

Brain Health Alliance Virtual Institute: Teaching Students Medical Informatics via Collaborative Research Projects

**S Koby Taswell, Adam Craig and Carl Taswell, MD, PhD
Brain Health Alliance, Ladera Ranch, CA, USA**

Introduction

In 2007, the not-for-profit organization Brain Health Alliance (BHA) began its mission to build an on-line network and community of individuals and organizations dedicated to advancing the state-of-the-art in brain health sciences through education and research focused on the use of biomedical informatics, imaging and computing for brain problems. In 2014, as the initial educational research program and centerpiece of this mission, BHA accepted its first class of Virtual Institute (BHAVI) students, and matriculated them from high schools, colleges and university graduate schools to work on BHA research related to brain imaging and computing sciences. BHAVI students are proudly called *brainiacs*.

Methods

Students apply to the annual BHAVI program¹ by submitting a current academic transcript, letter of interest and letters of recommendation. A BHAVI director then interviews each applicant to assess qualifications, aptitude and attitude. Accepted students participate in the program by attending webinars, joining on-line videoconferences with mentors, advisors and other students, and most importantly, working on their research projects supplemented by a required curriculum of searching, reading, writing and software programming exercises. Students choose from a list of pre-approved projects or submit a research proposal for approval by a BHAVI director. Students take primary responsibility for progress on their projects while receiving guidance from advisors and assistance from other students. BHAVI encourages students to develop reciprocal collaboration skills through secondary projects that contribute to the primary projects of other students. Students also pursue educational projects and attain a benchmark of knowledge and skill in an area of computational sciences and software engineering (CSSE) relevant to their primary projects.

Results

While all BHAVI research projects apply software engineering to the solution of problems in the brain sciences, each student project aligns with one of 3 thematic research areas named the BrainWatch Project, the PORTAL-DOORS Project and the CTGaming Project that correspond to 3 categories of computing, termed respectively, numeric, symbolic and hybrid. Numeric computing work addresses the use of mathematical image processing and virtual reality displays for the BrainWatch Project². Symbolic computing work applies vocabularies, ontologies and semantic web technologies to build a knowledge engineering workbench with the NPDS cyberinfrastructure system for the PORTAL-DOORS Project^{3,4}. Hybrid computing work combines both numeric and non-numeric technologies to develop clinical telegaming applications with telecare monitoring of and therapy for neurodegenerative disorder patients in their homes for the CTGaming Project⁵. During program years 2014–2018, BHAVI has mentored 45 students around the world, producing 14 student papers published and presented at professional medical science and engineering conferences⁶.

Discussion

The BHAVI program has operated annually as a *virtual institute* in the sense that all interactions have occurred on-line via telecommuting and videoconferencing such that students have not been required to travel to a physical classroom or any in-person on-site premises. The on-line nature of BHAVI has both enhanced its reach but hindered its coordination and communication. A prior study found that students in on-line courses, compared with students in on-site courses, had more difficulty communicating with teachers and classmates sufficiently to motivate themselves to learn the material⁷. To help counter these barriers, BHAVI fosters mentoring relationships also between older and younger students as well as coordination between BHAVI mentors and students' instructors at their degree-granting institutions.

Conclusion

For the past 5 years, BHAVI has successfully taught high school, college and graduate students medical informatics, CSSE and scholarly publishing through a team-project research-focused on-line curriculum for brain health sciences.

References

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Abstract

During program years 2014–2018, a total of 45 high school, college and graduate students have participated in the Brain Health Alliance Virtual Institute (BHAVI), a project-based learning and research training program. BHAVI students have published 14 conference papers in clinical and translational research informatics and data sciences. BHAVI uses frequent videoconferencing between students and mentors as its primary collaboration tool, and overcomes obstacles to on-line education with support from on-site advisors.