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1. Executive summary

- The broad goals of the *Tech to Teaching* project are: (1) To create an infrastructure on the Georgia Tech campus that encourages and enables students to pursue careers in K-12 or college teaching; and (2) To develop and implement programming that ensures these students succeed in their initial years in these career paths. These goals are to be achieved by integrating multiple ongoing projects through a collaborative effort of the **Center for the Enhancement of Teaching and Learning (CETL)**; the **Office of Undergraduate Studies (OUS)**; the **Center for Education Integrating Science, Mathematics, and Computing (CEISMC)**; the **Alliances for Graduate Education and the Professoriate (AGEP) Program**; and **Facilitating Academic Careers in Science and Engineering (FACES)**. Across the Georgia Tech campus there are twenty-two funded programs and projects that are relevant to the Tech-to-Teaching effort, including **Research Experiences for Undergraduates (REUs)**, **Research Experiences for Teachers (RETs)**, two NSF-funded **Integrative Graduate Education and Research Traineeships (IGERTs)**, a **GK-12 project**, and a **Noyce Scholarship program**.

- This Annual Report details activities and achievements to date designed to achieve the specific objectives of the *Tech-to-Teaching* program, which were to: (1) Create a pathway to middle and high school STEM teaching by providing students with appropriate advising, and courses in educational pedagogy that can be applied to subsequent educational certification; (2) Provide opportunities for mentoring by K-12 teachers during summer research internship programs, immersion experiences in the form of school-based internships under the guidance of master K-12 teachers, and induction support through annual teacher retreats; (3) Create a pathway to collegiate teaching that provides graduate students with appropriate advising, courses and workshops in educational pedagogy, and academic job and career mentoring by faculty through teaching practicum positions and immersion experiences teaching undergraduate courses at local colleges.

- Initial status at the beginning of the *Tech-to-Teaching* program was assessed through three evaluation activities. (1) **In-depth interviews and focus groups**: individual hour-long interviews designed to gauge the climate of support for the program were conducted with the deans of the College of Computing, the College of Engineering, and the College of Sciences, while focus groups were conducted with the associate deans, school chairs, undergraduate coordinators, and graduate coordinators of these Colleges. The purpose of this series of interviews and focus groups was to obtain initial feedback from these administrators about their perceptions of issues related to Georgia Tech’s role in preparing STEM faculty for teaching careers in middle schools, high schools, or post-secondary institutions where the primary focus is on undergraduate education. The discussions revolved around three main topics: perceptions of careers chosen by undergraduate and graduate students in the Colleges, resources available for students who want to learn about teaching careers, and Georgia Tech’s role in producing STEM teachers. (2) **Surveys**: faculty members in the Colleges of Computing, Engineering, and Sciences were asked to complete a survey about their perceptions of issues related to Georgia Tech’s role in preparing STEM faculty for careers in post-secondary institutions.
where the primary focus is on undergraduate education. The survey addressed respondents’ perceptions and valuation of faculty positions at institutions where the focus is primarily on undergraduate education, doctoral students who are interested in pursuing such a career, the perceived prestige level of various career paths for Georgia Tech doctoral students, and the faculty members’ degree of preparation for advising doctoral students about a variety of career paths. In addition, all members of the Georgia Tech Academic Advising Network (GTAAN) also received an invitation to complete a survey addressing their perceptions of issues related to Georgia Tech’s role in preparing STEM undergraduates for teaching careers in middle and secondary schools. (3) Analysis of annual reports: each of the twenty-two component grants and projects was asked to submit its latest annual report to determine the relationship and degree of potential for further integration into the Tech-to-Teaching program. These were categorized and studied according to five goal-oriented themes as those that: (a) serve underrepresented or underserved populations; (b) provide training for K-12 teachers or K-12 teaching experiences to college students; (c) offer research opportunities for K-12 teachers or students; (d) investigate and implement innovative pedagogical techniques; (e) enhance interest and involvement in specific content areas.

- Findings from the baseline interviews and focus groups were that:
  - Georgia Tech doctoral students are primarily interested in pursuing academic careers at Research Extensive institutions, although an increasing number are becoming interested in teaching at non-Research Extensive institutions, with a desire for less research pressure, better work/life balance, and for greater interaction with students.
  - The primary resources available for students to learn about teaching careers include TA training, teaching practicums, teaching seminars, workshops and services provided by CETL, and outreach opportunities provided by CEISMC. But there is wide agreement among the interviewees that Georgia Tech does not provide sufficient pedagogical training for pre-doctoral students.
  - The vast majority of undergraduates chooses careers in industry or attends graduate school; very few enter Georgia Tech with an interest in a teaching career in middle or secondary schools.
  - Once enrolled at Georgia Tech, involvement with undergraduate teaching assistantships and with CETL and CEISMC programs influences students’ interest in teaching careers.
  - Georgia Tech has a role to play in producing STEM teachers for middle and high school, but the Institute should maintain its focus on providing STEM content while ensuring pathways exist for students to pursue teacher certification programs at other colleges and universities.
  - Participants are generally supportive of undergraduates interested in pursuing a teaching career, although concern was expressed that additional resources are needed to help facilitate students’ entry into STEM teaching careers.
  - Among all constituents, academic careers at Research Extensive institutions are seen as the most prestigious, while baccalaureate and associate-level institutions are seen as significantly lower in prestige. Nonetheless, teaching at baccalaureate institutions is seen as equally suitable for men and women, and as a career that requires hard work, creativity, and a broad breadth of knowledge.
General conclusions from faculty and advisors surveyed were that:
  - Undergraduates interested in K–12 teaching careers are often inspired by a teacher and a desire to inspire other students about a subject that they love.
  - Georgia Tech provides appropriate content knowledge for students who want to teach STEM subjects in the schools.
  - Students who are interested in K–12 teaching careers are not seen as academically weaker than their peers who choose other careers.
  - The prestige level of teaching careers in middle and high schools is seen as quite low, although a high school teaching career is more prestigious than one in middle school.
  - Advisors feel only adequately prepared to advise students about teaching careers in middle and high school, but they are aware of resources such as CETL, the STEP program, and Beth Spencer.

Analysis of project annual reports indicates that the participating projects and programs described here are widely varied, but all share an overarching theme of improving the educational experience of students. Many projects target student groups that are often overlooked, such as those with disabilities or from lower-income families. Others seek to promote content areas that may not be readily accessible to large groups of students, such as computing and engineering. Implementation of an innovative pedagogical technique, such as design-based or project-based learning, lies at the root of several projects. A number of the projects place Georgia Tech students in K-12 classrooms, thus providing benefits to the undergraduate students both from interactions with teachers and with younger pupils.

K-12 pathway activities produced the following results:
  - Two courses were offered through CETL for undergraduate level students. These courses, titled *Principles of Learning and Teaching I* and *II*, deliver content on basic educational psychology issues and theories, as well as practical issues of teaching and becoming certified to teach. The first course serves as a prerequisite for the second. Both courses focus on teaching students what they will need to know in order to succeed on the Georgia Assessments for the Certification of Educators® (GACE™) Professional Pedagogy exam. In addition to content delivery, the 2nd course includes a weekly in-school teaching program in which students gain real-world teaching skills and experience.
  - Enrollment in these courses was 36 students (over two semester offerings) in the 1st course and 3 students in the 2nd course; all enrolled students passed these courses. Course survey ratings revealed that in general, students were pleased with the quality of these courses.
  - Opportunities for students to receive mentoring from established teachers were provided through the Teaching SURE program. In this program, K-12 teachers participating in summer research experiences in GT labs are paired with GT pre-teaching students. These student-teacher pairs work together for an 8-week period to conduct STEM research and create classroom lesson plans based on this research. In some cases these pairs also have the opportunity to work with GT graduate students, faculty members, post-docs, and/or groups of high school students. Nine GT students
participated in this program during summer 2009; eight participants responding to a post-experience survey agreed or strongly agreed with the statement “after the Teaching SURE experience I believe I will be a better teacher.” One student did not respond to the survey.

- Advising for undergraduate students interested in teaching is available from Beth Spencer (Office of the Provost: Undergraduate Studies). Over 200 advising sessions were conducted from January to October, 2009; this figure serves to highlight the interest in teaching careers among GT students.

- Higher education pathway activities produced the following results:
  - Two courses were offered through CETL for graduate level students. A course titled *Fundamentals of Teaching, Learning and Course Design* delivered content on the learner-centered paradigm. The central activity completed by each student was designing a college-level course in a subject area of their choosing. The other course, *Student and Teacher Enhancement Partnership (STEP) Summer Training*, was required of all STEP fellows. Content covered in this course pertained to practical, teaching-relevant topics (e.g., lesson planning, presentation skills, grading, motivating students, etc.). Enrollment in these courses was 13 students in the Fundamentals course and 14 students in the STEP training; all enrolled students passed these courses. Analysis of course survey ratings and STEP participant journals suggested that in general, students felt that their experiences in these courses were valuable.
  - CETL offered nine workshops in spring, 2009 for the general graduate student audience. These workshops covered topics related to the academic job search, teaching, research, and options for academic career paths. Attendance for these workshops ranged from 8 to 28 participants each with a total attendance of over 200 students for the full set of workshops. Average participant ratings for the item “I would recommend this workshop to others” fell between Agree and Strongly Agree for all workshops, indicating that participants were generally satisfied with their experiences in these workshops.
  - In terms of graduate advising, graduate students have the opportunity to meet with Dr. Lydia Soleil and/or Dr. Karen Head to receive advising on pursuing a teaching career, academic job searches, and academic writing and communication. Drs. Soleil and Head advised 72 total students in 126 total sessions (many students participated in multiple advising sessions) from January – September, 2009.

- To date, three hundred seventy-one individual Georgia Tech students have been identified as having taken advantage of one or more elements of *Tech to Teaching* activities during the January-September timeframe for 2009. The database for these 371 participants includes student demographics and specific activities for each student. The ongoing program will address questions such as:
  - How does the performance of students in our database who have expressed interest in a teaching-oriented career path compare with those in the general Georgia Tech population who are pursuing more traditional pathways?
  - Are there specific identifying characteristics representative of those students at Georgia Tech who demonstrate an interest in teaching-oriented career paths?
To what degree do teaching-oriented students gain the knowledge, skills and dispositions necessary for teaching from their interactions with *Tech-to-Teaching* activities?

To what extent do students gain easy access to information about teaching careers from their interactions with *Tech-to-Teaching* activities?
2. Measuring our baseline status

The *Tech to Teaching* program aims to align and adapt the initiatives developed through various existing funded educational programs to create the necessary infrastructure on the Georgia Tech campus that will encourage and enable students to pursue, effectively and successfully, careers in college or K–12 teaching.

A central component of the assessment plan for the *Tech to Teaching* program is the establishment of baseline data concerning faculty, staff, and administrator perceptions of K–12 and collegiate STEM (Science, Technology, Engineering, and Mathematics) teaching careers prior to the implementation of the *Tech to Teaching* programmatic activities and initiatives. This initial baseline evaluation includes individual interviews, focus groups, and surveys of various constituents within the Georgia Tech community, including faculty supervising doctoral students, undergraduate advising staff, and college administrators.

Two major activities were conducted in order to establish a baseline for understanding the cultural dimensions of the *Tech to Teaching* project:

1. A series of interviews and focus group discussions with administrators was conducted in order to gauge the climate of support surrounding the various aspects of the *Tech to Teaching* project.
2. Separate surveys were conducted targeting graduate and undergraduate student advisors. These surveys gauged the advisors’ perceptions about careers in teaching. The survey also asked advisors about their perceived level of preparedness to effectively advise students interested in teaching careers.

A summary of the findings from these activities is shown below. More complete data can be found in the separate report *Tech to Teaching: Baseline Report of Perceptions of K-12 and Collegiate STEM Teaching Careers* for activities 1 and 2 (submitted under “Findings” section of the fastlane annual report).

2.a. Baseline interviews and focus groups with administration

Individual baseline interviews were conducted with the deans of the College of Computing, College of Engineering, and College of Sciences. The interviews occurred in the deans’ offices during February 2009, and each lasted approximately one hour.

Separate focus groups were also conducted with the associate deans, school chairs, undergraduate coordinators, and graduate coordinators of the College of Computing, College of Engineering, and College of Sciences. The focus groups were conducted in the Center for the Enhancement of Teaching and Learning’s (CETL) conference room during March 2009, and each lasted approximately one hour.

The purpose of this series of interviews and focus groups was to obtain initial feedback from various administrative levels with the Colleges of Computing, Engineering, and
Sciences about their perceptions of issues related to Georgia Tech’s role in preparing STEM students for teaching careers in middle schools, high schools, or post-secondary institutions where the primary focus is on undergraduate education. The discussions revolved around three main topics:

- Perceptions of careers chosen by undergraduate and graduate students in the colleges
- Resources available for students at Georgia Tech who want to learn about K-12 and higher education teaching careers
- Georgia Tech’s role in producing STEM teachers

Findings:

- Participants agree that Georgia Tech doctoral students are primarily interested in pursuing academic careers at Research Extensive institutions, although there is also the sense that doctoral students are increasingly interested in teaching careers at non-Research Extensive institutions. Explanations for this increased level of interest include perceptions of less research pressure and better work/life balance, and a desire for significant interaction with students and wanting to get undergraduate students excited about a subject they love.
- Participants agree that the primary resources available for students to learn about teaching careers include TA training, teaching practica, teaching seminars, workshops and services provided by CETL, and outreach opportunities provided by CEISMC (Center for Education Integrating Science, Mathematics, and Computing). There is, however, concern expressed by all constituencies that Georgia Tech does not provide sufficient pedagogical training for doctoral students.
- Participants agree that the vast majority of undergraduates choose careers in industry or attend graduate school, and that very few undergraduates enter Georgia Tech with an interest in pursuing a career as STEM faculty in middle or secondary schools. Factors perceived as influencing student choices include a lack of a College of Education and STEM-related education majors, and external factors such as salary, working conditions, and the degree of bureaucracy in such careers.
- Once enrolled at Georgia Tech, involvement with undergraduate teaching assistantships and involvement with CETL and CEISMC programs appear to influence students’ interest in teaching careers.
- Participants agree that Georgia Tech has a role to play in producing STEM teachers for middle and high school, but the Institute should maintain its focus on providing STEM content while ensuring pathways exist for students to pursue teacher certification programs at other colleges and universities.
- Participants are supportive of undergraduates who are interested in pursuing a teaching career, and there is consensus that Georgia Tech provides appropriate depth and breadth of content knowledge for teaching STEM content in middle and high school. While the perception is that programming opportunities provided by CETL and CESIMC are relevant and useful for students interested in such a career, there is concern that additional resources are needed to help facilitate students’ entry into STEM teaching careers.
2.b. Baseline attitudinal surveys

Separate surveys were conducted targeting graduate and undergraduate student advisors. These surveys gauged the advisors’ perceptions about careers in teaching. The survey also asked advisors about their perceived level of preparedness to effectively advise students interested in teaching careers.

2.b.i. Faculty baseline survey

Faculty members in the Colleges of Computing, Engineering, and Sciences were asked to complete a survey about their perceptions of issues related to Georgia Tech’s role in preparing STEM faculty for careers in post-secondary institutions where the primary focus is on undergraduate education. The survey addressed four main topics:

- Perceptions of the characteristics of faculty positions at institutions where the focus is primarily on undergraduate education
- Perceptions of the characteristics of Georgia Tech doctoral students who are interested in pursuing such a career
- Perceptions of the prestige level of various career paths for Georgia Tech doctoral students
- Perceptions of the faculty members’ degree of preparation for advising doctoral students about a variety of career paths

Findings:

- Among all constituents, academic careers at Research Extensive institutions are seen as the most prestigious academic career paths for doctoral students. Academic careers at baccalaureate and associate-level institutions are seen as significantly lower in prestige. While not as prestigious as a Research Extensive academic career, careers at baccalaureate institutions are seen as equally suitable for men and women, and as careers that require hard work, creativity, and a broad breadth of knowledge.

2.b.ii. Advisors baseline survey

All members of the Georgia Tech Academic Advising Network (GTAAN) also received an invitation to complete a survey addressing their perceptions of issues related to Georgia Tech’s role in preparing STEM undergraduates for teaching careers in middle and secondary schools. The survey addressed four main topics:

- Perceptions of the characteristics of STEM faculty positions in middle and secondary schools
- Perceptions of the characteristics of Georgia Tech undergraduates who are interested in pursuing such a career
- Perceptions of the prestige level of various career paths for Georgia Tech undergraduates
- Perceptions of the advisors’ degree of preparation for advising undergraduates about a variety of career paths
Findings:

- The advisors agree that undergraduates who are interested in K–12 teaching careers share a number of characteristics, such as being inspired by a teacher and wanting to get students excited about a subject that they love.
- There was overall agreement that Georgia Tech provides appropriate content knowledge for students who want to teach STEM content in the schools. Georgia Tech students who are interested in K–12 teaching careers are not seen as academically weaker than their peers who choose other careers, and the general sense is that an interest in K–12 teaching develops during their time at Georgia Tech.
- Advisors see the prestige level of teaching careers in middle and high schools as quite low, although a high school teaching career is more prestigious than a middle school teaching career.
- While advisors feel only adequately prepared to advise students about teaching careers in middle and high school, they are aware of resources such as CETL, the STEP (Student and Teacher Enhancement Partnership) program, and Beth Spencer.
- Participants are supportive of undergraduates who are interested in pursuing a teaching career, and there is consensus that Georgia Tech provides appropriate depth and breadth of content knowledge for teaching STEM content in middle and high school. While the perception is that programming opportunities provided by CETL and CESIMC are relevant and useful for students interested in such a career, there is concern that additional resources are needed to help facilitate students’ entry into STEM teaching careers.
- Undergraduate advisors feel only adequately prepared to advise students about middle and high school STEM teaching careers.

