

Infusing Academic Service Learning into Electronic Engineering Technology Senior Design Project

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Abstract:

Autistic children have an unusual way of responding to sound. They feel very uncomfortable with the loud level of sound generated from conversations in a public gathering and individual conversations. Although they are very annoyed by the high level of noise, they enjoy music, even at a high volume. Unlike a normal individual, their intolerance to noise can result in scratching, extreme physical discomfort and even self-mutilation.

This paper is proposing a design concept for an Electronic Engineering Technology (EET) Course that will infuse Academic Service Learning (AS-L) for the EET students. Designing a filtered hearing aid for autistic children will build a link between the community and the university. A service learning integrated EET course will also benefit faculty as it enables more process-oriented teaching and engages all learners. Infusing such a service integrated course can benefit them through infusion of creativity and enthusiasm from college students and their contribution to community development. Through the process, faculties are also able to generate increased student civic responsibility by showing the need for their expertise in the community.

Background:

A service integrated technology course benefits faculty as it enables teaching more process-oriented courses and engages all learners. Faculties are also able to generate increased student civic responsibility by showing the need for their expertise in the community. Besides merely building links between community and university, a service integrated course can also benefit them through infusion of creativity and enthusiasm from college students and their contribution to community development.

The purpose of this paper is to suggest a process to design and develop a head phone type filtered hearing aid for autistic children. This electronic device will filter a range of frequencies and patterns of sound that irritate them. A closed-loop feedback control system will be able to identify the range of sound systems comfortable for a particular autistic individual. Then a filter can be designed and trained to convert an information signal input into a specification of predetermined range of signals based on each individual's comfort zone. Any random voice can be converted to an 'ideal' voice through the trained, filtered, and digitally converted sound system.

The proposed filtered head phone will allow them to be more focused in the class room. Students will have to interact with autistic children and collect data regarding the need to suppress the unwanted spectrum of frequency and also identify the range of spectrum for which their hearing system is comfortable with. Such research in developing a filtered headphone will allow students

to be involved in academic service learning as they will be required to interact with the community and educate themselves about autism.

Figure1: Academic Service Learning

What Is Academic Service-Learning?

Academic Service-Learning (AS-L) is a teaching and learning strategy where students participate in a meaningful service activity that meets identified community needs and reflect on the service activity to gain further understanding of course content, a broader appreciation of the discipline and an enhanced sense of civic responsibility.

What is Engaged Scholarship?

Engaged Scholarship involves the faculty member in a reciprocal partnership with the community, is interdisciplinary, and integrates faculty roles of teaching, research, and service. While there is variation in current terminology (public scholarship, scholarship of engagement, community-engaged scholarship), engaged scholarship is defined by the collaboration between academics and individuals outside the academy - knowledge professionals and the lay public (local, regional/state, national, global) - for the mutually beneficial exchange of knowledge and resources in a context of partnership and reciprocity. - *David Scobey, Harvard Center for Community Partnerships, Bates College*

Our Mission

The mission of the EMU Office of Academic Service-Learning & Engaged Scholarship is to build an infrastructure that will support students, faculty, administrators, and community members in their efforts to implement academic service-learning and foster community engaged scholarship. The Office of Academic Service-Learning provides several services to its constituents:

- **Faculty Fellow Seminars** are offered each fall and winter. Five selected faculty are released quarter-time to participate in a semester-long weekly seminar. Fellows learn academic service-learning theory, implementation and assessment.
- **Community Partners** are identified and fostered with the assistance of office staff. Interested faculty can work with the office to contact and partner with agencies and community sites. A database with profiles of available sites is maintained by the office.
- **Research Opportunities** are available for faculty and students through the office. Information on current research, publishing opportunities, and conference presentations is also available. Staff assistance is provided for data collection and literature reviews.
- **A Resource Library** located in the Office of Academic Service-Learning provides journals, books and other publications related to academic service-learning. A number of electronic resources are also available through the office via the Internet.
- **Networking** is available through our Office. Faculty have the opportunity to meet one on one and discuss important decisions about their courses, find valuable information, share ideas and keep up to date on any news events. Through this interaction, faculty from partnerships and supportive networks and engage in collaborative scholarship.

Eastern Michigan University Academic Service Learning

<http://www.emich.edu/asl/>

Infusing Academic service learning:

Through Academic Service-Learning (AS-L) students can participate in a service activity that addresses the needs for designing a filtered hearing aid for autistic children. With the reflection on the service activity, students will gain further understanding of course content, a broader appreciation of the discipline EET, and an enhanced sense of civic responsibility toward Autistic children.

