

# Multi-Disciplinary, Scientific, Gender Research

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## INTRODUCTION

Many phenomena of interest in education research are results of voluntary human action: whether a first-year college student elects to pursue a degree in information technology or not, whether the pursuit is in computer science vs. computer engineering, and whether the student will persist in a discipline throughout her or his college matriculation or change disciplines after a year or two. Although the human action is observable and can be tracked, the reasons an election is made and when it is made are not easily modeled. This article describes the design of a multidisciplinary, scientific study of gender-based differences, and ethnic and cultural models in the computing disciplines. The term computing disciplines is a collective one subsuming for ease of discussion the various disciplines that have evolved from the mid 20<sup>th</sup> century through the present 21<sup>st</sup> century, for example, computer engineering, computer science, computer information systems, information science, information technology, telecommunication systems management, and so forth. The researchers and study advisors formed a multidisciplinary team that is investigating in a scientific way the psychological, social, and educational rigidities that might exist between computing disciplines, and in so doing is developing different predictive models for women and ethnically underrepresented groups, in particular, African Americans. The article highlights recognized guiding principles for conducting scientific research in education and explains how the guiding principles have been implemented thus far in the study.

## BACKGROUND

In 1959, as part of a prestigious lecture series at Cambridge University, Professor C. P. Snow, a recognized physicist and poet, gave a talk entitled

“The Two Cultures” (Snow, 1964). Professor Snow expressed his concerns regarding the growing gap between the scientific and literary intellectuals of the time. He hypothesized that the reasons for the divide were a belief in educational specialization and a tendency to allow social forms to “crystallize.” He suggested that once a cultural divide is established, all the social forces operate to make it more rigid and enduring.

Professor Snow’s observations and hypotheses might well be applied generally to today’s growing gap between women and men in the computing disciplines. However, the cultural divide may indeed go beyond gender differences, existing between specific computing disciplines (e.g., between computer engineering and information technology) or between types of institutions of higher education (e.g., between historically black colleges and universities [HBCUs] and predominantly white institutions [PWIs]), or it may exist in some other tier of the multilayered educational experience of the person (Lopez & Schulte, 2002). Researchers have documented the influence of culture: institutional culture (Barker & Garvin-Doxas, 2003), departmental culture (Meeden, Newhall, Blank, & Kumar, 2003), and computing discipline culture, that is, the human centric vs. math-science centric (Denning, 2001). The concept of culture seems to be associated with gender and ethnicity as well, playing a role in African American women attending HBCUs or PWIs (Constantine & Watt, 2002).

In a group of people, a culture develops from ongoing group discussions about values, meanings, expectations, and prevailing unwritten rules, thus affecting the perceptions, appraisals, and behavior of individual members of the group (Seel, 2000). Through learning and socialization, people internalize either consciously or unconsciously patterns of culture. The consequences of culture are that studies, say, involving the STEM disciplines (science, technology, engineering, and mathematics), may

produce findings that may or may not translate into valid conclusions for all or some of the computing disciplines. Likewise, even studies in a specific computing discipline involving subjects from only PWIs may produce findings that may or may not transfer to HBCUs. The cultural divides in the computing disciplines exist because of the educational specializations that have been constructed. As Professor Snow suggested, the socialization process (i.e., the daily conversations and negotiations among the group members as well as between group members and nonmembers) will endeavor to make these divides more rigid. Consequently, extreme care must be taken in educational studies to delineate the conditions under which findings are applicable. Furthermore, large studies spanning a wide geographic area (e.g., the United States) over several years are needed to attempt to grasp the influence of culture in the computing disciplines.

## **MAIN THRUST OF THE ARTICLE**

### **Forming a Multidisciplinary Team**

Research in education must concern itself with the physical, social, and economic environments in which the research is conducted because contextual factors often influence research results in significant ways. For example, care must be exercised when using data collected from the computing disciplines before 2000 and 2001 (i.e., the dot-com bust and the 9/11 terrorist attack on the World Trade Center period) to draw inferences about the student population of the computing disciplines today. The economic markets that influence recruitment into the computing disciplines have changed significantly since that time. Thus, research on human action must take into account a number of contextual factors as well as the individual's understanding, intentions, and values. Consequently, studies must be multidisciplinary.

The remainder of this subsection describes the multidisciplinary team assembled under a National Science Foundation (NSF) grant to conduct a study on gender-based differences, and ethnic and cultural models in the computing disciplines. The principal investigators (PIs) are Antonio M. Lopez, Jr. (pro-

fessor and the Conrad N. Hilton endowed chair in computer science), Lisa J. Schulte (associate professor and chair of psychology), and Marguerite S. Giguette (professor and the BellSouth distinguished professor in computer science). All are from Xavier University of Louisiana.

The advisory board is a highly skilled, multidisciplinary group that can help address the physical, social, and economic environments.

Sylvia Beyer, associate professor of psychology, University of Wisconsin-Parkside. Her research focuses on gender differences in self-perceptions in male-dominated domains.

Doris Carver, professor of computer science and associate vice chancellor of research and graduate studies, Louisiana State University. She is an IEEE fellow and editor-in-chief of *Computer*.

Joanne Cohoon, research assistant professor in the Curry School of Education, University of Virginia. She is a sociologist who studies technology, gender, education, and their interaction.

Andrea Lawrence, associate professor and chairperson of computer science, Spelman College. She is the president of the Association of Departments of Computer and Information Sciences and Engineering at Minority Institutions.

Jane Margolis, research educationist, University of California Los Angeles, in the Graduate School of Education and Information Studies. She recently conducted an investigation of African American and Latino male and female high-school students' decisions to study (or not study) computer science in three public Los Angeles high schools.

Bradley Jensen, academic relationship manager, Microsoft, Inc.

Alfred Zenon, logistics engineer, Apogen Technologies, Inc.

Since Xavier University of Louisiana is not a Research I (Carnegie classification) institution, research partners were recruited to help the PIs develop the investigation methods to be used and to analyze the data collected. The research partners are as follows.

Madonna G. Constantine, professor and chair of the psychology department, Columbia University. She is a fellow of the American Psychological Association (APA) and codeveloper of the Cultural Congruity Scale. She is a consulting editor for the

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