2.c. Baseline internet visibility

Prior to the start of the Tech to Teaching program, Georgia Tech websites and print material were examined to see where and how references to teaching careers were made. The website search and capture occurred in December 2008 and serves as baseline data as the Tech to Teaching program moves forward. While Georgia Tech does not offer any programs that lead to teacher certification, undergraduate and graduate students have a number of options available to explore pathways to teaching careers.

Office of the Provost: Undergraduate Studies:

Provides a link to pre-teaching advising services, including information on teacher certification requirements for the State of Georgia, routes (both traditional and alternative) to certification, and contact information for a dedicated pre-teaching advisor.

The Center for Education Integrating Science, Mathematics, and Computing (CEISMC):

Provides links to various activities in the Atlanta region related to K-12 educational opportunities, such as the CEISMC Mentoring Program, The Student and Teacher Enhancement Partnership (STEP) Program, the Teaching Assistant (TA) Development Program, and the Robert Noyce Scholars Program in Physics and Chemistry.
The Center for the Enhancement of Teaching and Learning (CETL):

Provides links to the Teaching Assistant (TA) Development Program, the Student and Teacher Enhancement Partnership (STEP) Program, undergraduate and graduate courses addressing issues related to teaching and learning, and teaching workshops open to faculty and teaching assistants.

Office of Undergraduate Admission:

The admissions office website provides information regarding pre-professional programs, including preparation for teaching careers on the web and in both print and web-based brochures and viewbooks. Additionally, students can indicate their interest in teaching careers on the undergraduate admission application. According to the Associate Provost for Enrollment Services, seven applicants for the 2009-2010 academic year indicated on their application that they were interested in a teaching career. Of those seven applicants, three were accepted and two enrolled.

Pre-teaching preparation information is also included in both guidance counselor and student admissions workshops.
3. Beginning to integrate - other grants and projects

Annual reports (or their equivalent) were collected for 22 current grants or projects with components potentially related to Tech to Teaching. These reports were studied in order to better understand their relationship and potential for integration with the Tech to Teaching project.

Project PIs were also informed of Tech to Teaching project details such that a conversation about integrating these various efforts could begin. This conversation was framed using a set of questions about how Tech to Teaching and the various grants and projects can best serve each other’s needs and create synergies advancing mutual goals.

The goals and activities for each grant or project have been catalogued. The content selected from these project reports has either been directly quoted or paraphrased for this report. Additionally, each project or grant was categorized according to five themes related to Tech to Teaching activities. These themes are described below along with the catalogued project goal information for each project within each theme. Additional details about each project (also organized by theme) can be found in Appendix A.

**Theme I: Programs designed to serve underrepresented and/or underserved populations**

The programs classified in this section have as their primary aim providing services, guidance, and opportunities to members of underrepresented and underserved populations. Specific populations served by this collection of programs include women of color in the academy, underrepresented science and engineering college students, African American high school students, and high school and college students with various types of disabilities. Through their efforts in addressing many aspects of these individuals’ experiences, these programs take a multi-faceted approach to encouraging the success of their participants.

These programs are relevant to Tech to Teaching in that the individuals reached by these programs (and specifically by aspects of these programs that connect with Tech to Teaching) may have an increased likelihood of entering into a teaching career as a result of the program content and activities. The GRADE (Georgia Tech Research on Accessible Distance Education), SciTrain, and SciTrain University programs generate online resources which should prove quite useful for Tech to Teaching participants in terms of improving their ability to provide excellent teaching to students with disabilities. Participants in the FACES (Facilitating Academic Careers in Engineering and Science) program could further increase their marketability for university jobs by taking advantage of Tech to Teaching programs designed to improve their teaching skills. Also, redundancies in workshops offered through FACES and Tech to Teaching could be eliminated, and the workload for offering these workshops could be shared by the two programs. Opportunities may exist for Tech to Teaching participants to interact with K-12 students through the BEAT (Building Engineering Achievement in Transportation) the Traffic Two program.
1. ADVANCE Leadership Award: Cross-Disciplinary Initiative for Minority Women Faculty (PI Transfer) (2009 Annual Report)

Project Focus/Goals

- To identify and address the unique challenges facing women of color in the academy…to direct innovative approaches to study and provide professional development and socialization opportunities for women of color.
- Overall, our Cross-Disciplinary Initiative for Minority Women Faculty, through its thorough integration of research (conducted by PIs and students), professional development, socialization, education and outreach activities will contribute to 1) the success and advancement of minority women faculty in science and engineering, 2) the training of researchers who can work at the interface between social science and science and engineering and 3) the body of knowledge on underrepresented minority women in STEM.


Project Focus/Goals

- FACES is comprised of several components, each designed to assist underrepresented engineering and science students with navigating the path to an academic career; these components include research experiences, graduate school recruitment efforts, and lectures and workshops on graduate education and academic careers.
- Funding provided for participants in the project includes doctoral fellowships, travel expenses, and start-up funds for new PhDs.


Project Focus/Goals

- The overarching goal of the BEAT program is to promote STEM achievement in the primarily African American schools in south Fulton County through the use of classroom activities in STEM courses, implementation of a rigorous engineering course sequence, and student and teacher research internships at Georgia Tech. All program activities will be focused on Transportation Engineering, in the fields of traffic modeling and in the structural and geophysical engineering of transportation infrastructure.
- The real-world applicability of transportation issues makes it an ideal avenue for introducing science and engineering concepts to middle and high school students.
4. *Georgia Tech Research on Accessible Distance Education (GRADE) (2007 Annual Report)*

**Project Focus/Goals**

- The project goals relate to improving issues related to distance education; the goals fall into three distinct areas: professional development, barrier removal, and outreach through the Multimedia Educational Resource for Learning and On-Line Teaching (MERLOT).


**Project Focus/Goals**

- SciTrain is dedicated to improving knowledge and practice in the field of disability education. Its activities are designed to work together to generate research data on the needs of STEM teachers, create training modules based upon that research, evaluate the effectiveness of the research, and then disseminate training and research data. SciTrain’s evaluation activities are essential to creating a baseline of teacher knowledge about accessible STEM. This is being accomplished through its ongoing evaluation research, including focus groups, longitudinal studies, online surveys and related work.


**Project Focus/Goals**

- To provide STEM instructors with effective training, resources, and incentive for making reasonable accommodations to in-person courses, labs, online and hybrid courses.
- Online resources will be developed in order to inform stakeholders about the barriers that students with disabilities face in their STEM educations and provide information about strategies to remove those barriers in order to improve access.
- Instructors in high-impact courses will be trained through workshops and online modules.
- After initial local efforts (at GT and UGA [University of Georgia]), all materials will be made available online so that a national audience can be reached.

**Theme II: Programs whose goal is to either develop/train K-12 teachers, or provide a K-12 teaching experience to college students**

The programs falling under this category work to provide either training/development opportunities for current K-12 teachers, or immersion experiences in K-12 teaching for college students. These programs provide valuable experiences for both the teachers and college students participating in them, but also for the students being taught. The mission of these programs overlaps most clearly with the goals of *Tech to Teaching*. Specifically,
participation in STEP (Student and Teacher Enhancement Partnership) can provide Tech to Teaching participants with a real-world teaching immersion experience which may solidify or eliminate their desire to pursue teaching (both of which are worthwhile outcomes). Tech to Teaching participants who have decided to pursue a career in K-12 teaching may find that the incentives offered by the Noyce Scholarship program allow them to gain teaching certification without facing financial hardship. Some redundancies in training offered by Tech to Teaching and these programs could potentially be eliminated by combining some programming. Individuals who want to pursue teaching further after a positive experience in STEP or should be referred to the Tech to Teaching Program.

7. GIFT (Georgia Intern-Fellowships for Teachers) (Summer, 2009 Data)

Project Focus/Goals

- Provide industry and university mentors an efficient method of identifying and selecting teachers interested in participating in internships.
- Quickly orient teachers to business and university work environments, and mentors to K-12 workplace culture.
- Provide participants (teachers and mentors) support throughout the summer by assigning small groups of teachers to a master-teacher facilitator.
- Assist teachers with creating an Action Plan for implementing summer experiences into the classroom or more generally applying the GIFT experience in the classroom.
- Provide support for Action Plan implementation in the classroom through visits by GIFT staff.
- Foster the development of an extended professional community of learners.
- Encourage extended partnerships for communication and collaboration between teachers, industry and university mentors and pass that approach on to the students of the GIFT teachers.


Project Focus/Goals

- Two-year scholarships are being provided to thirty-two science and engineering students majoring in fields that may lead to either chemistry or physics certification. The students will be receiving annual $10,000 scholarships during their senior year and subsequent enrollment in the fifteen month chemistry and physics Master of Arts Teaching program.
- The project is serving as a model for two institutions of distinctly different cultures (one a university with a strong education school, the other a technological university) to join forces to create an exemplary program that is producing effective grades 6 - 12 chemistry and physics teachers. Project features include the initiation of a twelve credit hour educational course sequence at Georgia Institute of Technology, the close working relationships of the universities with school systems serving the greater
Atlanta area, and the K-12 teaching experience of the science education faculty.
[quote taken from NSF website]

*please note that STEP Up! is a phase II continuation of the STEP program, and for this reason STEP Up! is generally referred to simply as “STEP” on the GT campus. Therefore, in this report the STEP Up! program is generally referred to as “STEP”.

Project Focus/Goals

- The STEP Up! (Student and Teacher Enhancement Partnership) program aspires to institutionalize K-12 teaching internships as a valued component of graduate and undergraduate education and to continue working to help create a university campus climate that encourages the active participation by students and STEM (Science, Technology, Engineering, and Mathematics) faculty in the challenges of K-12 education. The program partners undergraduate and graduate student Fellows with metro-Atlanta area high school science or mathematics teacher-coordinators to enhance both the math and science education in the high schools and the educational experiences of the student Fellows.

Theme III: Programs which are primarily research-oriented but provide research opportunities to K-12 teachers and/or students

The programs classified in this section are primarily synergistic due to the partnerships they create between Georgia Tech and K-12 institutions. The purpose of a number of these programs is to enhance the content knowledge and research process skills of teachers and/or students in the K-12 system. However, by working together to determine how this knowledge (and skills) translates into the classroom, students involved in these projects gain insight into K-12 teaching careers and Georgia Tech faculty will be able to better advise students about K-12 STEM efforts and connect these students with individuals already in the K-12 system.


Project Focus/Goals

- This IGERT program is focused on the creation of a training environment that combines cellular and systems neuroscience with microelectronics/computing technology and microelectromechanical systems (MEMS). The novel combination of disciplines will result in a program whose intellectual merit is embodied in the development and application of systems that integrate neural tissue and engineered components. Research applications range from enhancing knowledge of living organisms, to augmenting damaged neuronal tissue, to creating biologically-inspired engineered systems. The participating faculty members have a strong track record of interdisciplinary education and research that has laid the foundation for this effort.
The IGERT program will build upon this foundation through a combination of educational infrastructure and interdisciplinary research opportunities that will facilitate the training of IGERT fellows, who will emerge from the program as a new breed of scientist-engineer that understands and can apply knowledge that crosses these two, previously disparate disciplines. [quote taken from igert.org]


Project Focus/Goals

- Our IGERT program integrated ecology, chemistry, sensory biology and small scale physics of flow (hydrodynamics) to understand how marine and freshwater organisms communicated chemically and how these chemically-mediated interactions structured populations and organized communities.


Program Focus/Goals

- We will provide teachers with a high quality research project in nanoscale science and engineering, assist them in understanding the education and career opportunities in STEM and nanotechnology so that they can relate these opportunities to their students, and assist the RETs (Research Experience for Teachers) in introducing nanotechnology into their science classroom.

Theme IV: Programs designed to investigate and implement innovative pedagogical techniques

The projects classified in this category give students working with faculty members on these project very strong opportunities for both theoretical and experiential learning. Depending upon the project, this knowledge is relevant to the K-12 arena, higher education, or both.

Additionally, these projects provide excellent opportunity for Tech to Teaching programming to provide students who may be working on these projects with background knowledge needed to be successful in working on the project. Courses and workshops specifically addressing the needs of these programs should be an integral part of the ongoing content development effort for the CETL courses and workshops (described below in section 3).

Project Focus/Goals

- The question that this project addresses is whether the new online publishing paradigm represented by Wikis can be successfully leveraged for science education? In this research, collaborative software that extends Wiki technology to support science learning by high-school students will be created. Students will learn about science content and method by collaboratively researching and writing about controversial science topics, supporting their writing with strong citations, and publishing their writing on the Internet. [quote taken from NSF website]


Project Focus/Goals

- This project seeks to provide a laboratory-like experience in ECE courses which do not have a lab component. Low-cost, portable experiments are designed to be conducted in the classroom or at students’ homes. A center, The Center for Teaching Enhancement using Small-Scale Affordable Labs (TESSAL), was initiated for this project.


Project Focus/Goals

- This project is a partnership between research teams at Georgia Tech and Rutgers University. The two teams collaborate on most project functions, with GT taking the lead in the development of learning technologies and Rutgers taking the lead in implementing and evaluating the technologies.


Report Focus/Goals

- The purpose of this report is to catalyze a conversation within the U.S. engineering community on creating and sustaining a vibrant engineering academic culture for scholarly and systematic educational innovation—just as we have for technological innovation—to ensure that the U.S. engineering profession has the right people with the right talent for a global society.

17. Middle School Science Curriculum Materials: Meeting Standards and Fostering Inquiry through Project-based Inquiry Science Units (2009 Annual Report)
Project Focus/Goals

- Project goals: Our goals for this project were to integrate project-based inquiry curriculum units for middle school science that were developed in three different places into a full three-year comprehensive project-based inquiry middle school science curriculum.


Project Focus/Goals

- This project entails an investigation of a design-based science pedagogy. While attempting to understand the design challenge, and perhaps during first attempts to achieve the challenge, students identify the science content they need to apply for success, and they move between learning that content and applying it to achieve the design challenge. In the best of enactments of a design-based approach, learning is active, expertly facilitated by the teacher, and includes a variety of opportunities for publicly articulating science understanding, debating understandings, explaining phenomena, and debugging those explanations.
- Technology-based goals: to understand (i) the functions simulation and modeling software should have when integrated with physical design, building, and testing that will promote better science learning in the context of design and build activities and (ii) guidelines for designing the interactions between learners and the software for ease of use and to promote personal connections and curiosity among learners.
- Learning-based goals: to understand which practices for interleaving physical design and testing with computer simulation, modeling, and explanation scaffolding will result in deep science learning among more learners participating in design-based learning.
- Efforts focused on middle-school (grades 6-8) learners.


Project Focus/Goals:

- In this project, we’ve been seeking to see how development of scientific reasoning happens in a learning environment in which nearly all of the practices important to transferable learning (see, e.g., Bransford et al., 2000) are carried out. This literature tells us that practices that engage students actively in focusing attention on critical issues, features of problems, abstractions and principles, and evaluating their own understanding, are important to promoting transferable learning, and that learners need repeated deliberative practice of targeted skills and using targeted content to learn well. Learning by Design [the classroom curriculum developed as part of this project] provides enactments of Project-Based Inquiry that carry all of these out. We
sought to find out what typical paths of that development look like under these circumstances and what effects those paths.

**Theme V: Programs aimed to increase interest and involvement in certain content areas**

The programs placed in this category are both related to computing. However, the general concept of addressing STEM fields applies. These projects provide opportunities for students to participate in outreach activities where formally planned teaching and learning experience are integral to the effort. These programs would benefit tremendously from using students who participate in *Tech to Teaching* activities as part of the research and outreach teams because of the knowledge these students possess about how the target audiences may be likely to interact with the materials. The *Tech to Teaching* project can provide the highest level of benefit if elements of the programming are designed to specifically address the needs of these programs and these connections are made explicit during the delivery of these content elements.


**Project Focus/Goals**

- The Using Media Computation to Attract and Retain Students in Computing project is using research on why women have avoided computing to develop an alternative path to introductory computing…This project is developing a course which is presenting the same concepts as found in typical introductory computing courses, but it is using new examples based on media computation…The media computation approach is proving to be particularly successful at attracting and retaining women, and at motivating non-CS [Computer Science] majors to succeed in computing. It is creating a path to computing that appeals to a broader group of students. Initial results are indicating that students on this path are achieving the same learning and performance levels as those on traditional paths. Ultimately, greater diversity in computing will result in a more technologically literate and globally competitive citizenry. [quote taken from NSF website]


**Project Focus/Goals**

- To improve the quality of computing education throughout the pipeline and across the state, and in so doing, broaden and increase the flow of qualified students in undergraduate and graduate computing programs.
Additional Programs: programs useful for informing the implementation and evaluation of *Tech to Teaching*

These types of programs provide useful context for the *Tech to Teaching* team in designing and implementing all levels of programming. In addition, *Tech to Teaching* itself may be studied by programs such as these, to the mutual benefit of both parties.


