



Quality of Life Technology Research Experience for Veterans/Teachers Program

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Mary Goldberg, MEd received her bachelors degree in Psychology & Spanish and a Masters of Education in Administrative and Policy Studies from the University of Pittsburgh. She has been the Lead Education and Outreach Coordinator at the Department of Rehabilitation Science and Technology and Human Engineering Research Laboratories since 2007, where she has served as Co-PI on four training programs in the field of assistive technology for undergraduates, veterans, and Masters students. She is dually involved with the Research Experience for Undergraduates and Teachers programs, in addition to other education initiatives at the Quality of Life Technology Center, all funded by National Science Foundation. Ms. Goldberg is pursuing her PhD in Administrative and Policy Studies of Education with an expected completion of fall 2013 focusing on measuring the effectiveness of online training related to assistive technology.

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Jon Pearlman, PhD, received his BS in Mechanical Engineering from the University of California at Berkeley and his M.Sc. in Mechanical Engineering from Cornell University with a focus in Biomechanics and his PhD in Rehabilitation Science and Technology at the University of Pittsburgh. His research centers on Assistive Technology Product development and quality control. Related to these topics, Dr. Pearlman has several assistive technology design and development projects which are funded through the VA and the University of Pittsburgh; many of these projects are in collaboration with clinician and commercialization partners to ensure they are clinically relevant and are commercially available. To support quality control of assistive technologies, Dr. Pearlman sits on the ISO and ANSI/RESNA standards committees for the Wheelchair testing, and provides technical advice to the VA's prosthetic purchasing committee.

Quality of Life Technology Research Experience for Veterans and Teachers

Introduction and background

Over half a million veterans have utilized the education benefits of the post 9/11 G.I. Bill [1]. It is estimated that over two million persons with military experience will enroll in post-secondary institutions in the near future [2]. Veterans returning to school often require an adjustment period, time to relearn study skills and reacquaint themselves with student life [3]. Furthermore, a subset of this special student population includes veterans who have acquired disabilities through trauma and who could require an additional adjustment period and support system to academic life. As veteran friendly campuses, the University of Pittsburgh (Pitt) and Carnegie Mellon University (CMU) run specific programs to help veterans' transition. One such program out of the Quality of Life Technology (QoLT) Center (a collaborative effort between Pitt's Department of Rehabilitation Science and Technology and CMU's Robotics Institute to promote the independence of people with disabilities), the Experiential Learning for Veterans In Assistive Technology and Engineering (ELeVATE), provides an education transition program for veterans with disabilities (VwD) to continue their rehabilitation therapy, engage in research, and receive supplemental instruction in preparation to enter (or re-enter) engineering and technical degree programs. ELeVATE allows VwD to acquire essential technical skills (design, machining, software, technical writing) in an immersive academic environment collaborating and working with an interdisciplinary team of masters', doctoral, and other rehabilitation engineering students and PhD and MD faculty. Additionally, the veterans are provided with support networks in our region along with counseling. ELeVATE strives to be a model program that demonstrates the feasibility of a vocational rehabilitation program extended to rehabilitation care and academic preparation.

On the other end of this spectrum, K-12 students face different but an equally challenging set of issues resulting in missed opportunities and lower educational achievement [4]. The National Science Board has expressed concern with the current state of affairs in K-12 education specifically with "the growing inequality of K-12 students' access to a solid math and science education" [5]. The students exiting the K-12 schools are often under-prepared for a career in STEM (Science Technology Engineering and Math) and require remedial courses to begin post-secondary education [6]. One of the problems identified by the National Science Foundation is the growing number of inadequately trained STEM teachers [7]. Research has shown that well equipped and knowledgeable teachers in precollege grades can improve the educational

achievements of their students [National Science 5]. In an effort to enhance teachers' pedagogical techniques and provide resources for professional development through the teachers' career, the Nation Science Foundation has facilitated the Research Experience for Teachers (RET) program for over two decades. QoLT runs one such RET program with an aim to bring an innovative product realization process to supplement STEM education in the local K-12 schools. The program differs from other RET initiatives in the process followed and continued contact with the teachers, by instituting year-round activities. It provides teams of K-12 teachers with an authentic 15-week research experience through product realization focus, opportunities for professional development through an intensive 4-week curriculum development workshop to help translate the knowledge and skills the teachers obtained to the schools and subsequently their students. Another unique component is the culminating local student design competition between the teachers' participating schools. The top teams are awarded an internship in QoLT labs.

RET and ELeVATE both focus on engaging their respective target populations, STEM teachers from economically and racially diverse school districts in the RET program, and VwD in the ELeVATE program, in our QoLT research and development efforts. VwD represent a potential campus resource by increasing diversity and offering a different perspective to the student body due to their unique experience and training. Considering the potential benefits of linking these two diverse populations, a revised program combining the two efforts was initiated at QoLT. Titled Research Experience for Veterans and Teachers or REV/T, the program incorporates groups of VwD and local K-12 teachers in a single knowledge and skills training course followed by modules specifically tailored for each group. In the current paper, we look at the REV/T model and the eventual research questions we will be able to elaborate upon after we evaluate this year's data and complete multiple cohorts.

