

Summary

The purpose of this proposal is to develop a set of assessment instruments designed to measure student learning outcomes and student attitudes in introductory computing courses. Through extensive testing, the validity and reliability of the resultant instruments will be demonstrated. The motivation for this proposal is based on recent National Science Foundation (NSF) sponsored research projects in which the investigators established the need to devise new assessment tools and to update two-decades-old assessment tools for computer science education. The need for new and updated assessment tools is particularly crucial in a dynamic field where changes in, and availability of, computing technology has reverberating effects on pedagogy and student experience in the classroom.

This project proposes to develop and validate three assessment instruments. Each instrument will be developed in both standard paper-pencil distribution and for on-line delivery. Two instruments will measure student learning outcomes and one will measure students' attitudes towards computers and computer science. Of the two instruments designed to measure student learning outcomes, one will be designed for literacy courses and the other will be designed for use in introductory programming courses. Each of these instruments will be designed in a manner that measures fundamental concepts that are not language specific. The goals and outcomes of this project are summarized as follows.

- 1) Create two learning outcomes assessment instruments, one for computer literacy courses and one for introductory programming courses, that measure the following:
 - a. fundamental concepts in programming
 - b. algorithmic thinking in programming
 - c. problem solving through programming
- 2) Create an attitudes survey that measures students':
 - a. confidence in their own ability to learn computing skills and programming
 - b. beliefs in their ability to succeed in computing courses
 - c. perceptions of computing as a male field
 - d. beliefs in the usefulness of learning about computers and programming
 - e. interests in computing

Broader Impacts: A primary goal of many computer science education projects is to determine the extent to which a given instructional intervention has had an impact on student outcomes. A challenge that is faced by researchers is that valid and reliable assessment instruments that measure the desired goals and outcomes across different platforms are not currently available. This project seeks to develop and validate assessment instruments that measure fundamental concepts and students' attitudes within introductory computer sciences courses. Careful attention during the validation process will be dedicated to the impact that gender and ethnicity have on the consequential validity of the resultant instruments.

Intellectual Merit: As is discussed in this proposal, there are currently no validated assessment instruments available to researchers to use in measuring general programming and problem solving skills in computer science when different platforms and innovative techniques are used to introduce students to fundamental programming concepts. Furthermore, the most current validated assessment instrument that measures students' attitudes with respect to computer science is two decades old. Given the changing nature of computer science and computer technology, up to date and validated instruments are needed. This proposal seeks to address these critical needs. The research team has been specifically selected to include an expert in the assessment of higher education and experts in the use of different platforms for teaching introductory computer science courses. In combination, this team provides the appropriate skills to reach the proposed goals.