Project Focus/Goals

- This project involves researchers from the School of Public Policy and the Center for Education Integrating Science, Mathematics, and Computing (CEISMC).
- The objectives of this research project are:
  - To review how partnership performance is evaluated in the STEM educational community and also in a variety of other settings drawn from other policy contexts, industry, and not-for-profits; and
  - To develop and test a model exploring how degrees of embeddedness among partners influence the process by which STEM educational outcomes are pursued and achieved.

New Programs with opportunities for integration with *Tech to Teaching*

Several new programs have begun at Georgia Tech since the inception of the *Tech to Teaching* Program. These programs have been able to take direct advantage of available programming and thus begin with an integrated perspective from the outset.

1. *Chemistry Graduate Assistance in Areas of National Need (GAANN)* grant

The PI on this grant stated that they emphasized the availability of *Tech to Teaching* programs and resources for the GAANN participants.

Project Focus/Goals

This program provided fellowships, through academic departments and programs of IHEs [Institutions of Higher Education], to assist graduate students with excellent records who demonstrate financial need and plan to pursue the highest degree available in their course study at the institution in a field designed a an area of national need.

2. *Noyce: Increasing Mathematics Teachers for ALL Students (IMTAS)*

Project Focus/Goals

This project is recruiting, preparing and retaining 36 teachers of secondary mathematics for high needs areas of diverse populations. Junior and senior level students are recruited
primarily from GT and KSU (Kennesaw State University). These recruits then enter KSU’s Master of Arts in Teaching degree program for mathematics education. This program is designed to increase the number of teachers for high needs areas, and instructs teachers specifically in how to work with students for whom English is a second language.

3. Noyce: Impacting Metro-Atlanta Science Teaching (I-MAST)

This project is a collaboration between Georgia State, Georgia Tech, and four high-need school districts.

Project Focus/Goals

I-MAST is addressing the critical need for high quality science teachers who are prepared for and committed to teaching in Metro Atlanta High-need school districts. I-MAST Robert Noyce Scholars are being recruited and selected from the pool of STEM majors from Georgia State and Georgia Tech to pursue secondary science teacher certification via a 5-year Master of Arts in Teaching (MAT) Science program at Georgia State; selection criteria ensure the participation of underrepresented groups. Twenty-four of these STEM undergraduate majors are receiving 2-year scholarships in their senior year of undergraduate studies and their first year of teacher certification studies.

Conclusions regarding integration

The projects presented in this report are widely varied and do not directly overlap in any consistent manner. However, an overarching theme of improving the educational experience of some type of students is apparent in each project. Many projects target student groups that can often be overlooked, such as students with disabilities or lower-income students. Others seek to promote content areas that may not be readily accessible to large groups of students, such as computing and engineering. Implementation of an innovative pedagogical technique, such as design-based and project-based learning, lies at the root of several projects. Despite the large variability in their methods and areas of focus, these projects do indeed share a common thread of seeking to improve the educational experiences of students.

A major goal of Tech to Teaching is to integrate multiple extant projects so that all can be run more efficiently and effectively. Several examples of integration that have already occurred including:

- The Teaching SURE (Teaching Summer Undergraduate Research Experience) program (a major component of Tech to Teaching which is presented in detail in section 3.c.i.) has already completely integrated the GIFT and several other RET site grants under the Tech to Teaching umbrella to ensure that the students are in labs with teachers present.
- The FACES practicum (this program is described under Theme I above) has merged with the Tech to Teaching practicum.
• Several grant proposals which were submitted in fall 2009, but have not yet received notification about whether they will be funded, have incorporated elements of Tech to Teaching directly into their proposals.

The additional varied projects described above present numerous opportunities for integration with Tech to Teaching. Developing effective mechanisms to accomplish this integration is the next step. A discussion with PI’s for approximately 12 of these projects held in November 2009 produced the following suggested integration mechanisms:

• Oprimize delivery of training for students participating in the various programs by eliminating redundancies in provision of training across campus.
  • Seek opportunities for students in related programs to receive some of their training through Tech to Teaching courses and workshops, especially if this delivery can occur with some customized content modules for the specific programs.
  • Investigate customization of Tech to Teaching content that might explicitly tie existing content to specific projects such that students can clearly make the necessary connections between the training and their particular project.
• Increase visibility of communication to students and faculty about Tech to Teaching.
  • Get the word out about Tech to Teaching activities to students already participating in outreach programs such as those with K-12 students. These student populations may likely be strong target audiences who might have an interest in teaching as a career (or an interest improving their teaching).
  • Encourage the development of a pre-teaching student organization.
• Hold a forum for faculty to discuss Tech to Teaching programs.
• Set up opportunities for interaction between GT faculty and faculty from other types of institutions.
• Create a website/resource list of all campus/community teaching-oriented activities.
• Encourage Tech to Teaching participants to link into other projects which entail opportunities for interaction with K-12 students.
4. Activity-specific reporting

The *Tech to Teaching* programming umbrella contains five main elements – four of which occur in a sequential order, with the other occurring throughout. Each of these elements contains a set of activities to help students move along the trajectory towards a teaching career. The five elements are advising, coursework, mentoring, immersion, and induction into the community. These elements are displayed in Figure 1.

Figure 1: *Tech to Teaching* activities ladder

* P.L.C. stands for Professional Learning Community

Substantial progress has been made in producing the infrastructure represented in Figure 1, and the project is ahead of the timeline included in the initial submission of the grant proposal (see Table 1). The pieces ahead of schedule include:

- a pilot offering of CETL 8001 in spring rather than in fall of year 1, leading to the decision to split the course into two pieces,
- a second offering of the first piece of CETL 8001 (course design and teaching for higher education) in fall of year 1,
- a pilot of CETL 8002 (mentored practicum), actually delivered as two separate single credit courses (one for the “doing” and one for “reflection”),
- the delivery of several academic job search workshops in year 1,
• a year 1 cohort of 9 REU (Research Experience for Undergraduates)/RET (Research Experience for Teachers) students (the year 2 target number) rather than 6 (the year 1 target number).

Table 1: Tech to Teaching proposal timeline

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sp</td>
<td>Sun</td>
<td>F</td>
<td>Sp</td>
<td>Sun</td>
</tr>
<tr>
<td>9001</td>
<td>Dev</td>
<td>Dev</td>
<td>Offer</td>
<td>Offer</td>
</tr>
<tr>
<td>9002</td>
<td>Dev</td>
<td>Dev</td>
<td>Dev</td>
<td>Offer</td>
</tr>
<tr>
<td>9003</td>
<td>Dev</td>
<td>Dev</td>
<td>Dev</td>
<td>Offer</td>
</tr>
<tr>
<td>Ac Job</td>
<td>Dev</td>
<td>Dev</td>
<td>Dev</td>
<td>Offer</td>
</tr>
<tr>
<td>Fac Dev</td>
<td>Dev</td>
<td>Dev</td>
<td>Dev</td>
<td>Offer</td>
</tr>
<tr>
<td>TS-GS</td>
<td>Dev</td>
<td>Dev</td>
<td>Dev</td>
<td>Offer</td>
</tr>
<tr>
<td>TS-IO</td>
<td>Dev</td>
<td>Dev</td>
<td>Dev</td>
<td>Offer</td>
</tr>
<tr>
<td>2001</td>
<td>Offer</td>
<td>Offer</td>
<td>Offer</td>
<td>Offer</td>
</tr>
<tr>
<td>2002</td>
<td>Offer</td>
<td>Offer</td>
<td>Offer</td>
<td>Offer</td>
</tr>
<tr>
<td>RET/RET</td>
<td>Offer</td>
<td>Offer</td>
<td>Offer</td>
<td>Offer</td>
</tr>
<tr>
<td>Retreat</td>
<td>Offer</td>
<td>Offer</td>
<td>Offer</td>
<td>Offer</td>
</tr>
</tbody>
</table>

Definitions:
8001: Three credit course to be offered through CETL for doctoral students about course design and teaching in higher education settings
8002: Three credit course to be offered through CETL for participants in the mentored teaching practicum
8003: 1 credit course to be offered through CETL for participants in the Faculty Internship program
Ac Job: Workshops on the academic job search
Fac Dev: Materials and professional development for faculty advisors and mentors to assist them in the job of advising students interested in academic careers
TS-GS: T-Square site for graduate students in the program and for a community after graduation
TS-IO: T-Square site for faculty advisors and mentors for a repository of materials and a community for sharing ideas and practices
4001: Existing 3 credit course offered through CETL about educational practices and theory for students interested in pursuing teaching in the K-12 arena
4002: Existing 3 credit course offered through CETL about applying theory in the K-12 classroom, includes 6 hours/week internship in a school
RET/RET: Placement of undergraduate students into labs where teachers are carrying out an RET experience, providing a research experience while being mentored by a master teacher
Retreat: A retreat for new teachers
Dev: Develop new courses/materials/workshops
Offer: Offer the courses/materials/workshops
Offer 2: Offer two sections of the course
[Courses and workshops and materials will be regularly reviewed and revised based on feedback and review.]
69912: Number of students in RET/RET teaching program

Current progress towards implementing activities supporting each of these five elements is described in detail in the sections below.

4.a. Advising

At both the undergraduate and graduate levels, advising activity has already risen to a substantial level. Currently, all tracked advising activity related to Tech to Teaching occurs through positions under the CETL umbrella and in the Office of Undergraduate Studies.

4.a.i. K-12 pathway advising

Undergraduate advising activity begins with information sessions at events for potential and for new students at Georgia Tech. This includes information pamphlets and/or a staffed booth at career fairs and orientation types of events. Students are also directed to the undergraduate advisor via a check-box on the GT application form indicating areas of potential career interest. Tens of students checked this box in the 2009 application cycle,
while only one single student had checked the box in the previous year, indicating that the outreach efforts described above are having an impact.

Beth Spencer (Office of the Provost: Undergraduate Studies) provides advising for undergraduate students, graduate students, and alumni who are interested in pursuing a teaching career and/or seeking advice about their teaching-related job searches. Interestingly, over 40 additional advising sessions were conducted in the month of October, indicating a continued increase in student utilization of this resource.

Table 2: Undergraduate advising count for January – September, 2009

<table>
<thead>
<tr>
<th>Advisor</th>
<th>Total # of Unique Students</th>
<th>Total # of Sessions (students may have more than 1 appt.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beth Spencer</td>
<td>177</td>
<td>239</td>
</tr>
</tbody>
</table>

4.a.ii. Higher Education pathway advising

Graduate advising activity stems from the utilization of communication channels arising from established relationships between CETL and various departments on campus regarding teaching assistant preparation. This has occurred since 2006 through a set of departmentally embedded courses that were designed with the assistance of CETL and jointly (or completely in a few cases) conducted by CETL for specific departments. This activity has now expanded to include general graduate professional development activities under the umbrella of the Tech to Teaching program.

Dr. Lydia Soleil provides advising for graduate students who are interested in pursuing a teaching career and/or seeking advice about their academic job searches. She also provides observations and reviews for graduate student instructors. Dr. Karen Head provides advising regarding graduate student academic writing and communication.

Table 3 shows the advising activity for Drs. Soleil and Head between January and September, 2009. Increasing demand for graduate advising services has led to a two-week scheduling delay, prompting discussions concerning appropriate resource allocation. This dramatic and unexpectedly high student utilization of this resource indicates that the Tech to Teaching program is satisfying a significant need within the community of students seeking teaching positions in higher education.

Table 3: Graduate advising count for January – September, 2009

<table>
<thead>
<tr>
<th>Advisor</th>
<th># of Students</th>
<th># of Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Lydia Soleil</td>
<td>29</td>
<td>43</td>
</tr>
<tr>
<td>Dr. Karen Head</td>
<td>43</td>
<td>83</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>126</td>
</tr>
</tbody>
</table>

Specific advising contacts were also recorded based on the students who participated in the pilot graduate course covering principles of teaching and learning. Of the 13 students
who enrolled in CETL 8803 (spring 2009 course) the following advising interactions occurred:

- Five letters of recommendation were requested from the instructor.
- One student informed the instructor when they secured a tenure-track job starting in fall 2009.
- One student informed the instructor about starting a teaching position in Thailand next fall (however, this was pre-determined before the student came to grad school).
- Two students requested information and continued on with practicum experiences for fall 2009 and those same 2 will participate in immersion experiences next fall.
- Two students requested information and participated in pseudo practicums in chemistry during the summer of 2009.
- Specific consultations were conducted with:
  - 5 of the students on their teaching philosophies,
  - 2 on their CVs,
  - 2 on their cover letter,
  - 1 on academic job search strategy.

4.b. Coursework

The content delivery components of the Tech to Teaching project are housed within CETL. These components include both for-credit courses and regular workshops delivered as an informal seminar series. The coursework and workshops form an important element of both the K-12 and higher education pathways of Tech to Teaching.

4.b.i Summary of course & workshop development process

For the K-12 pathway, the undergraduate courses CETL 4001 and 4002 form the backbone of the content delivery. These courses had been offered for several years prior to the Tech to Teaching project and were thus already established. However, they were not connected to campus-wide activities and remained somewhat isolated from the larger picture of the K-12 career pathway. With the Tech to Teaching project now underway, these courses are being adapted to serve the needs of the larger program. Recent efforts have focused on integrating these courses into student pathways towards MAT degrees with partner schools (in particular Kennesaw State University and Georgia State University).

For the higher education pathway content has had to be built from scratch. The Preparing Future Faculty program was used as a starting point for developing these content courses, and L. Dee Fink’s book “Creating Significant Learning Experiences”, which targets course design at the higher education level, was integrated into course offerings to enhance the course design component.

The original proposal for Tech to Teaching included one course (CETL 8001) to address principles of teaching, learning, and course design. This was offered as a pilot in spring,
2009. However, it was determined that a single course was not sufficient to address all the issues needed for a strong student learning experience. Therefore, it was decided that the course should be broken into two components – one for the fundamentals of teaching and learning, and one for course design. The piece addressing fundamentals of teaching and learning is currently being offered in fall, 2009.

Finally, these courses in the principles of teaching and learning for the higher education pathway have been incorporated into a newly planned two level “Certificate Program” for Tech to Teaching. These certificate programs will provide formal recognition to students who complete either a specific subset of the elements represented in the Tech to Teaching ladder (see the ladder in Figure 1 above) or the entire set. The coursework in the principles of teaching and learning represented by these courses forms a substantive and easily quantifiable component of the certificate requirements.

The following description of the Tech to Teaching certificate program is taken directly from Tech to Teaching website:

**Teaching**

*Tech to Teaching* is meant to be flexible, so individuals can progress through the program using different combinations of CETL options and departmental options based on career goals, home department issues, and other factors. There are two levels where the students will receive recognition: completion of the first three steps (Level A), or completion of all five steps (Level A and B). Each step builds on the previous steps, and students can proceed at the pace and to the level that they desire.

**TECH TO TEACHING LEVEL A**

**Step 1: Introductory experience**
Two terms as a college-level TA for a laboratory and/or recitation section at Tech and/or elsewhere or the equivalent. This excludes assignments as a "grader" or equivalent with the sole responsibility of only grading and holding office hours.

CETL options are being developed for students who do not have the opportunity to TA in their home department at Tech.

**Step 2: Foundational Course: CETL 8802TL: Foundations of Teaching & Learning (2 units)**
This course is intended for graduate students who are planning academic careers and want to learn how to improve college students' learning. This course focuses on the knowledge and skills necessary for effective classroom instruction and management in higher education, including educational psychology, lesson planning, and delivery techniques.

*Prerequisite:* Two terms as a college-level TA for a laboratory and/or recitation section at Tech and/or elsewhere or the equivalent. This excludes assignments as a
"grader" or equivalent with the sole responsibility of grading and holding office hours.

NOTE: Students who have already done a practicum (Step 3) are eligible to take 8802 TL.
In the future, schools may offer an equivalent discipline-specific course.

**Step 3: Mentored Practicum/Shadowing (3 units)**
Coming in spring, 2010

Students will work with a faculty mentor at Georgia Tech to gain an inside view of the practicalities of teaching. They will have the opportunity to teach mini-lessons or full class periods, do other teaching-related tasks (e.g. writing homework or exam questions), get feedback on their performance from various sources, and discuss various aspects of teaching with their mentor. Options at Tech include working with a mentor in the student’s home department or with a GT 1000 instructor. Students can get advice from CETL on how to initiate a practicum experience with a faculty mentor at another local institution.

*Prerequisite:* CETL 8802 TL or CETL 8712 (STEP summer course).

NOTE: Students who have already done a practicum (Step 3) are eligible to take 8802 TL (Step 2).

**TECH TO TEACHING LEVEL B**

**Step 4: Advanced Course: CETL 8802CD: Course Design for Higher Education (2 units)**
Details coming in fall, 2010.

Prerequisite: 8802TL

NOTE: Students who have completed the STEP Program are eligible to take 8802CD.

**Step 5: Mentored Immersion Experience (solo instructor of record) – 1 unit**
Students will teach their own course with the support of an assigned mentor. Options at Georgia Tech may include teaching in home department or teaching the GT 1000 Freshman Seminar. Students may also have the opportunity to be the instructor of record in a class taught at one of our partner institutions: Georgia Perimeter College and Spelman College.

