportunities in the STEM technical fields thus incorporating this underrepresented population of lifelong problem solvers. This diversification in the STEM workforce in the United States justifies the expenditure of resources to make new opportunities available for persons able to apply these specialized skills sets to scientific questions and allows for a new perspective within the STEM workforce.

Increasing STEM representation of blind and visually impaired students through hands-on science experiences, Presenter: Mick Isaacson and Lyle L. Lloyd

Students who are blind or have low vision (BLV) are underrepresented in postsecondary studies and careers in the fields of sciences, technology, engineering, and mathematics (STEM). Hands-on experiences may contribute to the development of confidence in one's capacity to function independently in science. BLV students are

frequently denied hands-on science experiences during primary and secondary education. Inadequate hands-on science experiences may not foster sufficient self-confidence in the sciences to promote consideration of postsecondary education and careers in STEM by BLV students. The present paper reports on the development of a “Talking LabQuest” scientific data collection device. Testing of this device found that it allowed BLV middle and high school students to have hands-on experiences in the collection of scientific data. In addition, it was found to enhance learning, self-confidence in science, and consideration of postsecondary studies and careers in STEM.

Audemes and STEM Education for the Blind and Visually Impaired,
Presenters: Steve Mannheimer, Mexhid Ferati, Davide Bolchini and
Mathew Palakal, School of Informatics, IUPUI

We present an overview of an innovative approach to STEM education for blind and visually impaired K-12 students based on short non-verbal sound collages called audemes. Audemes combine snippets of sound effects and music that in themselves convey simple concepts and concatenate into sequences to signify more complex concepts. For example, a 3-sec. snippet of a teapot *whistling* combines with an engine *chug-chug-chugging* to signify “steam engine;” Or, snippets of racecars *zoom-zooming* (signifying “speed”) + rooster *crowing* (“sunrise” or “sunlight”) = ____? (“speed of light”). Used as aural enhancements to classroom lessons, audemes significantly improve long-term retention of concepts, even after five months. When used in brainteaser riddles or narrative games, audemes offer BVI students a stimulating mental challenge to give STEM pedagogy new intellectual and affective dimensions. Our work explores the intersection between verbal and non-verbal semantic realms, and seeks to develop algorithmic approaches to textbook mining that correlate effectively with intuitive listener cognition to create deeper, more memorable understanding of STEM concepts. This work has attracted a 2010 grant from Google Research Awards and a 2011 NSF grant for Informal Science Education to develop the audeme game platform for BVI students.

Tactile Pictures - Cheap Fast & Easy, Presenter: Amelia Dickerson

Sensational Black Boards make it possible to create inexpensive tactile pictures in any setting, with equipment that weighs a couple of ounces and fits in a notebook. There will be a demonstration of techniques used with the Black Board as well as an audio described video of people using boards to share tactile/visual information.

A significant portion of content in the STEM areas is presented as visual graphics. There are a number of ways to present this information in a tactile manner so it is accessible, including embossing, swell paper, and thermoform paper. While these methods have many advantages, each method requires specific skills, expensive materials and tools plus plenty of preparation time. Sensational Black Boards, on the other hand, work with a ballpoint pen and typing paper to provide information promptly.

Teaching Physical Science to Students who are Visually Impaired and Blind: Lab modifications and classroom techniques that work,
Presenter: Alan Roth

Science students who are visually impaired and blind generally are excluded from participation in labs, due to fears and concerns from teachers who are not equipped to teach these students. In this short presentation you will learn how to modify equipment and make tactile diagrams to create a successful lab and classroom environment in Physical Science.

Teaching Biology to Students who are Blind or Visually Impaired: Lab adaptations and tactile diagrams to help students learn, Presenter: Becky Heck

Biology students who are blind and visually impaired often need adaptations and modifications to their lab equipment or tactile diagrams and models available to them to help them understand the material being presented. Ideas will be presented to help students become successful in a science lab or classroom setting.

CyberTouch™: a System for Freehand Raised-Line Drawing, Erasing, Communication and Reproduction

Presenter: Michael Rosen, PhD; Michael Coleman, PhD; Joshua Coffee, BS; Keegan Brown, BS; and Akie Hashimoto, BS

The blind currently can use commercially available manual raised line drawing (RLD) kits, akin to pencil and paper, for freehand sketching. As a user sketches with a stylus on the RLD medium (a thin plastic sheet on a stiff rubber backing), stylus pressure and drag produce a raised (tactile) line that user can feel as s/he draws. A limitation is that current tactile drawing systems only produces a single non-erasable, non-reproducible original. Until now, no product for the blind could offer the sort of digital capture and sharing of drawings afforded to the sighted by tablet computers and the Internet.

