The HumAn Learning Project:

Human Expertise, Analytics, & Student Learning in Multi-Section General-Education Courses at Indiana University

Phase 3 Proposal

A 3-in-1 Joint Project Submitted by
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to the
Student Learning Analytics Fellows Program
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Abstract

The HumAn Learning Project uses learning analytics to triangulate on strategies for fostering student success in multi-section, general education courses. Phase 1 of the project, completed in 2015, uncovered important demographic trends in success among sections of a single course enrolling 800-1000 students and facilitated by 9-10 AIs annually. Phase 2, completed in 2016, developed a context for these trends with multivariate modeling comparisons to student success in other IU general education courses and pilot tested an intervention based on a synthesis of learning and disciplinary theories. Phase 3, proposed here, extends and further tests the premises and applications of this research by partnering faculty members who teach large, general education courses at IU. The new work will (1) marshal institutional data on learning and student progress (e.g., demographics, college preparation, g.p.a., retention, choice of major, time to degree) in order to develop further multivariate modelling of student success and (2) design and implement classroom interventions based on our prior research that also reflect disciplinary ways of knowing. The project addresses the high-stakes matter of student success in big courses—crucial for the sponsoring departments, their schools, the graduate student section leaders, and the undergraduate students who hope to lay a foundation for successful college and professional careers. Moreover, it offers a significant innovation in learning analytics research, coupling data produced passively during the regular business of higher education with faculty-initiated, course-specific interventions that reinforce disciplinary ways of knowing. The goal is to foster student success, specifically building on the Cultures of College intervention piloted in Phase 2. Anticipated outcomes include improved ways to “mind the gaps” in student achievement that are based on gender, educational preparation, and race; revisions in graduate-student instructor orientation; and theoretical advances in learning analytics. (290 words)
Project Description (3 page maximum):

1. **Purpose of the investigation.** The purpose of the HumAn Learning Project is to leverage the disciplinary capacities of Human-based knowledge (faculty experts in a particular field) along with the Analytic potential of institutional data collection in large-enrollment courses to maximize student success. The short-term goals of the project are to use data to establish what is happening in particular multi-section, general education courses; to design and implement discipline-based interventions in an array of arts and sciences courses to facilitate what can be; and to theorize the potential of a synthesized Hum-An approach to student learning. The project models how the conscientious tracking of student performance that faculty in higher ed commonly conduct can be upgraded with rigorous modelling. The new research proposed here builds on several years of our findings:
   - **Phase 1** of the project, completed in 2015, uncovered important demographic trends in success among 2719 students and 30 AIs involved in a single, multi-section, general education course at Indiana University Bloomington.
   - **Phase 2**, complete in 2016, (1) refined our understanding of these trends within the course using multivariate modeling and comparisons to student success in other IU general education courses, (2) assessed variability of student success across sections of the course, (3) analyzed student performance over time, and (4) piloted a discipline-based intervention designed to close demographically-based learning gaps.
   - **Phase 3**, as planned since the beginning of the project and proposed here, extends this research to other multi-section, general education courses. The goal is to understand and impact large numbers of IU students through large courses taken at the important general education juncture of their education. We thus propose addressing a robust range of courses: Anthropology A122, College P155, and Chemistry C117. Each course offers interesting variations on the large class theme: the formatting variations of discussion, lab, and free-standing sections taught by graduate student instructors; the potential for recruiting and retaining majors; the challenge of fostering success among diverse student groups; and the potential for impacting retention to the third semester.

**Research objectives.** The overall objective of this research is to improve student success in multi-section, general education courses in the humanities, sciences, and social sciences by theorizing and testing a new synthesis of institutionally generated learning analytics and expertise-based instruction. In Phase 1, we identified differential success in various student cohorts in the last three years of a single course (CMCL-C122/ANTH-A122 Interpersonal Communication), based on single-variant models. In addition, we identified demographic and content-based challenges to those cohorts and identified pedagogical and structural opportunities for improving student engagement and success. In Phase 2, we continued to collected data and refined our analysis of it with multivariate modelling and comparison to similar courses on campus. We also piloted an intervention, based in Anthropological theory and course content, designed to address demographically-based achievement gaps.