Below, the results from both the K-12 and higher education pathway course offerings from spring and summer are discussed.
4.b.ii. CETL courses

CETL offered a total of four courses, two at the undergraduate level and two at the graduate level, during the spring, 2009 and summer, 2009 semesters. Course offerings were:

- CETL 4001: Principles of Learning and Teaching I
- CETL 4002: Principles of Learning and Teaching II
- CETL 8711: STEP Summer Training (modified from an existing course in order to better meet the needs of Tech to Teaching)
- CETL 8803: Fundamentals of Teaching, Learning, and Course Design (newly developed course)

The content and experiences provided by these courses serves to satisfy two of the major Tech to Teaching objectives outlined in the grant:

- Goal #1, Objective 1: “provide students with easy access to information about teaching careers”
- Goal #2, Objective 1: “students will possess the knowledge, skills, and dispositions necessary for teaching”

Total enrollment in these four courses was 66 students, and all 66 of these students passed their respective CETL courses. These students found their instructors in these courses to be highly effective, with interpolated median scores on the course survey item pertaining to overall instructor effectiveness ranging from 4.6 to 5.0 (on a 5.0 scale) for all four CETL courses. These figures are broken out by course in Table 4.

Table 4: CETL course enrollment, pass rates, and instructor effectiveness ratings

<table>
<thead>
<tr>
<th>Course Title</th>
<th># Students Passing Course</th>
<th>Rating for “Effective Instructor” Item (on a 1-5 scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CETL 4001: (spring, summer, 2009)</td>
<td>28/28 (spring) 8/8 (summer)</td>
<td>4.7 (n=11)</td>
</tr>
<tr>
<td>CETL 4002: (spring, 2009)</td>
<td>3/3</td>
<td>4.8 (n=3)</td>
</tr>
<tr>
<td>CETL 8803 (spring, 2009)</td>
<td>13/13</td>
<td>4.6 (n=11)</td>
</tr>
<tr>
<td>CETL 8711 (summer, 2009)</td>
<td>14/14</td>
<td>5.0 (n=1)</td>
</tr>
</tbody>
</table>

Detailed information about each of the courses in terms of enrollment, grades, content, structure, evaluation methods, course ratings, and means by which the Tech to Teaching objectives were achieved is provided below.

4.b.ii.1. K-12 pathway CETL courses

CETL 4001: Principles of Learning and Teaching (offered spring & summer, 2009)

- Basic educational psychology course
• Accepted by Kennesaw State University as partial fulfillment of MAT program requirements (subject to a test on the content)

• **Addresses the Tech to Teaching objective that “students will possess the knowledge, skills, and dispositions necessary for teaching (Goal #2, Objective 1)” by:**
  1. Providing information on a wide range of educational issues and theories:
     o Development of Cognition and Language (including Piaget and Vygotsky)
     o Personal, Social and Emotional Development
     o Learner Differences (including intelligence, SES, culture, and gender)
     o Learners with Exceptionalities
     o Behaviorism and Social Cognitive Theory
  2. Developing multiple skills through course activities and assignments:
     o Testing of knowledge gained in course with a midterm and final exam
     o Students asked to think critically about and reflect on course content in a weekly journal as well as an educational philosophy reflection paper
     o Students encouraged to investigate their own interests with a current issues paper on an educational topic of their choice
     o Presentation skills developed and assessed with an in-class presentation on the current issue topic

• Twenty-eight students completed this course during spring, 2009
  o Two students withdrew from this course.
  o Of those 28 students who completed the course, 26 (93%) earned As and two (7%) earned Bs.

• Eight students completed this course during summer, 2009.
  o One student withdrew from this course.
  o Of those eight students who completed the course, seven (88%) earned As and one (12%) earned a B.

Note: More detailed information on course assignments and evaluations is located in Table 7.

• Course evaluations:
  o Spring, 2009: fifteen of the 28 students who completed this course responded to the Course Instructor Opinion Survey (CIOS).
    ▪ This instructor earned high ratings across all items, with interpolated median scores (based on responses from 15 students) ranging from 4.4 to 4.9. For the two items most relevant to Objective 1 for Goal #2, ratings were high: students gave an interpolated median response of 4.4 to “Good job covering course objectives/content” and a response of 4.6 to “Explained complex material clearly.” Furthermore, no students disagreed or strongly disagreed with either of these items.
    o Summer, 2009: none of the students responded to the CIOS.
• Pre-test and Post-test item categories:
  o A test covering principles of teaching and learning was given to students at the beginning and again at the end of the course. Item content categories and number of items within each category are shown in Table 5.

Table 5: Item categories and counts within each category

<table>
<thead>
<tr>
<th>Item Category</th>
<th># Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>A sociocultural view of development: The work of Lev Vygotsky</td>
<td>1</td>
</tr>
<tr>
<td>Behaviorism - operant conditioning</td>
<td>4</td>
</tr>
<tr>
<td>Characteristics of beginning teachers</td>
<td>1</td>
</tr>
<tr>
<td>Effective instruction for students placed at risk</td>
<td>1</td>
</tr>
<tr>
<td>Effects of ability grouping</td>
<td>1</td>
</tr>
<tr>
<td>Information processing</td>
<td>1</td>
</tr>
<tr>
<td>Language development</td>
<td>1</td>
</tr>
<tr>
<td>Learner diversity - gender, culture, intelligence and SES [socioeconomic status]</td>
<td>4</td>
</tr>
<tr>
<td>Personal, social and moral development (Erikson &amp; Kohlberg)</td>
<td>4</td>
</tr>
<tr>
<td>Piaget's theory of intellectual development</td>
<td>3</td>
</tr>
<tr>
<td>Provisions of IDEA</td>
<td>3</td>
</tr>
<tr>
<td>Types of professional knowledge</td>
<td>1</td>
</tr>
<tr>
<td>Types of research</td>
<td>2</td>
</tr>
<tr>
<td>Working with learners with exceptionalities</td>
<td>2</td>
</tr>
<tr>
<td>Total: 29</td>
<td></td>
</tr>
</tbody>
</table>

• Pre-test vs. Post-test performance comparison:
  • Changes in % correct were analyzed to assess the extent of student learning on these items. Please note that the most recent data available for the pre- and post-test comparison is from fall, 2008 and as such is not necessarily representative of either of the student groups described above.
  • Of the 29 items, 6 were excluded from further analysis because the % correct on these items in the pre-test was 75% or higher.
  • The remaining 23 items can be summarized as follows:
Table 6: Items categorized by % change from pre-test to post-test

<table>
<thead>
<tr>
<th># items</th>
<th>Nature of change in % correct from pre-test to post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Increase of 25-75 percentage points</td>
</tr>
<tr>
<td>5</td>
<td>Increase of 5-24 percentage points</td>
</tr>
<tr>
<td>1</td>
<td>No change</td>
</tr>
<tr>
<td>4</td>
<td>Decrease of 10-17 percentage points</td>
</tr>
</tbody>
</table>

CETL 4002: Principles of Learning and Teaching II (offered spring, 2009)

- Continuation of CETL 4001
- Course has a lecture component as well as a three hour/week in-school teaching program
- Accepted by Kennesaw State University as partial fulfillment of MAT program requirements
- Addresses the Tech to Teaching objective that “students will possess the knowledge, skills, and dispositions necessary for teaching (Goal #2, Objective 1)” as well as the objective to “provide students with easy access to information about teaching careers (Goal #1, Objective 1)” [note: summer internship programs will serve to further address these objectives] by:
  1. Providing information on practical issues related to teaching:
     - Motivating students
     - Classroom management
     - Curriculum development
     - Instructional strategies, including:
       - Direct instruction
       - Lecture
       - Lecture discussion
       - Guided discovery
       - Cooperative learning
       - Technology integration
  2. Allowing students to gain real-world teaching experience with three hours per week in a classroom
  3. Assessing course outcomes in several ways:
     - Mastery of course knowledge assessed with midterm and final exams
     - Knowledge and skills gained through in-school teaching experience assessed with a field experience case study
  4. Continuing in the delivery of information covered in the Georgia Assessments for the Certification of Educators® (GACE™) Professional Pedagogy exam
- Three students completed this course during spring, 2009.
  - One student withdrew from this course.
  - All three (100%) of the students who completed this course earned As.
  - Reasons for the low enrollment in this course include: the course is geared towards students who have at least a moderately high level of certainty that they want to go into teaching, the traveling to schools component of the class sometimes makes it difficult for students to fit CETL 4002 into their class
schedules, and CETL 4001 is required as a prerequisite so they have to have
taken that course prior to enrolling on CETL 4002.
Note: More detailed information on course assignments and evaluations is located in
Table 7.
• Course evaluations: all three of the three students who completed this course in
spring, 2009 responded to the CIOS.
  o This course is primarily an in-school teaching practicum, so these ratings
  pertain more to the “skills” part of objective 1 for Goal #2. Students in this
course were pleased with the instructor in general, giving an interpolated
median response of 4.8 to the item “The instructor was an effective teacher.”
Both students responding to the statement “Explained complex material
clearly” strongly agreed with it. Students did express some concern with the
organization of the course, providing a rating of 2.3 for the item “Course
seemed well planned and organized.” This represents an area in which
improvement is needed for this course in future semesters. There is also some
room for improvement for the instructor of this course in the areas of covering
course objectives/content and appropriateness of number of course assignment
(with ratings of 4.0 and 3.5, respectively). One caveat for interpreting the data
specific to this class is that there were only 3 students, and there appears to
have been some confusion about how the survey items related to this type of
course, as there were several responses of N/A.
Table 7. CETL 4001 and 4002 course assignments and evaluations.

<table>
<thead>
<tr>
<th>Course</th>
<th>Assignment</th>
<th>Description</th>
<th>Assessment Tool</th>
<th>Analysis of Student Performance</th>
</tr>
</thead>
</table>
| 4001    | Journal           | Students reflect on weekly course/chapter content. Students are also required to practice using graphic organizers to organize their thoughts and connect them to course content. | None – students must have one journal entry per week or chapter depending on instructions given by instructor. Two entries using graphic organizers are required. | What are common strengths that students exhibit in terms of teaching and learning knowledge/skills/dispositions, and why are these strengths important in seeking and performing in teaching careers?  
What are common areas that students need to improve and what kinds of things can be done to address these areas?  
Other comments/insights you may have had about student learning related to these tasks |
<p>| 4001    | Educational Philosophy paper | Students identify their educational philosophy and relate philosophy to course content.                                                                                                                                 | Checklist – Writing guide                             | Research indicates teachers’ beliefs about teaching and learning are important in determining how teachers teach including what educational practices they adopt. These assignments provide opportunities for students to reflect on their beliefs about teaching and learning and connect those beliefs to topics covered in the course. Students’ beliefs about education focus on the learning of the content. When they enter the course, students have a tendency to think that as long as they know the content and can lecture K12 students will learn the material. The journal assignment, the philosophy paper and the observation reflect changes in their beliefs as the course progresses. 4002 further impacts their beliefs as they go into schools for longer periods of time. A great qualitative pre/post assessment might be the use of the educational philosophy paper. Students could write one as they enter and then one at the end of the course. Some students have expressed difficulty in completing these assignments. They indicated they are not used to expressing their opinions on topics because they have not been regularly provided this opportunity while students at Tech. |</p>
<table>
<thead>
<tr>
<th>Course</th>
<th>Assignment</th>
<th>Description</th>
<th>Assessment Tool</th>
<th>Analysis of Student Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>4001</td>
<td>Classroom Observation</td>
<td>Students observe instructional practices in the subject area they are interested in.</td>
<td>Observation template</td>
<td>Overall, students indicated that conducting an observation in a school different from the schools they have attended helps them to understand education in a different context. They also indicate course content gives them a framework for understanding the teaching and learning practices they observe.</td>
</tr>
<tr>
<td>4001</td>
<td>Current Issues Paper and Presentation</td>
<td>Students explore a current issue in education based on their individual interests.</td>
<td>Rubric</td>
<td>Overall, students have used this assignment to not only report on but provide an analysis of a current topic in education. Students use various resources including educational journals, texts and digital media. This assignment relates to “teaching as a profession” research literature.</td>
</tr>
<tr>
<td>4002</td>
<td>Field Experience/School Context Portrait</td>
<td>Students complete an in-depth study of the school they are working in.</td>
<td>None</td>
<td>A school context portrait provides an overview of the field experience school. This portrait includes demographic information and testing data. Some students indicated this assignment allows them to develop an understanding of the environment and achievement levels in the school where they are completing the field experience. The field experience provides opportunities for students to tutor students and teach classroom lessons. They also observe instructional practices in their chosen subject area. Some students have made the decision to not enter the profession based on the field experience.</td>
</tr>
<tr>
<td>Course</td>
<td>Assignment</td>
<td>Description</td>
<td>Assessment Tool</td>
<td>Analysis of Student Performance</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4002</td>
<td>Microteaching lesson</td>
<td>Students plan/teach a unit in the subject area they are interested in.</td>
<td>Unit Planning Template 5-E Instructional Model Template</td>
<td>This assignment allows students to focus on the roles of teachers as identified in standards-based teaching documents. One of the roles identified is teacher as “planner” of instruction. Students select content and adapt and design curricula to meet the interests, knowledge, understanding, abilities, and experiences of students at their selected grade levels. They also select teaching and assessment strategies that support the development of student understanding.</td>
</tr>
</tbody>
</table>

Overall, students are extremely knowledgeable about the content areas they are interested in teaching. In 4001 they begin to develop an understanding of educational foundations and the psychology of teaching and learning. Additional coursework is necessary in order to understand instructional practices. They can begin to develop this understanding in 4002. Many of the students taking the 4001 and 4002 courses have not decided to enter teaching as a profession and many have indicated they are simply taking the courses as free electives. However, the courses have identified students who are interested in teaching and many have indicated the courses have helped them to make that decision.
4.b.ii.2. Higher Education pathway CETL courses

CETL 8803: Fundamentals of Teaching, Learning and Course Design (offered spring, 2009)

- Graduate level course whose main component is designing a college-level course in a subject area of each student’s choosing
- Addresses the Tech to Teaching objective that “students will possess the knowledge, skills, and dispositions necessary for teaching (Goal #2, Objective 1)” by:
  1. Focusing on theoretical and practical information regarding the learner-centered paradigm, which is delivered via class readings and will also serve as the basis for class discussions
     o Specifically, how this paradigm relates to course design and faculty responsibilities
  2. Encouraging students’ critical analysis of both their own and one another’s course designs based on the information they learn in the course
  3. Assigning each student to lead one class discussion, guided by information posted by fellow students on the T-square message boards
  4. Allowing students who successfully complete the course to leave equipped with:
     o Detailed knowledge about course design and the learner-centered paradigm
     o Partially or fully completed course design that could be used in future teaching assignments
     o Increased confidence in entering the academic job market due to improved skills and knowledge in teaching

- Thirteen students completed this course in spring, 2009.
  o One student withdrew from this course.
  o All 13 (100%) students who completed this course earned passing grades (this was a pass-fail course).
- Course evaluations: eleven of the 13 students who completed this course in spring, 2009 responded to the CIOS.
  o Ratings for this course were somewhat mixed. Overall, students were happy with the instructor, giving an interpolated median rating of 4.6 for the item “The instructor was an effective teacher.” For the items most directly related to objective 1 for Goal #2, the instructor scored well on “Good job covering course objectives/content” (4.7) but scored only moderately well on “Explained complex material clearly” (3.5). So this instructor delivered the appropriate information to the students, but there is room for improvement in how this instructor explains complex material to students. There is also an opportunity for improvement in the organization of the course, given that students gave a score of 3.4 on the item “Course seemed well planned and organized.” Students in this course also viewed attending class as worthwhile (rating of 4.6), and felt that the instructor was approachable (rating of 4.6) and encouraged consultation with students (rating of 4.8).
CETL 8711: Student and Teacher Enhancement Partnership (STEP) Summer Training
(offered summer, 2009)

- This course is required for all STEP fellows, and is run more like a training program rather than a typical course.
- Addresses the Tech to Teaching objective that “students will possess the knowledge, skills, and dispositions necessary for teaching (Goal #2, Objective 1)” by providing information on the following practical, teaching-relevant topics:
  - Learning Theory
  - Lesson Planning
  - Teaching/presentation skills (developed and assessed by requiring students to give multiple teaching presentations to the class)
  - Teaching strategies
  - Classroom assessment techniques (CATs)
  - Giving good feedback/asking good questions
  - Having an equitable classroom
  - One-on-one interactions with students (e.g., mentoring, tutoring, office hours)
  - Grading
  - Motivating K-12 students
  - Working with at-risk students
  - Sexual harassment issues
  - No Child Left Behind (NCLB) standards
  - Adequate Yearly Progress (AYP) standards
- Fourteen students completed this course in summer, 2009.
  - All 14 (100%) students who completed this course earned passing grades (this was a pass-fail course).
- Course evaluations: one of the fourteen students who completed this course in summer, 2009 responded to the CIOS; this student was pleased with nearly all aspects of the course but it is unwise to draw conclusions from this data due to the extremely low response rate.
- Due to the low response rate for CIOS among this class, the STEP fellow journal entries containing reflections on the summer training were analyzed. In general, fellows felt that their time in training/meetings was well spent. They expressed a desire to have more time spent on microteaching and inquiry-based learning, as well as more time spent with previous STEP fellows and teacher partners/coordinates.

4.b.iii. CETL workshops

CETL offered nine workshops in spring, 2009 for the general graduate student audience. Additionally, special additional workshops on particular topics were offered for Graduate Student Housing and for Chemical Engineering. Workshops were not held during the summer, 2009 term. Fall, 2009 workshops are currently in progress and will be analyzed in spring, 2010.