The REV/T model and program overview

The program is hosted at the Human Engineering Research Laboratories (HERL) part of Pitt's Department of Rehabilitation Science and Technology. This state-of-the-art facility houses research groups ranging from Biomechanics to Medical Robotics and Assistive Technology, in addition to a fully equipped prototyping and fabrication facility and an AT test lab. All REV/T participants have full access to these resources offering another avenue for experiential learning. Ability to quickly prototype ideas is a quintessential need of any design course, and REV/T participants are allowed access to prototyping tools ranging from the basic crafts to advanced desktop 3D printing.

REV/T is split into two main sessions: the first session (typically spring) focuses on an Assistive Technology (AT) project-based course where VwD and teachers collaborate on product design project(s), followed by the second session: a K-12 curriculum development session for the teachers and continuing research component as part of ELeVATE for the VwD (typically summer). There is continuous professional development that provides opportunities to both populations to acquire and improve their technical skills and gain a deeper understanding of the disability community. Using AT projects provides a motivational factor that might be missing in projects that traditionally focus on the artifacts of design itself rather than the benefits to humankind.

The AT projects are typically client oriented and follow the participatory action design principle. The involvement of the end-user in the product development process offers a more precise user requirement, particularly important in the case of AT that benefits a niche group. Depending on the project, the participants are split into two competing or complementary teams or like in the case of REV/T 2013, work on two different projects. The teams are mentored by faculty, other AT 'lead users' and graduate students who themselves have successfully completed the department's product realization courses and training.

The initial session of the REV/T that focuses on AT coursework covers product design and development with a particular emphasis on AT. The textbook "Product Design & Development" by Ulrich and Eppinger serves as the primary text for the course. The course work is delivered through a series of online multi-media lectures and homework followed by a weekly two to three hour in-class session where the teams work through the principles or methods learned from the online lectures with a particular focus on their project work. Much of the online instruction is carried out on a single website, which also serves as a portal for group discussion, client contact and homework submissions. Use of online collaborative technologies is actively recommended throughout the REV/T to enhance the participants' skills and allow them to experience the tools that resonate with the technology know-how and interests of contemporary students.

The teams follow the product design process as they continue client focused AT design with an end goal to develop a minimum of a proof of concept prototype and a business plan for commercialization. VwDs and teachers then split into different programs aligning closely with their respective end goals. The teachers continue with their experiential learning and work on developing the syllabus to incorporate a product realization based STEM module in their respective K-12 classes for the immediate academic session (fall). They use the tools and

technology experienced in the REV/T program to guide their pedagogy and activities. The schools are provided with additional support, if needed, to assist with the deployment of coursework along with 3D prototyping equipment to prototype student ideas. The participants' students work on a product design, culminating in a student design competition across the schools judged by a team chosen by the REV/T program organizers. On the other hand, VwD continue through the ELeVATE program and gain further research and technical experience, which will ultimately assist in their persistence through STEM degree programs.

The program was continuously assessed through online surveys and informal discussions with the participants throughout the duration of the program. A pre-post survey, focused on participant expectations and design efficacy, along with demographic information was used as part of the assessment, results of which are pending the completion of the program.

Seven teachers and four VwD participated in the REV/T 2013 program. While the VwDs were all male, there were three female teacher participants. Two AT projects were selected for the cohorts. A team of four teachers (2 male, 2 female) and three veterans worked on the project: design and development of assistive hunting device for a powered wheelchair client [AHD Group]. Three teachers (1 female, 2 male) and one veteran worked on the project: design and development of a robust enclosure for an activity-monitoring device that can be attached to a manual wheelchair wheel [AMD Group].

The projects were selected from a list of ongoing projects at HERL and from disability community partners, based on the availability of the stakeholder clients and potential learning outcomes from the projects. The groups persisted with the design effort developing proof of concept prototypes, writing up a final research paper describing the design, a commercialization plan, and two posters for the QoLT poster sessions.

Future steps and conclusions

The focus of the current iteration of the program was to include VwDs and teachers in a single streamlined program and develop a strategy for future implementation of REV/T programs at QoLT. REV/T was successful in achieving this overarching goal. The first cohort will complete the program in early 2014, following which a more thorough analysis would be undertaken to answer fundamental research questions the program began with: What were the teachers initial

conceptions and usage of design in their classroom, and how did they change after RET? What changes in the teachers are linked to the RET program and which cannot be explained by the RET? How did the incorporation of VwD affect the overall experience for the teachers and affect their classroom teaching?

VwDs, through their military experiences, provide an additional dimension to the experiential learning provided to the teachers through the RET program. VwDs, themselves, benefit from the program and have shown an increased appreciation and interest in technology and engineering. All four participants continued on through the ELeVATE program in the subsequent term for additional technical skills training and experiential learning. The teachers benefited from the AT based projects and gained a better understanding of the disability community. In addition, the teachers had an increased understanding of the product design and development process and were able to implement the same in their K-12 classes. Overall, the program successfully engaged the target population in STEM related activities and helped them towards their subsequent professional goals.

The program suffered from baseline technology familiarity and experience of the participants. To solve this issue, a more focused workshop on the use of available online collaborative tools and CAD software will be incorporated in the next cohort for REV/T. In order to better understand the effect of the REV/T experience on VwD and their academic goals, the next cohort will focus on including newly returning VwD who are at the beginning of their undergraduate programs in science related fields.

A more concentrated effort on the long-term effects of the program on the participants' career pathways is needed. REV/T offers opportunities to study two varied population groups while better understanding their needs and identifying ways to improve their professional skills. The program provides additional resources to veterans transitioning to academia and unique experiences and values for the teachers that can be carried forward through to their students.

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