The authors, supported by grants from the National Federation of the Blind, have developed CyberTouch™, a system with which erasable, free-hand RLD sketches can automatically be digitized, edited, communicated and mechanically reproduced. The image file can be shared with others, tactilely or visually, locally or remotely. Currently in prototype form (patent pending), CyberTouch™ commercialized will provide means for fast, versatile and legible tactile graphical communication in education, the professions, creation of art and everyday life. The authors have formed E.A.S.Y. LLC in order to develop, manufacture and market CyberTouch™ to current and potential users of tactile drawing.

A Moodle-based Accessible On-Line Algebra Course for Visually Impaired Students. Presenter: David Schleppenbach

This presentation will update the progress and review current outcomes of two projects aimed at increasing the number of students with disabilities (SwD) that earn undergraduate degrees in STEM fields and enter related graduate programs or the STEM workforce. These

closely related initiatives are founded on the assertion that effective programming to build the STEM pipeline must provide targeted, early and progressive interventions to SwD and other stakeholders that build STEM interest and motivation, increase educational and career opportunities, improve academic preparation and develop essential psychosocial skills. Results to date suggest that the Starting Wright web-based college and STEM career resources for SwD in grades 7-10, teachers and parents have the potential to increase motivation for transition to post-secondary STEM education. Similarly, current enrollment and persistence data indicate that individualized interventions for college SwD in STEM majors which are modeled on the comprehensive advising programs used with NCAA student athletes are showing promise as an emerging best practice from the Ohio's STEM Ability Alliance (OSAA) Scholars Program at Wright State University.

Emerging Best Practices to Support Transition of Students with Disabilities to College and Persistence in STEM Majors. Presenters: Clark Shingledecker, Brittany Boyne and Jennifer Barga

This presentation will update the progress and review current outcomes of two projects aimed at increasing the number of students with disabilities (SwD) that earn undergraduate degrees in STEM fields and enter related graduate programs or the STEM workforce. These closely related initiatives are founded on the assertion that effective programming to build the STEM pipeline must provide targeted, early and progressive interventions to SwD and other stakeholders that build STEM interest and motivation, increase educational and career opportunities, improve academic preparation and develop essential psychosocial skills. Results to date suggest that the *Starting Wright* web-based college and STEM career resources for SwD in grades 7-10, teachers and parents have the potential to increase motivation for transition to post-secondary STEM education. Similarly, current enrollment and persistence data indicate that individualized interventions for college SwD in STEM majors which are modeled on the comprehensive advising programs used with NCAA student athletes are showing promise as an emerging best practice from the Ohio's STEM Ability Alliance (OSAA) Scholars Program at Wright State University.

Chemistry and Students with Blindness: Chemical Equations,
Presenters: Amy L. Micklos Lewis and George M. Bodner

This presentation is designed to review how three mainstreamed high-school students with blindness navigate the visualizations of chemical equations. The students had difficulty producing scientifically appropriate representations of chemical equations, but their misconceptions reflect those of their sighted peers. There was an additional hurdle for the students with blindness. Their technology for Braille writing made it difficult for the students to identify and indicate subscripts as well as receive timely feedback. The data that will be presented was part of a larger study that explored the students understanding of the structure of matter and calculations about matter.

Making geoscience education accessible for students who are blind and visually impaired, Presenter: Gina Ceylan

Accessible opportunities in geoscience education are insufficient for students who are blind and visually impaired. A geoscience track was designed and implemented during the Youth Slam 2011, a high school science, technology, engineering, and math (STEM) academy run by the National Federation of the Blind. Using tactile graphics, braille, modeling clay, talking calculators, and other non-visual aids in conjunction with kinesthetic activities, students learned about plate tectonics. After mastering the basics of tectonics, groups chose case studies of tectonically active regions and developed relevant questions. Investigations of case studies and their geologic context enabled students to elaborate and apply their knowledge, which they then communicated through building models and giving group presentations.

Here, the focus is on materials and strategies most effective for learners who are blind and visually impaired. In accordance with

Universal Design for Learning (UDL) combinations of, and choices between multiple means of representation, expression, and engagement enabled students with a variety of visual impairment and learning styles to participate in the track fully. Group work and flexibility of curriculum and materials promoted inquiry and allowed activities to follow students' strengths and interests. Given universally designed opportunities, students were engaged, and excelled in learning geoscience.

Promotion of Active Participation of Students with Disabilities in Biomedical Laboratory Research, Presenter: Brad Duerstock, Institute for Accessible Science, Purdue University, West Lafayette, IN

The Institute for Accessible Science (IAS) was established through funding by the NIH Director's Pathfinder Award to broaden the participation of persons with disabilities (PWDs) in STEM careers. The goal of the IAS is to target and break down attitudinal and physical barriers that PWDs face in biomedical science through their transition from high school to postsecondary to graduate or professional education. By enabling PWDs to perform common laboratory techniques as independently as possible is critical for acquiring activity-based learning and practical lab experiences. Independence in biomedical science promotes greater access to laboratory research and consequently a career in many areas of STEM. The IAS Hub (iashub.org) was created to educate and support PWDs, their parents, educators, and researchers regarding educational institution accessibility, science curricula, career choices, other support groups, and disability-related concerns. Through the IAS Hub's interactive social forum, PWDs and other stakeholders receive guidance from peers and mentors to problems encountered when pursuing a STEM education and eventually a scientific career. Through the IAS accessible biomedical immersive laboratory (ABIL) initiative, research internships for students with disabilities will be offered. Additionally, lab assistive technology and accessible scientific instruments are showcased through ABIL and the Hub and available for use.