These general audience workshops covered topics related to the academic job search (phone interviews, giving a job talk, CV), teaching (motivating students, intercultural
communications), research (presentations and poster design), and options for academic career paths (academic career options panels, career options in high school teaching). These workshops covered a broad range of topics and were well-attended (attendance for these workshops ranged from 8 to 41 participants). These workshops were conducted by CETL personnel, were scheduled throughout the spring semester, and lasted approximately 1.5 hours each. See Table 8 for attendance and overall ratings.

Table 8: Spring, 2009 Graduate Workshops:

<table>
<thead>
<tr>
<th>Title</th>
<th># participants</th>
<th>“Recommend to others” rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone Interviews</td>
<td>41</td>
<td>4.8</td>
</tr>
<tr>
<td>Motivating Students</td>
<td>16</td>
<td>4.3</td>
</tr>
<tr>
<td>Giving a Job Talk</td>
<td>36</td>
<td>4.7</td>
</tr>
<tr>
<td>Presentations and Poster Design</td>
<td>15</td>
<td>4.4</td>
</tr>
<tr>
<td>Academic Career Panel – faculty</td>
<td>35</td>
<td>4.5</td>
</tr>
<tr>
<td>Academic Career Panel – non-faculty</td>
<td>27</td>
<td>4.3</td>
</tr>
<tr>
<td>Intercultural Communication</td>
<td>13</td>
<td>4.5</td>
</tr>
<tr>
<td>CV Workshop</td>
<td>8</td>
<td>4.9</td>
</tr>
<tr>
<td>Career Options in HS (high school) Teaching</td>
<td>17</td>
<td>4.7</td>
</tr>
</tbody>
</table>

Four of these workshops are described in detail below as they relate to the Tech to Teaching goals and objectives: 1) Goal #1, Objective 1: Provide students with easy access to information about teaching careers, and 2) Goal #2, Objective 1: Students will possess the knowledge, skills, and dispositions necessary for teaching. The workshop on motivating students provided attendees with strategies for increasing the motivation of students in their classrooms, which relates directly to the objective of providing programming that will help students possess such skills. The two panels on academic career options as well as the workshop on career options in high school teaching offered participants the opportunity to gather information about teaching careers; this facilitates achievement of Goal #1, Objective 1. More specific information about the content as well as a summary of participant evaluations for these workshops (please see Table 9) is presented below.

Workshop on Motivating Students:
- There were 16 participants for this workshop.
- Information delivered in this workshop included:
  - Discussion of past experiences in which workshop participants had encountered a professor, instructor, or TA who was especially motivating
  - Educational theory on what contributes to student motivation or lack thereof
  - Common situations in which students often experience a lack of motivation, and steps teachers can take to overcome these situations
  - Techniques and strategies for increasing student motivation
- Participants were generally pleased with this workshop:
All 16 participants either agreed or strongly agreed with the following statements:

- This workshop helped me understand what is motivating and demotivating to students.
- This workshop provided me with concrete strategies for motivating students.
- The leader explained concepts clearly.

All but one participant either agreed or strongly agreed with the following statements (the one exception responded neutrally to these items):

- The activities/discussions I participated in aided my understanding of the concepts presented.
- This workshop met (or exceeded) my expectations.
- I would recommend this workshop to other graduate students/TAs/post-docs/etc.

Workshop on Career Options in High School Teaching:

- There were 16 participants for this workshop.
- Information delivered in this workshop included:
  - Steps on getting certified to teach K-12
  - Tips for locating K-12 jobs and getting hired
  - Discussion of things to consider in determining whether teaching K-12 is a good fit for participants
  - Comparisons between teaching K-12 and other career path options
  - How to locate and access pre-teaching advising and services

  Participants were generally pleased with this workshop:

  - All 16 participants either agreed or strongly agreed with the following item:
    - The leader explained concepts clearly.
  - Fifteen out of 16 participants either agreed or strongly agreed with the following items (the one exception responded neutrally to all of these items):
    - This workshop provided me with information useful for deciding if K-12 teaching might be a good career choice for me.
    - I now have a basic understanding of how I could become certified in Georgia if I decided to teach K-12.
    - This workshop helped me compare some of the pros and cons of teaching as an adjunct at a community college with teaching at the K-12 level.
    - The activities/discussions I participated in aided my understanding of the concepts presented.
    - This workshop met (or exceeded) my expectations.
    - I would recommend this workshop to other grad students/TAs/post-docs/etc.

Non-faculty Academic Career Panel:

- 22 participants attended this panel.
- Panelists were invited to address some of the following questions, in addition to answering questions from attendees:
Please briefly describe your career path since graduating with your PhD including how you got into your current field/job?

What are your present responsibilities at work and what is a typical day like?

For many Ph.D.s, the only lifestyle they know is that of a graduate student, post-doc, or faulty member. What is different about your position and why did you make the choice you did?

How do people typically get hired into positions like yours?

What advice do you have for our audience regarding how they can gain skills while in graduate school (but maybe not as part of the required graduate school activities) that will make them more marketable for non-faculty jobs in academia?

Attendees were generally pleased with this panel:

All attendees either agreed with or strongly agreed with these items:

- This panel provided me with more information about career options within academia.
- Overall, hearing about the panelists' perspectives was valuable.

Nearly all attendees either agreed with or strongly agreed with these items (1-2 participants responded neutrally to these items):

- The question and answer portion of the panel was valuable.
- This panel met (or exceeded) my expectations.
- I would recommend this type of panel to other grad students/TAs/post-docs/etc.

Faculty Academic Career Panel:

- 27 participants attended this panel.

Panelists were invited to address some of the following questions, in addition to answering questions from attendees:

- How and why did you decide to be a faculty member at a Community College, State College, Research University, Liberal Arts College, etc?
- What percentage of your time do you spend on the following: teaching, research, university, service, etc?
- How many hours per week do you work? How does this typically change over time (before vs. after tenure)?
- What are the 3 biggest advantages/rewards to your job?
- What are 3 of the biggest challenges/disadvantages to your job?
- What can graduate students do while still in graduate school to be more competitive for jobs in your line of work?

Attendees were generally pleased with this panel, although slightly less so than with the three previously discussed workshops:

- All participants either agreed or strongly agreed with this item:
  - I would recommend this type of panel to other grad students/TAs/post-docs/etc.

- Nearly all participants either agreed or strongly agreed with these items (1-2 participants responded neutrally on each item):
  - This panel provided me with more information about career options.
  - Overall, hearing about the panelists' perspectives was valuable.
- The question and answer portion of the panel was valuable.
  - Support for the item “This panel met (or exceeded) my expectations was slightly lower, with 8 participants strongly agreeing, 14 participants agreeing, 4 participants responding neutrally, and 1 participant disagreeing.

Table 9. Participant ratings summary for workshops relevant to *Tech to Teaching*

<table>
<thead>
<tr>
<th>Motivating Students</th>
<th>% responding “agree” or “strongly agree”</th>
<th># students responding</th>
<th>Interpolated Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>This workshop helped me understand what is motivating and demotivating to students.</td>
<td>100.0</td>
<td>16</td>
<td>4.2</td>
</tr>
<tr>
<td>This workshop provided me with concrete strategies for motivating students.</td>
<td>100.0</td>
<td>16</td>
<td>4.2</td>
</tr>
<tr>
<td>The activities/discussions I participated in aided my understanding of the concepts presented.</td>
<td>94.0</td>
<td>16</td>
<td>4.2</td>
</tr>
<tr>
<td>The leader explained concepts clearly.</td>
<td>100.0</td>
<td>16</td>
<td>4.5</td>
</tr>
<tr>
<td>This workshop met (or exceeded) my expectations.</td>
<td>94.0</td>
<td>16</td>
<td>4.1</td>
</tr>
<tr>
<td>I would recommend this workshop to other graduate students/TAs/post-docs/etc.</td>
<td>94.0</td>
<td>16</td>
<td>4.3</td>
</tr>
</tbody>
</table>

**Career Options in High School Teaching**

<table>
<thead>
<tr>
<th>Motivating Students</th>
<th>% responding “agree” or “strongly agree”</th>
<th># students responding</th>
<th>Interpolated Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>This workshop provided me with information useful for deciding if K-12 teaching might be a good career choice for me.</td>
<td>94.0</td>
<td>16</td>
<td>4.5</td>
</tr>
<tr>
<td>I now have a basic understanding of how I could become certified in Georgia if I decided to teach K-12.</td>
<td>94.0</td>
<td>16</td>
<td>4.6</td>
</tr>
<tr>
<td>This workshop helped me compare some of the pros and cons of teaching as an adjunct at a community college with teaching at the K-12 level.</td>
<td>94.0</td>
<td>16</td>
<td>4.9</td>
</tr>
<tr>
<td>The activities/discussions I participated in aided my understanding of the concepts presented.</td>
<td>94.0</td>
<td>16</td>
<td>4.4</td>
</tr>
<tr>
<td>The leader explained concepts clearly.</td>
<td>100.0</td>
<td>16</td>
<td>4.8</td>
</tr>
<tr>
<td>This workshop met (or exceeded) my expectations.</td>
<td>94.0</td>
<td>16</td>
<td>4.5</td>
</tr>
<tr>
<td>I would recommend this workshop to other grad students/TAs/post-docs/etc.</td>
<td>94.0</td>
<td>16</td>
<td>4.7</td>
</tr>
<tr>
<td>Non-Faculty Academic Career Options Panel</td>
<td>% responding “agree” or “strongly agree”</td>
<td># students responding</td>
<td>Interpolated Median</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>------------------------------------------</td>
<td>-----------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>This panel provided me with more information about career options within academia.</td>
<td>100.0</td>
<td>22</td>
<td>4.4</td>
</tr>
<tr>
<td>Overall, hearing about the panelists’ perspectives was valuable.</td>
<td>100.0</td>
<td>22</td>
<td>4.6</td>
</tr>
<tr>
<td>The question and answer portion of the panel was valuable.</td>
<td>95.0</td>
<td>21</td>
<td>4.5</td>
</tr>
<tr>
<td>This panel met (or exceeded) my expectations.</td>
<td>96.0</td>
<td>22</td>
<td>4.1</td>
</tr>
<tr>
<td>I would recommend this type of panel to other grad students/TAs/post-docs/etc.</td>
<td>91.0</td>
<td>22</td>
<td>4.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Faculty Academic Career Options Panel</th>
<th>% responding “agree” or “strongly agree”</th>
<th># students responding</th>
<th>Interpolated Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>This panel provided me with more information about career options.</td>
<td>93.0</td>
<td>27</td>
<td>4.5</td>
</tr>
<tr>
<td>Overall, hearing about the panelists’ perspectives was valuable.</td>
<td>96.0</td>
<td>27</td>
<td>4.7</td>
</tr>
<tr>
<td>The question and answer portion of the panel was valuable.</td>
<td>96.0</td>
<td>27</td>
<td>4.8</td>
</tr>
<tr>
<td>This panel met (or exceeded) my expectations.</td>
<td>82.0</td>
<td>27</td>
<td>4.1</td>
</tr>
<tr>
<td>I would recommend this type of panel to other grad students/TAs/post-docs/etc.</td>
<td>100.0</td>
<td>27</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Additional workshops for chemical engineering students
- Approximately 20-30 attendees at each event.
- Two workshops were presented by Lydia Soleil (CETL), Chris Jones (Chem Eng), and Dennis Hess (Chem Eng); these workshops were specifically for chemical engineering students. Dates and titles for these workshops were:
  - 4/7/2009: Assessing Yourself and Preparing for a Faculty Position
  - 4/21/2009: Applying for and Obtaining a Faculty Position
- No evaluation data was collected for these workshops.

Additional workshops for Housing, summer, 2009
- Approximately 10 attendees at each event.
- Two workshops were presented through the Housing department in summer 2009. These workshops were facilitated by Lydia Soleil (CETL). Dates and titles for these workshops were:
  - 5/27/2009: Academic Job Search
  - 6/3/2009: Teaching Philosophies and Portfolios
4.c. Mentoring

In the proposal for the *Tech to Teaching* project the following mechanisms (edited for brevity here) were outlined to ensure robust opportunity for students to receive formal mentoring along their pathway to teaching careers:

K-12 pathway:
The Georgia Intern-Fellowships for Teachers (GIFT) program ([www.ceismc.gatech.edu/gift](http://www.ceismc.gatech.edu/gift)), is a summer research internship program that places teachers into 6-8 week internships in university and corporate research laboratories and STEM-focused work sites. These GIFT teachers work with mentors in the research lab, becoming familiarized with the STEM content and the nature of research, and creating standards and inquiry-based lesson plans for implementation in the classroom. Georgia Tech also has a well-established undergraduate research program, enabling students to gain research experiences while pursuing their undergraduate degree programs. As part of *Tech to Teaching*, Georgia Tech will bring together GIFT and the undergraduate research program to create Research Experiences for Undergraduate (REU) pre-teaching positions for students interested in becoming teachers. These pre-teaching REU students will be paired with GIFT teacher mentors in the laboratory, and together the teacher and student will conduct STEM research and create inquiry-based lessons plans for implementation in the classroom. These two will also be paired with a member of the lab, either the faculty member, a graduate student, or a post-doc, and on occasion also with a team of high school students, effectively creating a vertical team that includes mentoring on many different levels.

This K-12 (undergraduate level) mechanism was implemented successfully with 9 students in summer, 2009 under the name *Teaching SURE* (Teaching Summer Undergraduate Research Experience).

Higher Education pathway:
*Tech to Teaching* will develop and offer a 3-unit graduate level course (8002) that will supplement the current mentored Teaching Practicum developed as part of FACES. One credit of the course will be a class meeting, while the other units will be practicum hours spent working with the mentor in a classroom at Georgia Tech. In 8002 (and 8003, described below) graduate students will learn the skills needed to be reflective teachers, and have the time, opportunity, and structure for reflecting on the impact of their practicum or internship experience on their own personal, professional and career development goals. Faculty will be recruited to participate as mentors in the Teaching Practicum program.

This higher education (graduate level) mechanism is currently being piloted on a small scale with a single instructor.

Additional details regarding these pilot implementation efforts are described below.
4.c.i. K-12 pathway mentoring

The Teaching Summer Undergraduate Research Experience (Teaching SURE) is a summer program for Georgia Tech undergraduate students designed to help them both explore a potential interest in teaching at the K-12 level and also gain knowledge and experience in laboratory research and research methods. Each student in the program is paired with an experienced K-12 teacher; the student and teacher work together in a GT research lab for an 8 week period. During this time, the GT students work on a research project and use their research experiences to help their teacher partners prepare plans for classroom activities.

Some of the program participants also had the opportunity to work directly with one or more high school students. The Teaching SURE program initial plans did not involve having the GT students work directly with high school students. This element of the program came about for some GT student-teacher pairs because the teachers were involved with either the GT High School Student Summer Research Program or a separate project where the teachers were creating curriculum materials for a summer camp. In these situations, the GT students worked with the high school students that their teacher partners were working with through these other projects. GT students whose teacher partners were not working with high school students spent their time conducting research projects with their teacher partners. Because the GT students who did work with high school students reported that they had really enjoyed it, the Teaching SURE program intends to maximize such opportunities in the future. A summary of the overall student perspective on the program is shown below.

- 9 students participated during summer, 2009.
- 8/8 survey respondents agreed or strongly agreed with “After the Teaching SURE experience I believe I will be a better teacher.”
- 7/8 survey respondents agreed or strongly agreed with “I feel that the Teaching SURE program improved my likelihood of success as I move along the pathway towards a teaching career in science or math.”

This program fits well within several of the Tech to Teaching goals. Goal #1, Objective 1 is to “provide students with easy access to information about teaching careers.” A close working relationship with an experienced teacher should provide an invaluable resource for gathering such information. Goal #2, Objective 1 states that “students will possess the knowledge, skills, and dispositions necessary for teaching.” The program has several specific components; including having the GT students work with their teacher partners to develop action plans, which speak directly to this goal of helping GT students develop the necessary skills for teaching. Additionally, the opportunity to work directly with high school students should be very illustrative in helping GT students figure out whether they possess, or would be able to develop, the disposition necessary for teaching.
Evaluations of the program were filled out by most of the participants. Their responses, and especially the comments they provided, demonstrate the ways in which this program was effective in addressing the *Tech to Teaching* goals outlined above.

**Highlights:**

- GT students seemed to have benefited both from interactions with their teacher partners and with high school students. GT students mentioned the interesting and informative conversations they had with their teacher partners, and talked about how these conversations provided insight on what it’s like to be a teacher. Several GT students indicated that working with the high school students “made” their experience.
- GT students felt they had acquired skills related to teaching as a result of their participation in this program. These skills included patience, knowledge of strategies for helping high school students learn, and knowledge of logistical aspects of teaching such as becoming certified and making lesson plans.
- All GT students responding to the item agreed that their participation in this program would make them a better teacher.
- Seven out of eight GT students responding to the item agreed that their participation in this program would improve their chances of success as they moved along the pathway towards a career in teaching math or science.
- Some GT students indicated a need for teacher partners to be provided with more clarification as to what the GT students’ roles should have been. Specifically, it seems that the action plan component of the program was not understood clearly by GT students or teacher partners, resulting in some GT students not working on it at all.
- Most GT students who did not work with high school students wished they had.