Overall, the research objectives for Phase 3 include these major moves:
1. Extend this research to include a robust range of fields across the College of Arts and Sciences: ANTH-A122, COLL-P155, and CHEM-C117.
2. Develop rich, multivariate models of student learning performance in these courses.
3. Design and test discipline-based interventions that address demographically-based learning gaps.
4. Theorize a contribution to learning science that synthesizes learning analytics and disciplinary content knowledge.
5. Disseminate results through publications and presentations.

*The data* gathered to address these objectives will include:
1. Student demographic data (e.g., Registrar data on year, gender, citizenship, transfer status)
2. Student success data (e.g., BAR and Registrar data on course grade, GPA, major, retention, performance on common exam questions)
3. Course-based performance data (i.e., pre- and post-assessments of the Cultures of College interventions)

2. **Significance and impact on undergraduate learning.** The project involves faculty members directing three large-enrollment courses for the College of Arts and Sciences:

   1. ANTH-A122 Interpersonal Communication enrolls about 400 students per semester and supports 9-10 Anthropology graduate student teaching assistantships per semester.
   2. COLL-P155 Public Oral Communication enrolls about 1000 IU students per semester and supports 20-23 graduate student assistantships in 15-18 departments each semester. In addition, 1000 high school students take the course through ACP.
   3. CHEM-C117 Principles of Chemistry and Biochemistry (General Chemistry) enrolls about 600 students per semester and supports 6 graduate student assistantships each semester. In Fall 2016, the instructor added 14 undergraduate AIs to facilitate problem solving in discussion sections, reducing the ratio of instructor to student from 40:1 to 13:1.

   These three large courses represent important investments by the sponsoring departments, the College of Arts and Sciences, and, not least, the undergraduate students who hope for good progress in their college careers and the graduate students who teach them in sections.

3. **Anticipated outcomes and their contribution to the success of student learning at IU.** In Phase 2 of this study we investigated the phenomenon that, because of their sheer size, large general education courses may mirror larger campus achievement trends. We documented that gaps in GPA based on race, gender, and generational status manifest in several general education courses on campus. We then used resources from our particular field of expertise, Anthropology, to theorize a remedy to these gaps and design a discipline-based intervention compatible with the content of a course under study. That intervention, Cultures of College, uses a central Anthropological notion to theorize that success in college requires fluency in one or more cultures specific to the college environment that first generation, ethnic minority, and international students may not be privy to without explicit introduction. The intervention in a course about culture, thus, expands its introduction of this notion to include Cultures of College. A successful intervention would have a significant impact on undergraduate learning by making transparent the practices that lead to success in college.

   In Phase 3, we extend the research to include more students in more departments. Importantly, in those courses we will seek similarly discipline-based responses to learning disparities that can be identified by institutionally-derived analytics. In this productive synthesis of disciplinary know-how and institutional tools, we can usefully inform faculty of what is while keeping their focus on what they know about what can be for student learning in their courses. Or in other words, we seek to test the premise that significant student learning can result from imbedding our responses to learning analytic insights into disciplinary frameworks—cultural, rhetorical, chemical or otherwise. In each case, we posit that aligning learning analytics with content knowledge can powerfully intervene in undesirable demographically based performance trends.

   We also anticipate being able make concrete **pedagogical recommendations for facilitating diverse student success** throughout these departments and in similarly large, general-education courses across campus.

   In addition, we anticipate that in these three departments, and potentially beyond, we can inform **revisions to the graduate-student instructor and undergraduate peer-instructor orientations** in ways designed to disrupt concerning trends and enhance student achievement.