Using G.W. Micro Products, Such As Window Eyes, to Access the Science Laboratory, Presenter: Drew Markley, Training Specialist at GW Micro

GW Micro is a trusted pioneer in the screen reader industry and offers innovative technology solutions for people who are blind or visually impaired. Come and learn about the powerful Window-Eyes screen reader, Orabis and Vocatex Plus talking CCTVs as well as the ReadEasy+ and Readit Wand USB reading and magnification system.

Comparison of Phonetic-based, Braille-based, and Stroke-based keyboard input of Written Chinese, Presenters: Xuyang Cao, Ludong University, Wenjing Zheng, Indiana University

Written Chinese is based on its ideographic characters which evolved from earlier forms of hieroglyphs. Unlike the languages of French with sound and spelling corresponding to each other, Chinese has distinct phonetic system for the pronunciation and the graphic system for the written symbols. The distinct stroke-based written system of Chinese poses difficulties in the keyboard input for the Chinese characters into a computer. This presentation aims to compare and demonstrate the advantages and disadvantages of three keyboard input methods used by blind in China.

Phonetic-based keyboard input: only pronunciations are required and the typical keyboard is used. When users input the pronunciation of the characters, the computer provides all the Chinese homophones for selection, and prompts phrases explaining each option. This becomes time-consuming for the blind user.

Braille-based keyboard input: In this mode, the typical keyboard is defined as a six-dot braille keyboard into to input Chinese Braille. However, Chinese Braille is the reflection of the pronunciation of Chinese, not the written form. Therefore, it is still phonetic based, and the selection of the homophones cannot be avoided.

Shape-based keyboard input: It is based on the structure of the written Chinese and every Chinese character can be input by 1 to 4 keystrokes. The character is directly located, without the step of selecting the desired one from a list of homophonic candidates. This method is ideal for those with low vision or acquired visual impairment who know the written form of Chinese, but not for the congenital blind who never learned how to write Chinese characters.

POSTER PRESENTATIONS

Hand-gesture Recognition for Users with Mobility Impairments

Performing laboratory tasks independently is deemed necessary for activity-based learning and performing research for students/scientists with mobility impairments. However, it can be difficult for students/scientists with upper extremity mobility impairments to conduct experiments by physically manipulating control panels or other tools, such as adding reagent to a beaker in a chemistry experiment. We proposed a hand-gesture recognition system for persons with mobility impairments to perform laboratory tasks with a robotic arm independently. There are two problems that remained unaddressed in the area of gesture recognition: (a) how to design the gesture lexicon that is most suitable for users with physical impairments, and (b) how to develop a gesture recognition system that is robust enough to track non-smooth gestures. First, a gesture lexicon is constructed from interviews with quadriplegics employing the Borg scale. Then a combined hand gesture segmentation technique will be used to get the trajectories of the hands. Finally, a particle filter method will be used to classify the trajectories into different commands to control the robot to move different directions or to perform different tasks. This hand-gesture recognition system has great potential to control the robot in a lab environment and the recognition processes can be implemented in real-time. Experiment results reveal an average recognition accuracy of about 90 percent for an 8 gesture lexicon.

Enriched open field facilitates exercise and social interaction in two strains of *Cavia porcellus*, Brewer, J.S., Voogd, M., Rosenthal, L., and Kleven, G.A. Department of Psychology, Wright State University, Dayton, OH 45435

The IAF hairless strain of guinea pig, *Cavia porcellus*, is the result of a spontaneous mutation in the Hartley strain. Although, the IAF guinea pigs have been used in research for over 30 years, very little information is available about the behavior of the IAF strain. In order to bridge this gap, behavior of IAF hairless and Hartley guinea pigs was observed in both home cage and open field enriched environments. Hartley and IAF strains were housed separately in groups of 2-3 for the home cage observation. However, guinea pigs were grouped as a herd of 10 in the open field arena. Both the open field and home cage behaviors were recorded for 1 hour each in 1080p and scored using JWatcher video software. Salivary cortisol, as a measure of stress level, was collected both prior to and immediately after behavioral observations. Analyses revealed higher levels of social interaction and physical activity in the open field environment, suggesting the open field may be providing increased opportunities for exercise and over-all enrichment.