**Specific Areas:**

**Interactions with teacher partners:**

- GT students met with their teacher partners an average of 4.43 times per week (7 GT students responded to this item).
- Seven GT students reported that the number of meeting with their respective teacher partner was “about right” while one GT student thought the number of meetings was “too few” (8 GT students responded to this item).
- Seven GT students provided comments about the nature of their interactions with their respective teacher partners:
  - Four GT students talked about the rewarding, interesting, and thoughtful conversations they had with their teacher partners. Specific quotes include:
    - our discussions regarding the challenges and requirements of teaching, which ended up being some of the most interesting conversations I partook in this summer.
    - Ms. X and I worked side by side every day to accomplish all of the lab work. We were given an office to share in XXXX for the summer. I frequently asked questions about different aspects of teaching life, challenges, rewards, surprises she has faced.
o Three GT students indicated having worked very closely with their teacher partners, two GT students indicated not having worked very closely with their teacher partner, and one GT student indicated having worked closely with his/her teacher partner for part of the program but then not working closely for the remainder of the program. Specific quotes include:
  ▪ We both had our different skill sets so our research was a little disjointed at times. This however held no boundaries towards our experience.
  ▪ She took a very hands-off role because she wanted to let me get experience with the kids and act as a bridge for the information. Her main goal was to keep them kids on task and to help me to grow as an educator.
  ▪ We worked together closely on one of the two projects I worked on this summer, and I assisted him in gathering some data for the unit on modern physics labs he was constructing. I wasn't heavily involved in the lesson plans however.

Interactions with high school students:
• Four GT students reported having worked with high school students during the program. Three of the GT students who did not work with high school students reported wishing that they had been able to work with high school students.
• GT Students who worked with high school students provided comments indicating that they really enjoyed this part of the experience and found it rewarding and useful. Specific quotes include:
  o I think it impacted my experience a lot. It made me feel as though I was not only researching for myself, but for the benefit of the [high school] students as well. It also put me in the shoes of a teacher, having to deal with the little daily mishaps and sidetracking that high school students are used to, as well as challenging me in finding the correct way to approaching teaching different [high school] students the same material when it wasn't immediately grasped.
  o They made the experience much better. I don't think this experience would have been nearly as memorable without them.

Teaching skills acquired during the program:
• Eight GT students provided comments addressing what skills and abilities related to teaching that they acquired during the program. Students were free to make multiple comments (this is why the numbers below add up to more than eight).

<table>
<thead>
<tr>
<th># Students Reporting</th>
<th>General content of GT student comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>learned to be more patient</td>
</tr>
<tr>
<td>4</td>
<td>learned specific strategies for helping high school students</td>
</tr>
<tr>
<td>2</td>
<td>learned about logistical aspects of teaching</td>
</tr>
<tr>
<td>3</td>
<td>learned other skills (e.g., directing a conversation, working with others)</td>
</tr>
</tbody>
</table>
Specific comments include:
- I feel like I can understand a high school student's perspective much better and will be more prepared to improvise solutions to difficult situations.
- I gained a bit of an understanding of how to take regulated curriculum for an academic year and break it into lectures with appropriate assignments, labs, and assessments.
- I managed to learn a lot about patience throughout the process and how to think creatively about new ways to approach old material to make it more interesting and available for [high school] students.
- I'm not sure I really acquired any skills related to teaching, per se. Probably the thing most important to teaching that I developed this summer was how to work closely with someone with whom you don't necessarily share knowledge or skillset or mode of interaction. Another useful thing was sharpening skills of presenting concepts and work in writing and with pictures.

Plans for future interactions with teacher partners:

Table 10.2

<table>
<thead>
<tr>
<th># GT students responding</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Maybe</td>
</tr>
<tr>
<td>3</td>
<td>No</td>
</tr>
</tbody>
</table>

6 GT students provided comments about the nature of future interactions with teacher partners.

Table 10.3

<table>
<thead>
<tr>
<th># GT students reporting</th>
<th>General Content of Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>GT students have no concrete plans for future interactions with their teacher partners</td>
</tr>
<tr>
<td>2</td>
<td>GT students plan to visit their teacher partner’s classroom</td>
</tr>
<tr>
<td>1</td>
<td>GT student plans to network with his/her teacher partner</td>
</tr>
</tbody>
</table>

Interest in pursuing teaching as a career:

Table 10.4

<table>
<thead>
<tr>
<th># GT students responding</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Likely</td>
</tr>
<tr>
<td>6</td>
<td>Somewhat likely</td>
</tr>
<tr>
<td>1</td>
<td>Very likely</td>
</tr>
</tbody>
</table>
**Item: “How has the Teaching SURE program changed your interest in pursuing a teaching career?”**

<table>
<thead>
<tr>
<th># GT students responding</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Somewhat less interested</td>
</tr>
<tr>
<td>4</td>
<td>No change in interest level</td>
</tr>
<tr>
<td>2</td>
<td>Somewhat more interested</td>
</tr>
<tr>
<td>1</td>
<td>Much more interested</td>
</tr>
</tbody>
</table>

**Interest in pursuing research as a career:**

**Table 10.5**

**Item: “How likely is it that you will pursue a graduate-level degree, either here or elsewhere?”**

<table>
<thead>
<tr>
<th># GT students responding</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Somewhat likely</td>
</tr>
<tr>
<td>7</td>
<td>Very likely</td>
</tr>
</tbody>
</table>

**Item: “Did your research experience this semester influence your research plans?”**

<table>
<thead>
<tr>
<th># GT students responding</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Change in potential skills as a teacher resulting from the program:**

**Table 10.6**

**Item: “After the Teaching SURE experience I feel I would be a better teacher.”**

<table>
<thead>
<tr>
<th># GT students responding</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Somewhat Agree</td>
</tr>
<tr>
<td>2</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

- Eight GT students provided comments to follow up on this item. These comments largely dealt with the GT students’ increased knowledge about what being a teacher entails and how to become one, rather than specific teaching skills they had gained. Specific comments include:
  - I will/would be a better informed teacher. Whether or not that would make me better at teaching, I can't really say, but I have gained some insight about the inner workings of teaching beyond what I saw of my teachers in high school. The teaching SURE program for me mostly gave me information about the field rather than concrete skills or methods to help me succeed in the teaching.
  - Through my interaction with X and other teachers that were a part of the SURF and GIFT program this summer, I was given a great deal of advice about earning an education degree, challenges in the first year and later years of teaching, politics of school regulations, overcoming difficulties with [high school] students, common health issues educators face, and many other struggles and rewards involved with being a teacher.
I learned more about what it would be like to be a teacher rather than learning to actually be a teacher.

Experiences with action plan component of the program:

Table 10.7

<table>
<thead>
<tr>
<th># GT students responding</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Somewhat or Strongly Disagree</td>
</tr>
<tr>
<td>5</td>
<td>Somewhat or Strongly Agree</td>
</tr>
</tbody>
</table>

Item: “To what extent do you agree with the statement: I was involved with the creation of my teacher partner’s action plan.”

<table>
<thead>
<tr>
<th># GT students responding</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Yes</td>
</tr>
</tbody>
</table>

- Seven GT students provided comments about how the action plan component of the program could be improved.

Table 10.8

<table>
<thead>
<tr>
<th># students reporting</th>
<th>General content of GT student comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>indicated a need for clarification of what the action plan was supposed to be and/or the fact that the GT students were supposed to be helping with the action plan</td>
</tr>
<tr>
<td>2</td>
<td>provided comments as to how the action plans could be improved</td>
</tr>
</tbody>
</table>

Experiences with end of summer round table discussions:

Table 10.9

Item: “To what extent do you agree with the statement: The end of summer round table discussions provided a valuable opportunity for me to articulate the outcomes of my experience”

<table>
<thead>
<tr>
<th># GT students responding</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Somewhat or Strongly disagree</td>
</tr>
<tr>
<td>5</td>
<td>Somewhat or Strongly agree</td>
</tr>
</tbody>
</table>

Item: “To what extent do you agree with the statement: Additional opportunities like the end of summer round table discussions could have been valuable.”

<table>
<thead>
<tr>
<th># GT students responding</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Somewhat disagree</td>
</tr>
<tr>
<td>6</td>
<td>Somewhat or Strongly agree</td>
</tr>
</tbody>
</table>
• Six GT students provided comments about how the end of summer round table discussions could have been improved.

Table 10.10

<table>
<thead>
<tr>
<th># students reporting</th>
<th>General content of GT student comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>indicated that they would have liked a different structure to the presentations, specifically that they would have liked to have the teachers and GT students presenting together</td>
</tr>
<tr>
<td>2</td>
<td>indicated that they saw no room for improvement</td>
</tr>
</tbody>
</table>

Impact of the program on GT students’ perceived success on pathway to teaching:

Table 10.11

| Item: “To what extent do you agree with the statement: I feel that the Teaching SURE program improved my likelihood of success as I move along the pathway towards a teaching career in science or math.” |
|----------------------|-----------------------------------------------------|
| # GT students responding | Response |
| 1                      | Somewhat disagree |
| 5                      | Somewhat agree |
| 2                      | Strongly agree |

Ways in which GT students thought teacher partners could have improved:
• One GT student commented that he/she would have liked to have been asked to help with the lesson plan more.
• One GT student mentioned an informal lunch with the teacher partner to provide a venue for casual discussion of issues related to teaching.
• One GT student said his/her teacher partner seemed uninterested in the lab component of the program.
• One GT student said that he/she would have preferred more interaction with the teacher partner.

Ways in which GT students thought they could have improved their experiences in the program:
• Six GT students said they should have taken a more active, assertive role to get more involved in research and/or teaching activities.
  o I could have pushed to work more with my teacher and create more potential opportunities.
  o I could have been much less shy at first and stepped up to ask questions and give suggestions. I also could have been a little better at motivating my teacher partner to help out.
• Two GT students said they couldn’t think of anything they should have done differently.
Comments on whether the overall Teaching SURE experience fulfilled GT students’ expectations:

- Eight GT students provided comments on this item.
- Five GT students indicated that the program fulfilled all of their expectations and they were happy to have participated:
  - This program did everything I expected: it gave me a look at research and education as possible choices for my future.
  - Yes, it was a wonderful experience and I really loved having the opportunity to participate in it.
  - I wasn't really sure what to expect when I began the program, but the summer experience was definitely very valuable. I really enjoyed the research experience, the exposure to a lab and graduate students, and the opportunity to talk with a teacher about issues in teaching today, especially about different types of [high school] students and their interest levels. It was a great program, and I'm glad I got to participate in its pilot year!
- Three GT students indicated that the program did not fulfill all of their expectations:
  - I did get a lot out of it. Though I was not expecting so much experience in research, I gained a lot of knowledge in that area. Going into the internship I was hoping to learn more about teaching- I didn't feel I got as much of that as I could have.
  - Not quite. I think that everyone should be paired with a teacher.

Other comments on the program:

- In short, I really liked it. This summer has made me want to go to grad school and to continue to pursue research opportunities during my undergrad years at Tech. Really, this program has motivated me to take my education as far as I am capable. I'm still interested in education. I love teaching and encouraging people. But before I settle down to teach high school (if that's where I end up) I want to go as far as I can go on the educational path in order to be able to add that breadth of experience to what I'm able to present to young people. I want to sincerely thank you for working so hard to make this program happen. It was a wonderful and valuable way to spend my summer.
- It would be nice to have more choice in what labs we are placed in.
- I appreciated the opportunity to be involved with undergraduate research, as I never have been in the past and feel that it is an important experience to partake at Tech.

Conclusions and Recommendations regarding the Teaching SURE program:

- Goal 1, Objective 1 of the Tech to Teaching grant pertains to providing GT students with easy access to information about teaching careers. The Teaching SURE outcomes described above indicate that GT students benefited from interactions with their teacher partners, and that these interactions provided insights about teaching as a career. Giving GT students direct access to a teacher should facilitate this goal, provided that there are opportunities for conversations between the GT student and teacher partner. The program could encourage such conversations by providing gift
cards for the GT students to take the teachers out for coffee/lunch, or setting up a 
lunch at GT.

- Goal 2, Objective 1 of the Teach to Teaching grant aims to help GT students gain the 
knowledge, skills, and dispositions necessary for teaching. GT students in the 
Teaching SURE program reported that they had acquired teaching-related skills, 
including patience, knowledge of strategies for helping high school students learn, 
and knowledge of logistical aspects of teaching such as becoming certified and 
making lesson plans. Furthermore, GT students felt that having participated in the 
program would make them better teachers, and that it would improve their chances of 
success in moving towards a teaching career.

- GT students indicated a few aspects of the program that they would like to see 
improved:
  - Teacher partners needed to have a more clear understanding of what the GT 
students’ roles should have been. Increased communication between program 
leaders and teacher partners as to what the GT students should be doing might 
help alleviate this issue.
  - The action plan component of the program was misunderstood by GT students 
and teachers, resulting in some GT students not participating in the 
development of the action plan. Again, increased communication between the 
program leaders and teacher partners regarding what the action plan entails 
and the manner in which the GT students should be involved would likely 
help with this.
  - The GT students who did not have the opportunity to work with high school 
students wished that they had. If this is feasible, it seems ideal to give all GT 
students the opportunity to work with high school students, especially given 
that several of the program participants indicated that working with the high 
school students “made” their experience.

4.c.ii. Higher Education pathway mentoring

Two mechanisms for mentoring in the higher education pathway have been tested.

First, in the summer of 2009 the traditional STEP training course was significantly 
revised to align more strongly with the needs of Tech to Teaching. STEP stands for 
Student and Teacher Enhancement Partnership. In this NSF (National Science 
Foundation) GK-12 program, twelve STEM graduate students receive training and then 
are placed in a local high school to work with the teachers and students there. The details 
of this summer training course are described under “Principles of Teaching and 
Learning” in section 3.b.ii. above. However, the experience for which these students are 
training in the course represents the mentoring element of Tech to Teaching ladder 
because they are working in close collaboration with the high school teachers.

Second, several students from the spring, 2009 pilot course on teaching, learning, and 
course design approached CETL about whether there might be an opportunity for 
additional experience in a hands-on environment. Thus, it was decided that these 
students could represent an early pilot of the CETL 8002 course model for the mentoring
experience (actually delivered as one credit of practicum and one credit of reflection each requiring separate registration). The three students are currently working with Dr. Donna Llewellyn to design and deliver the freshman orientation course GT 1000. This pilot effort, then, is simultaneously serving the purpose of developing the CETL 8002 course model for general faculty who may be involved with this practicum element of the Tech to Teaching project in the future. The results of this pilot effort will be analyzed during the spring, 2010 term. The practicum step in this process will be officially offered during the spring, 2010 semester.

4.d. Immersion

The immersion experience for students in the Tech to Teaching program is designed to give them the opportunity to have the full experience of teaching a course. The mechanisms for the K-12 and higher education pathways to allow students to do this are currently under development and are described below.

4.d.i. K-12 pathway immersion

It is important that any Georgia Tech student who wishes to pursue a career in secondary education have enough experience while still a student to ensure that they are making a thoughtful and educated decision. Since Georgia Tech does not have a College of Education or a formal teacher preparation program, the usual student teaching option is not available to our students. Therefore, this project is designing alternative means for achieving this goal.

From the grant proposal:

Georgia Tech has promoted experiential learning through its undergraduate co-op program since 1912, and firmly believes that obtaining relevant, academically related experience is an integral part of the educational process. Because of this belief, for the last 5 years Georgia Tech has funded an undergraduate version of the Student and Teacher Enhancement Partnership (STEP) GK-12 program, placing students into paid teaching internships at STEP partner schools for 5-10 hours per week. As part of the institutionalization of STEP, Georgia Tech will offer for-credit internships as part of CETL 4002 (see above), as well as continuing paid internships funded by individual schools and by Georgia Tech colleges. Internships will be assigned preferentially to students interested in pursuing K-12 teaching. The Tech to Teaching program will support staff time to coordinate and oversee K-12 teaching interns.

4.d.ii. Higher education pathway immersion

Many doctoral students at Georgia Tech do not have the opportunity to gain real college teaching experience through their academic department. However, it is vital that students who wish to pursue a career as a higher education faculty member at an institution that values undergraduate teaching have some experience prior to their first job. Therefore,
this project is working on developing opportunities for these graduate students to gain this valuable experience in a mentored environment.

From the grant proposal:

Georgia Tech will partner with Georgia Perimeter College (GPC) (a large, metro-Atlanta community college) and Spelman College (a historically black women’s college in Atlanta) to create a Faculty Internship program in which GPC and Spelman will hire graduate students to be the instructors of record in some of their classes (see attached letters of commitment). The graduate students will have teaching mentors at the partner school, and will enroll in a 1-unit graduate level course (8003) at Georgia Tech that supplements the Faculty Internship.

Initially, the programs and courses described above will be open to the students in IGERT programs, FACES, and STEP. By the third year of the project, they will be open to all doctoral students at Georgia Tech. The students will be required to take 8001 prior to participating in either the Practicum or the Internship. The benefit to participating in both the Practicum and the Internship is the opportunity to have two teaching mentors, one from Georgia Tech (Teaching Practicum) and one from outside of Georgia Tech (Teaching Internship), and experiences at two very different institutions. There will also be the option to do a Teaching Practicum outside of Georgia Tech or a Faculty Internship at Georgia Tech. The program will be flexible in order to provide opportunities that best serve the diverse career goals of participants.

These programs of immersion at the higher education level are still under development. There have been a couple of students who have pursued this option independently with our advice but a pilot of the formal program will begin in spring, 2010 with two of the students who piloted the higher ed practicum during fall, 2009.