4. **Research methodology.** We are submitting this joint proposal with the approval of George Rehrey and with the understanding each PI will be eligible to receive a full $2000 award, which will be

Robinson, Arthos, Robinson 4
necessary to conduct the research described. In turn, all three PIs will participate fully in SLAF activities. This research has exempt IRB approval and will be amended as needed. It relies largely on quantitative data—from the Registrar and BAR, course evaluations, and learning outcomes data—to group and compare cohorts of students, courses, and class sections. We have been in close contact with BAR Director Linda Shepard during the development of this research method.

Phase 3, proposed here, will incorporate earlier, sometimes less formal, research by all three PIs on their courses into statistically and theoretically rigorous new work (See Appendix A). We will conduct multiple regression analyses to explore variation in student outcomes across time using multiple demographic markers in the same model. Specifically, we will use panel data techniques to analyze students’ outcomes over time. Our primary outcomes of interest are GPA, fulltime course enrollment status, course withdrawals, persistence, future course choices, and graduation rates of students enrolled in the target courses in the years 2012-2016.

(1) \( Y_{it} = \alpha + \beta X_i + \varepsilon_{it} \). In separate specifications, the dependent variable \( Y \) will capture the various outcomes of interest at the end of each semester (starting with the semester of the student’s enrollment in the target course). The variable \( X \) denotes the vector of student demographic markers such as race, gender, first-generation status, and baseline high-school GPA, SAT/ACT scores that influences student outcomes, as evidenced by the results obtained in Phase 1 of the study. \( \varepsilon \) denotes a random error term. Analyses of non-continuous outcomes will be treated appropriately using linear probability models or other techniques for limited dependent variables.

We will also examine the variation in student outcomes across the various sections of the multi-section courses. We will explore the use of fixed effects to account for the time invariant observed and unobserved differences across the various sections/instructors of the class that might influence student outcomes differentially. We will use the following model specification to explore such variations in student outcomes.

(2) \( Y_{it} = \alpha + \beta X_i + \theta_j + \varepsilon_{it} \). Similar to equation (1), equation (2) includes the same student characteristics (\( X \)) that have been shown to influence the various outcomes of interest (\( Y \)), as described earlier. In addition, the variable \( \theta \) represents section/instructor fixed effects that captures all time-invariant characteristics of the section/instructor that the student is exposed to when enrolled in a target course, which might influence his/her outcome differentially.

Course-based interventions will adapt the Cultures of College intervention (Robinson and Gopalan) and the notion of signature pedagogies (Shulman; 2005; Gurung, Hainey, and Chick 2009) respond to these analyses. In sum, our research team, which includes the PIs (J. M. Robinson, J. Arthos, and J. K. Robinson) plus a talented graduate student statistician from SPEA and other graduate student staff as needed, will explore the academic trajectories and contexts of students who enroll in this class using the rich student-level data available in the administrative records at IU.

5. **Measures of success.** Success will mean we have (1) refined our understanding of demographic trends in learning and teaching in three target general education courses, (2) identified important patterns within and across courses, (3) designed and begun to implement scalable interventions to address areas of concern, and (4) disseminated research findings, particularly exploring opportunities for transfer to other courses.

6. **Previous research results.** Phase 1 of the project, completed in 2015, uncovered important demographic trends in success among sections of a single course enrolling 800-1000 students and facilitated by 9-10 AIs annually. Among the most important findings were that first-generation, male, African-American, and nonresident alien students tended to have lower GPAs than students who describe themselves as white, Hispanic, Asian, two or more races, or having at least one parent with a bachelor of arts degree. Phase 2, completed in 2016, developed a context for these trends with multivariate modeling comparisons showing similar gaps in student success in other IU general education courses. Phase 3 also piloted an intervention based on a synthesis of learning and disciplinary theories.
Appendix A: A sample of earlier work by the PIs, establishing performance discrepancies to be further examined and addressed in Phase 3.