AS-L will support students, faculty, administrators, and community members while integrating instruction, research, and service to the community. They will have to interact with autistic children, and collect the data concerning the need to suppress the spectrum of unwanted range of noise and identifying the range of spectrum for which their hearing system is comfortable with.

Autism and its effect on the community:

Autism is a developmental disorder of brain. Complexity of this disorder can range in varying degrees, by difficulties in social interaction, verbal and nonverbal communication and repetitive behaviors. While this developmental disorder happens very early, their signs and symptoms begin to show later between 2-3 years of age. According to US center for deages and controls (CDC) the number of children with autism has increase by 10 fold in last 40 years. Currently, 1 out of every 68 children is born with autism. Study also finds that autism is four times more common among boys than among girls, 1 in 42 among boys and 1 in 189 among girls.

A combination of autism causing genes and environmental factors are possible responsible cause of autism. Research suggests there is no one cause of autism as there is not one type of autism. Each individual with autism has unique characteristic. Many of them have exceptional skills in music and not bothered by the high volume of its sound faces significant challenges in communication and physical health. (Autism Speaks)

Based on these varying degrees of autism, autistic children can also react to sound differently. Academic Service learning can increase acceptance, respect and support for the autistic children by increasing awareness in the community. Nearly two-thirds of children with autism have been bullied. People effected by autism are sometimes stigmatized for their unusual pattern of response to noise. Sometimes it may even generate negative reaction by the people who are not aware of Autism. Service learning activity can improve the quality of life for individual with autism by developing and delivering appropriate hearing aid. A filtered hearing aid can help these children by reducing the noise level received and perceived by these individuals over sensitive hearing system.

Assignment for Academic Service Learning Activity:

Purpose:

The purpose of this activity is to participate in a service activity involving autistic children. Students will have the opportunity to interact with autistic children. They will observe these children and for several days and watch how some of them react abnormally to the class noise generated through normal class activities and conversations among peers. Many of these autistic children have difficulty adapting to these normal noise level generated by the normal classroom

activity. They hear a much amplified version of this noise which is a typical problem most of the autistic children. Experiencing such incident among autistic children, students will be required to propose the design of a filtered head phone particularly catered toward the need of these autistic children. Design must involve a feedback control to ensure the filter adapts to the individual need of noise reduction.

Activities:

6 Sessions with autistic children: Students are responsible for arranging an appointment with a local high school special needs teacher to observe autistic children and identify those are affected by the sound generated from normal every day class activities. You are allowed to choose any six weeks of one hour sessions. Upon your observation you will be required to propose a design of a filter that could be infused in a head phone.

Evaluation criterion developed for senior design projects

- Simplicity of the design 15%
- Applicability 10%
- Weekly report 15%
- Formal reports 10%
- Formal presentation 15%
- Successful demonstration 25%
- Quality of your weekly evaluation assignment 10%

Formal Report:

The purpose of this activity is to improve your communication skill in a work place. Particularly, to prepare you as an engineer for a situation where you need to update your manager or a fellow colleague, who has little engineering background, about the project you are working on. You will be able to describe the technical event / project in a non-technical fashion using your broader understanding of the subject.

Write a formal report to your supervisor John Doe explaining your ASL activity. John has no engineering background and no knowledge about your subject. Your letter should include the following:

- Summarize the ASL activity you are involved in.
- Describe the procedure involved performing the ASL activity. If appropriate:
 - Explain the functions of the electrical equipment used.
 - Explain the method used to analyze the circuit design
 - Explain the analogy used to define the subject.
 - Discuss challenges involved in performing the ASL activity.
- Conclusion
 - Suggestion
 - Comment on the ASL activity

Guidelines:

- The text of the paper is to range from 10-20 pages in length.
- The paper must include your name, class name and the date.
- Typed with font roman or courier, size 12, single-spaced with 1” margin.
- Should be written in the form of a memo to your supervisor with subject “ASL activity”.

The paper is proposing an approach where an input signal will be processed. Parameters of the signal can be trained to reproduce a predetermined signal at the output of the system. This test will provide a foundation for a more complex design process. Using Fourier analysis and the use of Bessel’s functions, a practical on-line adaptive controlled filtered hearing aid could be designed, developed, and implemented.

Conclusion:

Research in developing a filter will allow students to be involved in service. It may not cure autism but surely can create an opportunity for EET senior design students to contribute to providing a solution to a common problem among autistic children. Normally, early intervention has enhanced recovery for many children effected by the spectrum of autism. Implementing such a system at an early age can help them recover from autism by improving their communication skills, and consequently allowing them to stay focused in the class room. Even late intervention with such a filtered headphone could improve learning. Enhanced recovery from autism can help them lead an independent life as they continue to grow as an adult.

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