4.e. Induction/Community

The final step in the Tech to Teaching ladder of programming is to maintain a sense of community and support for the Georgia Tech students as they transition into being alumni with careers in teaching. These components are still being designed and developed.

4.e.i. K-12 pathway induction/community

From the grant proposal:

All the preparation in the world will not suffice if teachers are placed into first year teaching positions without adequate support. As part of the joint Robert Noyce Scholars Program in Physics and Chemistry, Kennesaw State University and Georgia Tech will each sponsor one 2-day retreat per year, to be held at the respective campuses, to provide new teaching graduates of Kennesaw and Georgia Tech with an opportunity to come back together with each other and with
veteran teachers once per semester to discuss issues that have arisen in the classroom. Prior year graduates will also be invited back to participate in this Professional Learning Community.

4.e.ii. Higher education pathway induction/community

From the grant proposal:

The Tech to Teaching program will create an online community through Georgia Tech’s Collaboration and Learning Environment, “T-Square”, that begins when a graduate student participates in one of the courses and persists when the student moves on to their first faculty position. Teaching is often seen as a solitary pursuit and this program provides a place for a community of diverse researchers to come together to discuss their work as teachers. This face-to-face community will continue outside of the course meetings and beyond Georgia Tech as an online community where mentoring can take place between participants at all stages of the program, including those who have already graduated and moved on to faculty positions. To support the above activities, CETL will also offer faculty development materials online through T-square and provide workshops for any faculty (at Georgia Tech or the partner schools) serving as “teaching” mentors to gain skills in mentoring on teaching and the academic job search. The Advisor will be responsible for maintaining this online environment.

Students who participate in the full set of experiences described above will have gained the skills to be leaders among their peers in graduate school and in their future careers by having a strong understanding of how people learn and how to teach effectively. For those who choose the academic career path, they will be better prepared to educate the next generation of scientists and engineers. An increased focus on interdisciplinary approaches to scientific problems, as supported by the IGERT program, will find its way into undergraduate curriculums in higher education classrooms. Therefore, knowing how to approach teaching from an interdisciplinary perspective will only grow to be a more necessary skill. In addition, those graduate students who pursue the non-academic route will be better prepared to communicate with scientists and engineers from other disciplines. Regardless of their career path, all participants will have gained necessary knowledge and skills that are integral to being able to communicate well with non-technical audiences and the public.
5. Tracking *Tech to Teaching* participant activities

Three hundred seventy-one individual students have been identified as having taken advantage of one or more elements of *Tech to Teaching* activities during the January-September timeframe for 2009.

A database for these 371 participants in *Tech to Teaching* activities is in the process of being developed. This database will include student demographics in addition to a listing of activities for each student. These activities have already been identified for each student, and the Tech to Teaching assessment and evaluation team is currently working with the office of the registrar to collect the additional demographic data for these students.

In this way, questions such as the following can be addressed:

- How does the overall performance of students interested in teaching oriented career paths compare with those pursuing more traditional pathways at Georgia Tech?
- Are there specific identifying characteristics representative of the student population at Georgia Tech interested in teaching oriented career paths?
- What is the typical initial (and continuing) student interaction with *Tech to Teaching* project elements?
6. Conclusion
Our assessments of initial conditions during first year of operation of the Tech-to-Teaching program allow the following conclusions to be drawn:

- Although only a small percentage of Georgia Tech students are interested in pursuing a career in teaching, that group has distinct needs and its numbers are increasing among both undergraduates and graduate students.
- Deans, department chairs and faculty generally maintain positive attitudes toward teaching-oriented students, although it is widely felt that greater prestige attaches to more traditional Georgia Tech career pathways.
- Through the efforts of CETL, CEISMC, the OUS and other campus organizations, an infrastructure is emerging that encourages students to explore careers in K-12 or college teaching, but the efforts of the component organizations and projects are not yet sufficient nor are they well integrated as regards cooperation and sharing of information.
- The primary resources available for students to learn about teaching careers include TA training, teaching practicums, teaching seminars, workshops and services provided by CETL, and outreach opportunities provided by CEISMC. But there is wide agreement among administrators, faculty, and student advisors that Georgia Tech does not provide sufficient pedagogical training for pre-doctoral students.
- There is much to be learned from the database of the three hundred seventy-one individual Georgia Tech students that have taken advantage of one or more elements of Tech to Teaching activities during 2009, including answers to questions such as: How does the performance of teaching-oriented students compare with those in the general Georgia Tech population? To what degree do these students gain the knowledge, skills and dispositions necessary for teaching from their interactions with Tech-to-Teaching activities? Do they have easy access to information about teaching careers from their interactions with Tech-to-Teaching activities?
- The Tech-to-Teaching program is well positioned to improve cooperation and information-sharing and to enhance the growing infrastructure of projects and programs designed to encourage students to explore careers in K-12 or college teaching.
Appendix A. Additional information on GT grants and projects relevant to Tech to Teaching

The goals and activities for each grant or project have been catalogued. The content selected from these project reports has either been directly quoted or paraphrased for this report. Additionally, each project or grant was categorized according to five themes related to Tech to Teaching activities. These themes are described below along with the catalogued project goal information and project activities/accomplishments for each project within each theme.

Theme I: Programs designed to serve underrepresented and/or underserved populations

1. ADVANCE Leadership Award: Cross-Disciplinary Initiative for Minority Women Faculty (PI Transfer) (2009 Annual Report)

Project Focus/Goals

- To identify and address the unique challenges facing women of color in the academy…to direct innovative approaches to study and provide professional development and socialization opportunities for women of color.
- Overall, our Cross-Disciplinary Initiative for Minority Women Faculty, through its thorough integration of research (conducted by PIs and students), professional development, socialization, education and outreach activities will contribute to 1) the success and advancement of minority women faculty in science and engineering, 2) the training of researchers who can work at the interface between social science and science and engineering and 3) the body of knowledge on underrepresented minority women in STEM.

Project Activities/Accomplishments

- Conference:
  - Purpose: to convene a selected cohort of junior minority women engineering faculty with tenure-track positions; and second, to begin the processes of professional development and socialization into academic engineering.
  - Networking: …numerous networking activities took place bringing together minority women engineering faculty conference participants from across the nation and Georgia Tech faculty, administrators and students. Special emphasis was placed on providing opportunities for minority women graduate and undergraduate students and postdocs to interact with minority women faculty.
  - Evaluation:
    - Feedback from the 2 - day conference indicated that participants benefited from extensive opportunities for networking (amongst peers as well as with senior faculty and administrators), individualized career coaching, and professional development towards tenure and promotion.
The total number of survey respondents is 17 (three had to leave the conference before the survey was distributed). All 17 respondents strongly agreed (13) or somewhat agreed (4) with the statement I learned things I did not know before. Moreover, all 17 respondents report that they had adequate networking opportunities during the conference and that they plan to stay in touch with the career coaches as well as with other junior faculty.

- Website development (beta stage)
- National conference presentations:
  - American Educational Research Association
  - Commission on Professionals in Science and Technology
  - 2nd Annual Conference on Understanding Interventions (Center for the Study of Women, Science and Technology)
- Database development:
  - Developed a database focusing on engineering academic female faculty who are African American, Mexican American, Puerto Rican, Native American, and Alaskan Native/Native Pacific Islanders and the institutions in which they currently teach - including whether the institution has been awarded (or is in the process of applying for) ADVANCE grants and other programs focusing on diversifying the science and engineering professoriate and workforces.

Additional Information

- Future Directions:
  - 2nd conference will be held in conjunction with the Anita Borg Institute
  - Refine database.
  - Continue data collection through surveys and focus groups to document experiences of participants on the tenure path and beyond.
  - Develop tools to measure the impact of networking activities - on the international level as well as on the national level - and the strength of ties formed among group members and between junior and senior faculty.


Project Focus/Goals

- FACES is comprised of several components, each designed to assist underrepresented engineering and science students with navigating the path to an academic career; these components include research experiences, graduate school recruitment efforts, and lectures and workshops on graduate education and academic careers.
- Funding provided for participants in the project includes doctoral fellowships, travel expenses, and start-up funds for new PhDs.
Project Activities/Accomplishments

- The Alliance has produced 31 PhD graduates from underrepresented groups in the past year. This represents an increase of over 60% since the baseline year of this project. A total of 20 FACES PhD recipients have received academic appointments since the inception of the program in 1998.
- A $30,000 Career Initiation Grant was given to an individual in a chemical engineering faculty position at the University of California, Riverside.
- Two $35,000 Portable Postdocs were awarded to postdoctoral fellows at GT and UC-Berkeley.
- As of 2007, GT was ranked (by the Engineering Workforce Commission) No. 2 in engineering doctoral degrees awarded to African American students and No. 2 in engineering doctoral degrees awarded to all categories of minority students.
- Within this program at Georgia Tech, 16 faculty members mentor 48 graduate students.
- A key accomplishment of the FACES alliance is increased collaboration and communication between the member institutions in our programs. Georgia Tech, Emory, Morehouse, and Spelman have been more active than ever in FACES related activities, and this has really allowed a much stronger undergraduate through PhD pipeline in the program.
- By joining forces, Morehouse, Spelman, Emory, and Georgia Tech are able to present undergraduate African American students with the opportunity to interact with graduate students, to conduct research, and ultimately choose a wide variety of graduate degree options. This exposure to research and graduate school role models is essential in recruiting and retaining minority students.
- The minority retention/advancement efforts are going very well at GT. The enrollment of minority doctoral students has been steady over the past five years. The graduation rate for minority doctoral students (as a percentage of total doctoral students) has also been steady over the same time period. GT remains at the top for production of AA doctoral degrees, and ranks high for doctoral degrees awarded to Hispanics as well.
- FACES typically awards one Postdoctoral Fellowship and three Career Initiation Grants (CIGs) each year. These awards facilitate the movement toward and into academic faculty positions. The CIG has been extremely effective in providing young faculty with the support to kick-off their research programs. Along with the financial support from the Grant, the young faculty members are mentored by senior faculty from the AGEP program on strategies for success in academia, including proposal writing, time-management, networking, etc. This mentoring has resulted in great early success for past CIG recipients.


Project Focus/Goals
The overarching goal of the BEAT program is to promote STEM achievement in the primarily African American schools in south Fulton County through the use of classroom activities in STEM courses, implementation of a rigorous engineering course sequence, and student and teacher research internships at Georgia Tech. All program activities will be focused on Transportation Engineering, in the fields of traffic modeling and in the structural and geophysical engineering of transportation infrastructure.

The real-world applicability of transportation issues makes it an ideal avenue for introducing science and engineering concepts to middle and high school students.

Program Activities/Accomplishments

- Providing GT summer research internships during Summer, 2009 and 2010 for 4 teachers and 12 high school students from schools in south Fulton County (through the GIFT program)
  - Teachers will participate in research projects, design classroom activities, and oversee high school student research groups.
  - Students will work in four teams of 3 students each to complete research projects/papers, which will be submitted to local science fair and national STEM research competitions. Students will also attend workshops on technical writing and the college admissions process (facilitated by CEISMC).
  - Students and teachers will attend seminars by GT faculty and other researchers involved in transportation-related work, and go on field trips to locations relevant to transportation.
  - Summer, 2009: Four teachers participated from June 8th through July 24th; 12 students participated from June 15th to July 17th. All student research teams submitted research papers to the Siemens Competition for Math, Science and Technology.

- Developing framework and activities for 9th and 10th grade engineering courses (Foundations of Engineering and Technology and Engineering Concepts), focusing on transportation and civil engineering content
  - During 2009 the curriculum module was created; it focuses on inquiry learning and bridge construction. This module is currently being revised for dissemination, and planning for additional modules is ongoing.
  - A web-based traffic modeling tool will be used in these courses; a version of this tool was developed in 2009 and one of the GIFT teachers worked with a GT graduate student to create high school lessons using the tool.

- Offering 2-week professional learning workshops during Summer, 2009 and 2010 for high school teachers seeking to carry out engineering instruction
  - Will provide introduction to the two engineering courses (the 9th grade course in 2009 and the 10th grade course in 2010) as well as assistance with implementation.
  - Four high school teachers (2 engineering and 2 science) participated in the workshop during Summer, 2009.

- Institutionalizing summer camps implemented in the initial BEAT grant
Two high school civil engineering camps were held at GT during summer, 2009; 33 students participated.

A middle school BEAT camp was held at Westlake high school during summer, 2009; 25 students participated.

Plans are underway for the summer, 2010 camps.

Existing partnership between Fulton County and Georgia Tech

Transportation Systems Engineering research group
- Led by Dr. Laurie Garrow and Dr. Michael Hunter
- Implemented a 2-week curriculum on traffic modeling in a Fulton county high school class (fall, 2006)
- Two high school teachers worked in this lab through the GIFT program, learning about traffic modeling software and creating classroom activities (summer, 2007)
- High school students toured the lab, visited the GA Department of Transportation, and carried out classroom activities developed by graduate students in this lab (spring, 2008)
- Two high school teachers and six high school students worked in the lab during summer, 2008

Geosystems Engineering research group
- Led by Dr. Glenn Rix and r. Dominic Assimaki
- High school teachers and students worked in this lab through GIFT (summer, 2006, 2007 and 2008)

Structural Engineering, Mechanics and Materials research group
- Led by Dr. Reginald DesRoches
- High school teachers and students worked in this lab through GIFT (summer, 2006, 2007 and 2008)
- Dr. DesRoches leads the Earthquake Engineering Research Institute Student Chapter, which participates in community outreach programs to stimulate interest in STEM (including school visits, GT lab tours, and assisting with design competitions)

Partnership between Fulton county and CEISMC:
- CEISMC is the K-12 educational outreach center at GT, operating 20+ programs for students and teachers
- Successful outreach programs include:
  - GT research labs hosting high school teachers and students in summer research internships
  - GT academic units offering summer enrichment programs to advanced high school students
  - Partnerships between GT and the GaDoE and/or school systems on curriculum and technology issues
  - GT faculty working through CEISMC to create science/engineering activities for students participating in summer and weekend programs, and also to create professional development content for science/engineering teachers
4. Georgia Tech Research on Accessible Distance Education (GRADE) (2007 Annual Report)

Project Focus/Goals

- The project goals relate to improving issues related to distance education; the goals fall into three distinct areas: professional development, barrier removal, and outreach through the Multimedia Educational Resource for Learning and On-Line Teaching (MERLOT).

Project Activities/Accomplishments

*Professional Development:* GRADE provided training and technical assistance to enhance the knowledge and skills of faculty, staff, administrators and students.
- Design of an online tutorial with ten modules detailing accessibility issues in distance learning in higher education
  - Called Access E-Learning tutorial
  - As of 1/31/2006, 2,533 people had completed the full tutorial and 40,092 people had completed at least part of the tutorial
  - 12 fact sheets summarizing the basics of the tutorial were created and distributed to users of the tutorial
- Feedback on the tutorial was gathered from GT faculty and students with disabilities; this feedback led to substantial revisions to the tutorial.
- The tutorial was distributed nationwide through CATEA Internet sites and the MERLOT database; after its publication info on the tutorial was e-mailed to nearly 20,000 people.
- Roundtable meetings were held to promote discussion of access issues in distance education among GT faculty and students; these meetings then expanded to other campuses.
- A National Leadership Institute meeting of 50 researchers, administrators, professors, etc. was held at GT in August, 2005. At this meeting, participants reviewed current and future plans related to encouraging accessible online education.
- GRADE personnel gave presentations at dozens of conferences, presenting to 1,500 conference attendees total.

*Barrier Removal:* GRADE was committed to making Georgia Tech a model institution on accessibility for distance education. Successful strategies and results were disseminated nationwide to assist others in course design.
- GRADE created four fully accessible online courses, including one in human factors engineering; these courses were intended to serve as a model for other GT distance learning courses.
- These distance learning courses were evaluated by students with disabilities; evaluation data was used to revise and improve the course (Designing for the Life Span).
• GRADE consulted with personnel from the GT Center for Distance Learning and Professional Education (DPLE) to investigate accessibility issues in current courses and to gather advice for the construction of the model courses.
• The four GRADE model courses were added to the MERLOT database.
• GRADE personnel provided technical assistance to facilitate implementation of distance learning; this assistance was provided through conference presentations, roundtable meetings, seminars, and one-to-one assistance.

Outreach through MERLOT: GRADE partnered with the Multimedia Educational Resource for Learning and On-Line Teaching (MERLOT).
• GRADE and MERLOT personnel worked together to establish a set of voluntary guidelines for accessibility in distance learning. These are published online through CATEA.
• GRADE personnel used these guidelines to evaluate extant materials in the MERLOT database and provided a report of these results to MERLOT. The reviewers also generated a set of “promising practices” for improving the accessibility of distance learning materials.
• GRADE personnel provided ongoing technical assistance to MERLOT personnel.


Project Focus/Goals

• Project goals: SciTrain is dedicated to improving knowledge and practice in the field of disability education. Its activities are designed to work together to generate research data on the needs of STEM teachers, create training modules based upon that research, evaluate the effectiveness of the research, and then disseminate training and research data. SciTrain’s evaluation activities are essential to creating a baseline of teacher knowledge about accessible STEM. This is being accomplished through its ongoing evaluation research, including focus groups, longitudinal studies, online surveys and related work.