Bibliography


Nominating letters under separate cover:
1. Jeanne Sept, Chair of the Department of Anthropology
2. Patricia Ingram, Chair of the Department of English
3. Chair of the Department of Chemistry

Short CVs for PIs - maximum of 4 pages, see below.
EDUCATION

Ph.D. in English, Doctoral Minor in Folklore. Indiana University 2001.

ACADEMIC AND PROFESSIONAL APPOINTMENTS, Selected

Indiana University, Bloomington
Department of Anthropology, Professor of Practice, 2015-present.
Co-Director, Graduate Certificate for College Teaching, 2015-present.
Affiliated Faculty, Integrated Program on the Environment, 2013-present.
Department of Communication and Culture, Professor of Practice, 2013-2015.
Senior Lecturer, Department of Communication and Culture, 2008-2013.
Adjunct Assistant Professor, Department of Communication and Culture, 2000, 2006-2008.
Director, Campus Instructional Consulting, Indiana University, 2002-2008.

PUBLICATIONS, Selected

Books

Book Series Editor

Articles and Book Chapters—Performance and Anthropology—redacted for short CV

Articles and Book Chapters—Scholarship of Teaching and Learning, Selected


PRESENTATIONS AND CONFERENCE PAPERS, Selected

Robinson 2
Keynote and Plenary Presentations


Plenary Panel with Mary Taylor Huber and Jacqueline Dewar. International Institute for SOTL Scholars and Mentors, Loyola Marymount University, Los Angeles, June 1, 2012.

“Stories from the Field: Space, Place, and the Performance of Self.” Association for the Study of Literature and Environment biannual meeting, Bloomington, IN, June 2011.

“Faculty Inquiry Networks in the Scholarship of Teaching and Learning” SOTL Commons Conference, Statesboro, GA, March 2011.

“Building Faculty Development Networks.” International Symposium, Future of Faculty Development in Japan: Building the Core in Faculty Development, Kyoto University. January 2009.


“Expanding the Scholarship of Teaching and Learning.” Continuous Improvement Symposium of the Association for the Advancement of Collegiate Schools of Business, St. Louis, October 2001.

Invited Presentations, Selected


Conference Papers and Presentations (Peer Reviewed), Selected

Robinson, J. M. et al. “How graduate students are taught to tell the story of their teaching and what that has to do with SOTL: Results from a multidisciplinary, multinational comparison of pedagogy courses.” International Society for the Scholarship of Teaching and Learning, Los Angeles. October 2016.


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**GRANTS, Selected**


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**AWARDS, Selected**

Distinguished Service Award, International Society for Scholarship of Teaching and Learning, 2016.

Trustees Teaching Award, $2500, 2012. Indiana University.

Theodore M. Hesburgh Faculty Development Award, for the Scholarship of Teaching and Learning Initiative. Sponsored by TIAA-CREF. Initiative director and proposal co-author. $30,000. 2003.

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**SERVICE, Selected**

JOHN ARTHOS
Associate Professor

Ballantine Hall 416 827 W. 17th St.
Department of English Bloomington, IN 47404
Indiana University Bloomington (812) 679-8175
Bloomington, IN 47405 jarthos@indiana.edu

Education
Ph.D. in Communication, specialization in rhetoric, Wayne State University Department of Communication, Spring, 1995.
B.A. in Languages and Literatures, University of Michigan, 1978, Charles Angell Scholar.

Employment
Associate Professor, Department of English, Indiana University Bloomington, July 2015-present.
Associate Professor, John and Christine Warner Chair, Department of Communication, Denison University, August 2000–May 2014.
Assistant Professor, Communication Department, SUNY at Fredonia, August, 1995-July 2000.

Book Monographs

Research in Professional Journals/Books [single-author] (selected)


Courses taught (selected)

ENG-R340  Rhetoric of Social Movements (Indiana University, Fall 2016)
ENG-L756  Symbolism of Evil, (graduate seminar, Indiana University, Spring 2016)
ENG-R397  Visual Rhetoric (Indiana University, Fall 2015)
CMCL C513 Rhetorical Judgment (graduate seminar, Indiana University, Spring 2015)
COLL P155 Public Oral Communication (Indiana University, Fall 2014-present)
COMM-401 Narrative Truth (Denison, Fall 2013)
COMM-227  The New Literacy Lab (Denison, Spring 2012)
COMM-223 Rhetoric (Denison, Fall 2011)
COMM-406 Rhetoric and Social Movement (Denison, Fall 2011)
QS-406 Rhetoric and Social Movement (cross-listed) (Denison Fall 2011)
HNRS-283  Humanist Hermeneutics (Denison, Fall 2009)
COMM-101  Public Address (Denison, Fall 2008)
COMM-208  Theorizing Communication (Denison, Spring 2008)

Service (selected)

Liberal Arts and Management Program Task Force, The College of Liberal Arts, Indiana University,
Summer 2016.
Department of English Graduate Admissions Committee, member, Fall 2015/Spring 2014.
Indiana University General Education Arts and Humanities Subcommittee member, 2016-present.
Indiana University General Education Arts and Humanities committee member, 2016-present.
Rhetoric Tenure-Line Search Committee, Department of English, member, Fall 2015.
Writing & Rhetorical Studies Committee, IU Department of English, member, Fall 2015-present.
Rhetoric Program Committee, IU Department of English, member, Fall 2015-present.
Indiana ACP High School instructors training and support for P155 equivalence courses, assist Course
Coordinator, 2014-present.
Jill K. Robinson, Ph.D. 
Indiana University 
Department of Chemistry 
800 E. Kirkwood Ave. 
Bloomington, IN 47405 
jirobins@indiana.edu

Education:
1999    Ph.D. Analytical and Atmospheric Chemistry, University of Colorado, Boulder, CO
1994    B.S. Chemistry, Truman State University, Kirksville, MO

Academic Positions:
2008-present  Senior Lecturer, Department of Chemistry, Indiana University, Bloomington
2002-2008    Lecturer, Department of Chemistry, Indiana University, Bloomington, IN
1999- 2002   Academic Professional Lecturer in Analytical Chemistry, University of Wyoming, Laramie, WY

Courses:
General Chemistry I and II lecture and laboratory
Honors General Chemistry I and II
Preparatory Chemistry lecture and laboratory
Quantitative Analysis
Environmental Chemistry (300 level)
Instrumental Analysis lecture and laboratory
Ethics in Science

Honors and Awards:
2016    Mosaic Fellow for Active Learning Indiana University 
2011    Indiana University President’s Award for Distinguished Teaching
2010    Excellence in Teaching Award, Indiana University Board of Trustees 
2008    Excellence in Teaching Award, Indiana University Board of Trustees
2003    Excellence in Teaching Award, Indiana University Board of Trustees
2002    Outstanding Service by a Faculty Member, University of Wyoming Chemistry Students
2001    Extraordinary Merit in Teaching, University of Wyoming College of Arts and Sciences
2001    Award for Excellence in Teaching, University of Wyoming Honors Program (Student Choice)
1999    Faculty Growth Award, University of Wyoming
1998    Graduate Fellowship, Cooperative Institute for Research in Environmental Sciences
1998    Graduate Fellowship in Atmospheric Chemistry, National Science Foundation
1995    Graduate Excellence in Teaching Award, University of Colorado
Publications and Patents:

- Analytical Sciences Digital Library Active Learning Modules
  - Biological Mass Spectrometry: Proteomics, Jill K. Robinson, Michelle Kovarik
  DOI: 10.1007/s00216-012-6473-x

Professional Presentations:

- *Harris Teaching Workshop Keynote Speaker, University of Alberta, Canada, 2016*
  - Strategies for Effective Active Learning
- *Biennial Conference on Chemical Education, Colorado, 2016*
  - Learning is Not a Spectator Sport
- *Texas Community Colleges Consortium, Houston, 2016*
  - Strategies for Effective Active Learning
- *ALEKS Symposium, Boston, 2015*
  - General Chemistry Placement: A Comparison of Review Courses
- *249th American Chemical Society Meeting, Denver, 2015*
  - Using Technology to Facilitate Discussion in an Instrumental Analysis Course
- *Biennial Conference on Chemical Education, Aug. 2015*
  - Project Based Learning in Analytical Chemistry Laboratory
- *Pittcon, Chicago, IL, 2014*
  - Analytical Chemistry Students Perform Quality Assurance Tests for a Local Microbrewery
- *Pittcon, Philadelphia, PA, 2013*
  - Active Learning Strategies for Large Analytical Chemistry Lecture and Laboratory Courses
- *243rd American Chemical Society Meeting, San Diego, 2012*
  - “A Tale of Ales: Project Based Learning in Analytical Chemistry Laboratory”
- *Biennial Conference on Chemical Education, Bloomington, IN, 2008*
  - “A New Integrated Laboratory and Lecture Course in Bioanalytical Chemistry”
- *Indiana University, Summer Enrichment Program, 2007*
  - “The Chemistry of Global Warming”
- *International Center for First Year Undergraduate Chemistry Education, Boulder, CO, 2007*
  - “Strategies to Improve Problem Solving in First Year College Chemistry”
- International Center for Undergraduate Chemistry, On-line Conference, December 2006
  - “Less is More: 1:2:1 Curriculum at Indiana University”
  - “1:2:1 Curriculum at Indiana University; A 4 Year Journey”
- Biennial Conference on Chemical Education, West Lafayette, IN, July 2006.
  - “Using CALM to Implement Indiana State Science Standards”
- International Center for First Year Undergraduate Chemistry Education, Champaign, IL, 2005
  - “A One Semester General Chemistry Course Designed for a 1:2:1 Curriculum”
- Rocky Mountain Symposium on Photons in Chemistry, Estes Park, CO, 1998
  - "A New Chemiluminescence Method for the Measurement of Nitric Oxide in the Atmosphere"
- American Chemical Society, Fall Meeting, Las Vegas, Nevada, 1997
  - A Lightweight Instrument for the Analysis of Total Reactive Oxides of Nitrogen in the Atmosphere
- University of Colorado Atmospheric Chemistry Symposium, Boulder, CO, 1996
  - Historical Record of UV-B Flux at the Earth's Surface by Analysis of Thymine Photodimers in DNA Preserved in Ice Core Pollen
- Rocky Mountain Conference in Analytical Chemistry, Denver, CO, 1996
  - Historical Record of UV-B Flux at the Earth's Surface by Analysis of Thymine Photodimers in DNA Preserved in Ice Core Pollen.

Additional Teaching and Advising:

2016  Faculty Learning Community-Indiana University: Collaborative Learning
2015  New Faculty Orientation: Master class on student engagement for the new faculty at Indiana University.
2015  Science in a Snap: Teacher Professional Development Workshop, Wonderlab Science Museum
2015  Master Class: Using technology to facilitate discussion in the collaborative learning studio.
   (Sponsored by Indiana University Center for Innovative Teaching and Learning)
2015  Preparing Future Faculty Panel, Indiana University: Workshop on Student Engagement
2013-present  Academic mentor for student athletes
2012  Engaging Students in Scientific Inquiry Faculty Panel Presenter
   (Sponsored by Indiana University Center for Innovative Teaching and Learning)
2010  Preparing Future Faculty Panel: Balancing Teaching, Research, and Service
2007, 2010  Master Class: Using clickers to promote discussion in a large lecture hall
   (Sponsored by Indiana University Instructional Support Services)
2007  Freshmen Learning Project Fellow-Indiana University
2005-present  Indiana University Dance Marathon Faculty Advisory Board
2005-2010  Faculty Advisor: Alpha Chi Sigma Professional Chemistry Fraternity
2002-present  AI Training, Indiana University: Assisted in preparing associate instructors (AI’s) for laboratory and discussion sections by developing interactive training sessions such as role playing and microteaching.
2005-2007  Science Education Doctoral Committee Member: Advised chemical education student on curriculum for teacher workshops, created assignments for the purpose of revalidating classes, and served on the committee for the oral exam and doctoral defense.
2005  Service Learning: Developed several hands-on activities for college students in General Chemistry to teach in a 6th grade classroom.
2003-present  Study Skills Workshop: Presented a workshop titled “How to Study for College Level Science Courses” for incoming freshmen at Indiana University.
1999-2001  Faculty Advisor: American Chemical Society Student Affiliate Chapter, Univ. Wyoming
2000  Meet the Professors Program: Visited Wyoming high schools for college recruitment.
Professional Activities:

2013-present  Contributor: Development of E-learning Modules for Analytical Chemistry
National Science Foundation Transforming Undergraduate Education program

2015  Symposium Organizer: Active Learning in the Undergraduate Analytical Chemistry Curriculum
249th American Chemical Society Meeting

2015  American Chemical Society General Chemistry Exam Committee for 2017 Exam

2014  Textbook Reviewer: Reviewed 5 chapters in Quantitative Analysis by Daniel Harris, 9th Ed. W.H. Freeman

2014, 2016  *Active Learning in Analytical Chemistry Workshop*  This workshop was funded by an NSF Transforming Undergraduate Education grant. I was one of twelve analytical chemistry faculty who developed active learning materials and facilitated a workshop for thirty professors from historically black and Hispanic serving universities.

2012  Faculty Advisory Board Member for Themester:
Good Behavior/Bad Behavior: Molecules to Morality

2012  *National Science Foundation Reviewer:* Targeted Infusion Projects for Improving STEM education at Historically Black Colleges and Universities.

2011-present  Peer Reviewer: Journal of Chemical Education

2009, 2011  *National Science Foundation Review Panel:* Transforming Undergraduate Education (TUES) Grants in Analytical and General Chemistry

Science Outreach:

2008-2012  Outreach Coordinator: Nanoscience Center, Indiana University


b.  *Nanoscience Projects in Local Schools* (2009-2012): Worked with New Technology High School teachers in Bloomington and Columbus to develop nanoscience projects. During these projects 250 students visited research facilities on the IU campus such as the Cyclotron and Nanocharacterization Facility. A survey developed by the IU Center for Evaluation and Education Policy (CEEP) indicated that the number of students indicating a preference for STEM degrees doubled as a result of this experience.

c.  *Molecules Matters Teacher Workshop* (2010-2012): Developed and taught a two week workshop which trained middle and high school science teachers in nanoscience and project-based learning.

d.  *Nanodays at the Louisville Science Center* (2009): Developed three hands-on activities to teach nanoscience concepts to the general public; “Stained Glass Art with Gold and Silver Nanoparticles,” “Lithography,” and “Nanotechnology in Commercial Products.” Recruited and trained 25 Indiana University graduate and undergraduate students to help with the event.

2004-present  Chemistry Open House Participant: Presented a “Careers in Chemistry” booth, performed demonstrations at the Chemistry Department “Magic Show,” and supervised the various rooms with annual theme set by American Chemistry Society for National Chemistry Week, “Cooking with Chemistry,” “Life Science,” “Nanoscience,” etc.

2009  Judge for Science Olympiad Finalists, Indiana University

2009  Wonderlab Teen Night: Developed a Crime Scene Investigation Activity Based on DNA Analysis.

2007-2009  *Science in a Snap (A Summer Institute for Teachers):*  Developed a one day workshop at Wonderlab Science Museum to help elementary teachers better understand chemistry concepts set by state standards.