Project Activities/Accomplishments

• Objective 1: SciTrain will perform a literature review of research and practices in attempts to provide accessible STEM in the classroom and laboratory.
  o The main literature review was conducted in Year 1; 268 articles were reviewed and 50 were chosen for inclusion. The review was updated and expanded each year, with a total of 147 articles included by Year 3.
  o Abstracts and annotations for each article were created in order to provide organization and ease of searching.
  o References, abstracts, annotations, and copies of the full articles included in the review are available online.
• Objective 3: A series of focus groups will be conducted to identify specific student needs. This information will be used to determine the accommodations that are
critical for students with specific disabilities and usable by the largest number of students possible.

- A focus group was conducted with Cobb County special education teachers in January, 2009.
- Focus groups have been extended to years 2 and 3 due to their contributions in directing the online course materials and assessing the website’s usability.

**Objective 4:** SciTrain will create three Web courses to instruct teachers in the creation of accessible STEM education for high school students.

- Publication of these courses began on September, 2007. All courses are available online.
- Courses include Accessible Math Training and Accessible Computer Science Training.
- All courses include modules pertaining to specific disabilities, including learning disabilities, ADHS, Autism Spectrum Disorders, and Mobility and Dexterity Disabilities.
- Courses are designed for regular STEM teachers but contain some resources specifically for special education teachers.
- Since October 1, 2008 the courses have received 16,752 unique visits.

**Objective 5:** Host a discussion forum for teachers to share experiences and ask questions of project staff.

- An online forum was created but was highly underutilized; teachers cited “lack of time” as the primary reason for non-use.
- During year 3, SciTrain worked to provide an incentive for teachers to use the online forum in the form of making it part of earning a certificate and/or Professional Learning Units. This component of the project is ongoing.

**Objective 6:** Publish an Accommodations Database for brief, just-in-time solutions to problems that feature assistive technology aids.

- This database was published in December, 2007 and is frequently updated.

**Objective 7:** Publish a searchable Publications Database of journal articles that address the needs of accommodations for STEM.

- This database was published in October 2007 and now contains 147 articles searchable by keyword.

**Objective 8:** Web Site Evaluation for Accessibility and Usability

- The SciTrain website undergoes testing after each major addition/expansion to the materials. The site has been tested to comply with various usability guidelines, with positive results for general usability.

**Objective 9:** Accessible Science, Math and Computer Science Courses Testing.

- Longitudinal study of 7 Cobb County teachers who took the online course(s) and implemented the material in their classrooms during Spring, 2009
  - Weekly online log about their experiences with using the accommodations
  - Reviewed the SciTrain online course materials
- Users of the SciTrain courses were randomly selected to complete an online rating of the courses (approximately 70 total participants).
Study of student engagement during Spring, 2009 to evaluate SciTrain’s goal of creating science classrooms that are equally engaging for disabled and non-disabled students.

- Survey of 73 Georgia math and science teachers; 24 reported having implemented the SciTrain materials in their classroom and 18 of these believed this had made a difference in their students’ engagement.


Project Focus/Goals

- to provide STEM instructors with effective training, resources, and incentive for making reasonable accommodations to in-person courses, labs, online and hybrid courses.
- Online resources will be developed in order to inform stakeholders about the barriers that students with disabilities face in their STEM educations and provide information about strategies to remove those barriers in order to improve access.
- Instructors in high-impact courses will be trained through workshops and online modules.
- After initial local efforts (at GT and UGA), all materials will be made available online so that a national audience can be reached.

Project Activities/Accomplishments

- Review of research and practices for accessible STEM education
  - Early in the project, personnel will so a lit review to investigate issues related to successful implementation of STEM education for postsecondary students with disabilities.
  - This lit review will build upon that conducted for SciTrain.
  - Information generated by this lit review will guide the creation of online and training materials.
- Selection of STEM content experts
  - 3 GT instructors, one each from the physical sciences, biological sciences, and mathematics will be selected to serve as content experts during the development of training materials.
- Selection of STEM Faculty Champions
  - Instructors from GT and UGA will be selected to serve as champions. These individuals will work to facilitate buy-in for the changes proposed by SciTrain U.
  - These instructors will teach large freshman level STEM courses and will oversee numerous TAs. Through their large sphere of influence it is hoped that they can quickly and efficiently further the practices advocated by SciTrain U.
  - Up to 40 hours of assistance from CETL will be provided for each champion to implement accommodations in their own classes.
- Multiple Evaluation Activities

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Evaluation activities include data mining for students and faculty, focus groups, online surveys, and longitudinal studies.

- Delivery of in-person workshops
  - Workshops for STEM faculty, TAs, and tutors will be conducted. Topics will relate to making STEM classes accessible to all students and eliminating barriers for students with disabilities.
- Provision of personalized technical assistance
  - Technical assistance will be available to educators through telephone, e-mail, and regular mail.
- Update and expansion of current SciTrain (high school) and GRADE project resources
- Meld updated/expanded SciTrain and GRADE content to create STU online training modules
  - The resulting materials will be merged to create the STU site, a one-stop shop for postsecondary STEM instructors consisting of a series of training modules on how to make STEM curriculum accessible to postsecondary students.
  - Modules will target instructors, student service providers, and IT personnel.
- Development of online resources (fact sheets, discussion forum, AT (assistive technology) Wiki; development and delivery of quarterly webcasts
- Hosting workshops at conferences
  - STU staff will attend 7 conferences per year and will present at least four of these.
- Website evaluation for accessibility; online testing of modules/revision

Additional Information

Project Evaluation: Questions and respective evaluation methods:

- What are the differences, if any, in completion rates of students with documented disabilities in courses taught by STU-trained faculty vs. those taught by non-STU trained faculty?
  - Collection of student and instructor demographic and achievement data from Disability Resource Centers at GT and UGA
- What percentage of STU-trained faculty incorporates elements of training into their classrooms?
  - Faculty surveys, classroom observations
- Based on current literature and recent SciTrain and GRADE findings, what learning environments will prove most successful for program stakeholders?
  - Literature reviews, evaluation of SciTrain and GRADE findings
- Which stakeholders are provided with what resources?
  - Count of training modules developed, workshops/webcasts delivered, participants trained, students taught, visitors to online sources
- What do participants learn as a result of program participation?
  - Participant reactions to training, participant focus groups, participant surveys, and classroom observations
- What actions are the various stakeholders taking toward improving content/pedagogical knowledge, organizational capacity, and available resources?
Who adopts which accommodations? What organizational barriers or accelerators hinder or promote accommodation adoption?

- Participant focus groups, participant surveys, classroom observations, participant reflective journals

Assessment data from quarterly report spanning July 1, 2009 – September 30, 2009

- To date, the estimated impact of SciTrain U activities is 2,373 GT students and 1,700 UGA students, and 30 total unique faculty attendees from both schools.
- The first fall 2009 GT workshop was attended by 28 people including faculty, staff, advisors, TAs and students. Pre- and post-workshop surveys were given; analysis of this data indicated that the workshop had an overall positive effect on attendees.
- Data was gathered by means of weekly online journal entries, focus groups, and classroom observations; data analysis is ongoing.

Theme II: Programs whose goal is to either develop/train K-12 teachers, or provide a K-12 teaching experience to college students

7. GIFT: Summer (2009 Data)

**Project Focus/Goals**

- Provide industry and university mentors an efficient method of identifying and selecting teachers interested in participating in internships.
- Quickly orient teachers to business and university work environments, and mentors to K-12 workplace culture.
- Provide participants (teachers and mentors) support throughout the summer by assigning small groups of teachers to a master-teacher facilitator.
- Assist teachers with creating an Action Plan for implementing summer experiences into the classroom or more generally applying the GIFT experience in the classroom.
- Provide support for Action Plan implementation in the classroom through visits by GIFT staff.
- Foster the development of an extended professional community of learners.
- Encourage extended partnerships for communication and collaboration between teachers, industry and university mentors and pass that approach on to the students of the GIFT teachers.

**Project Activities/Accomplishments**

- 73 teachers from 21 school districts throughout Georgia participated in 4-7 weeks summer internship and research fellowships. Since 1991, GIFT has placed teachers in more than 1500 positions statewide;
- 26 high school students worked alongside teachers, forming R.E.A.L. (Research, Experiment, Analyze and Learn) teams in laboratories at Georgia Tech
- 11 teachers were placed in corporate internships at industry leaders such as Cisco, Georgia Power and General Electric
• 55 teachers were placed in research labs at partnering institutions Georgia Tech and the University of Georgia
• 7 teacher facilitators served in dual roles at corporations and universities working with teachers and sponsors as mentors and liaisons during internships.

8. Noyce (Teacher Recruitment Initiative in Physics and Chemistry)
Year 1 (2008 Annual Report)

Project Focus/Goals

Two-year scholarships are being provided to thirty-two science and engineering students majoring in fields that may lead to either chemistry or physics certification. The students will be receiving annual $10,000 scholarships during their senior year and subsequent enrollment in the fifteen month chemistry and physics Master of Arts Teaching program.

The project is serving as a model for two institutions of distinctly different cultures (one a university with a strong education school, the other a technological university) to join forces to create an exemplary program that is producing effective grades 6 - 12 chemistry and physics teachers. Project features include the initiation of a twelve credit hour educational course sequence at Georgia Institute of Technology, the close working relationships of the universities with school systems serving the greater Atlanta area, and the K-12 teaching experience of the science education faculty. [quote taken from NSF website]

Project Activities/Accomplishments

• What we plan on doing in the Fall 2008 semester is to award up to 10 Noyce scholarships to senior undergraduates at GT and KSU majoring in chemistry or physics, or to graduate students enrolled in the MAT at KSU in chemistry or physics. We also plan on conducting a evening get-together of Noyce scholars where we engage in team building activities, invite the scholars to community service opportunities in the local schools, and prepare a brief panel question-and-answer session with local K12 teachers. In the Spring, 2009 semester, we expect to conduct monthly seminars with our scholar community, set up a blogging site for continued support and communication, and conduct another mini-retreat. We will also be accepting applications for year 2 scholarships at that time.


Project Focus/Goals

• The STEP Up! program aspires to institutionalize K-12 teaching internships as a valued component of graduate and undergraduate education and to continue working to help create a university campus climate that encourages the active participation by students and STEM (Science, Technology, Engineering, and Mathematics) faculty in the challenges of K-12 education. The program partners undergraduate and graduate
student Fellows with metro-Atlanta area high school science or mathematics teacher-coordinators to enhance both the math and science education in the high schools and the educational experiences of the student Fellows.

Program Activities/Accomplishments

- Experiences of GT student participants:
  - All Fellows cited a desire to gain more experience in teaching as the primary reason for participating in the STEP Up! program. Among 12 graduate Fellows who responded to the online survey, seven said that their career goal was to stay involved with education, either as a college professor, K-12 teacher, or professional who volunteers and/or works on a part time basis with K-12 students. In 2007-2008 group, three Fellows cited becoming a college professor as their career aspiration. Fellows, especially those who were particularly interested in teaching, refer to STEP as a great opportunity to experiment teaching.
  - STEP Fellows were very enthusiastic about their experience and have developed multiple skills because of their participation. Similar to the previous years, all Fellows indicated that they have become better teachers and they have developed better communication skills because of participation in STEP. Fellows also report developing other personal skills like leadership, organization skills and flexibility.
  - All Fellows agreed that they have learned a great deal about the teaching profession. Participation in STEP has helped many Fellows to clarify their career aspirations. While some Fellows embrace the idea of teaching at high school level as a desirable career goal, other Fellows decided that high school teaching is not what they want to do in the future.
  - All Fellows agreed that STEP has been a rewarding and challenging experience for them. The following were cited as the most important factors contributing to a successful experience: Useful communication and support from their assigned teachers and program administrators, freedom in the classroom, and the feeling that a few students were actually reached.

- Experiences of teacher participants:
  - Teachers reported getting along well with the Fellows and evaluated the Fellows highly. The majority of teachers found the Fellows well prepared and pedagogically successful.
  - Teachers cited a variety of activities as very successful. They valued the class lectures, innovative labs, problem-solving, field trips, tutoring and mentoring by Fellows. They also appreciated Fellows’ abilities to connect taught material with real-life application.

Theme III: Programs which are primarily research-oriented but provide research opportunities to K-12 teachers and/or students

The programs classified in this section are primarily synergistic due to the partnerships they create between Georgia Tech and K-12 institutions. The purpose of a number of
these programs is to enhance the content knowledge and research process skills of
teachers and/or students in the K-12 system. However, via working together to determine
how this knowledge (and skills) translates into the classroom, students involved in these
projects will gain insight into K-12 teaching careers and Georgia Tech faculty will be
able to better advise students about K-12 STEM efforts and connect these students with
individuals already in the K-12 system.

10. IGERT: Hybrid Neural Microsystems: Integrating Neural Tissue and Engineered

Project Focus/Goals

This IGERT program is focused on the creation of a training environment that combines
cellular and systems neuroscience with microelectronics/computing technology and
microelectromechanical systems (MEMS). The novel combination of disciplines will
result in a program whose intellectual merit is embodied in the development and
application of systems that integrate neural tissue and engineered components. Research
applications range from enhancing knowledge of living organisms, to augmenting
damaged neuronal tissue, to creating biologically-inspired engineered systems. The
participating faculty members have a strong track record of interdisciplinary education
and research that has laid the foundation for this effort. The IGERT program will build
upon this foundation through a combination of educational infrastructure and
interdisciplinary research opportunities that will facilitate the training of IGERT fellows,
who will emerge from the program as a new breed of scientist-engineer that understands
and can apply knowledge that crosses these two, previously disparate disciplines. [quote
taken from igert.org]

Project Activities/Accomplishments

- Interdisciplinary Research Achievements:
  - Members of the research team have conducted the following projects:
    - A study on the functional conductance relationships in a model neuron
database of a Central pattern generators (CPG).
    - A new interdisciplinary collaboration with another IGERT lab…at
Georgia Tech that seeks to use computational modeling, and more
specifically a novel technique that we developed termed relational
modeling as a high throughput screening process for potential
experimental and clinical therapeutics.
    - Research on infinite multirhythmicity in three dimensions.
      Theoretically, an analog circuit displaying this behavior will be able to
store arbitrary amounts of information. [a research team member] is
currently designing such a circuit.
  - The results of these research projects will be distributed through conference
presentation and publication; the computational modeling work led to an NIH
proposal involving its application to spinal cord injuries.

- Education Achievements:
A research team member participated in the STEP program.
A research team member taught a course in the development of hybrid neural Microsystems during Spring, 2008.

Outreach Activities:
A research team member took part in a workshop for middle and high school students. The workshop (part of Brain Awareness Month), designed to provide exposure to neuroscience concepts, was held at the Morehouse School of Medicine.
A research team member participated in a panel about graduate school for a summer REU program at Emory.
A research member conducted lab tours at Georgia Tech and at Marietta High School for area high school students.
A research member presented his research at Marietta High School as part of Brain Awareness Month.
Research members introduced neuroscience and engineering concepts to students at a local elementary school.


Project Focus/Goals

- Our IGERT program integrated ecology, chemistry, sensory biology and small scale physics of flow (hydrodynamics) to understand how marine and freshwater organisms communicated chemically and how these chemically-mediated interactions structured populations and organized communities.

Project Activities/Accomplishments

- IGERT allowed us to build a series of 8 novel and integrated classes that crossed the disciplines of biology, chemistry, and engineering, to simultaneously train biology, chemistry, and engineering students across each of these disciplines, and to then involve all of these students in team-focused multidisciplinary research on topics within aquatic sciences that span these disciplines…This approach “infected” our students with an appreciation and enthusiasm for interdisciplinary science. A significant sub-set of these students then carried this approach into their own teaching in both university (as a teaching assistant or even independently teaching university courses as a late-stage Ph.D. student) and high school teaching.
- After their initial years of IGERT training several of our IGERT students participated in intensive year-long efforts where they taught part time for one year in a high school that was failing to meet state education standards. They took a summer course in teaching methods, and then spent 10 hours per week conducting lectures and leading discussions in local high schools. They prepared and led labs for biology and environmental science classes and started an after school tutoring program that focused on preparing students from underperforming schools for the graduation test and for AP tests. They also commonly worked with high school teachers to better integrate hands-on approaches into class-room science experiences. Our students also
organized enrichment activities for their students such as visits to the Georgia Tech campus and to the new Georgia Aquarium.

- Other activities include providing students with opportunities for international education and research efforts, the creation of a capstone field experimental course in which students on interdisciplinary teams investigated novel questions in the field, and having students run the IGERT seminar series.

- When IGERT started, we initiated a course we called “tools of science” where we discussed general opportunities, challenges, obligations, and skills needed to be successful scientists and educators. Topics included aspects of ethics, minorities, and women in science, how to write proposals and papers, how to be a good reviewer, how to pick a productive professional path and the different challenges and opportunities offered by industry, government, university, college positions, etc. This class was offered year 1 to IGERT students only. The “buzz” from the class created request from the Biology Dept. to have it opened to all first year graduate student. This demand expanded and there are now Tools of Science courses being taught independently in the Biology Dept, Chemistry and Biochemistry Dept, and in Earth and Atmospheric Sciences Dept. The need for these courses to be interactive and small enough for significant discussion among all students mandated separate courses, but all of these courses are based on the initial IGERT model.


Program Focus/Goals

- We will provide teachers with a high quality research project in nanoscale science and engineering, assist them in understanding the education and career opportunities in STEM and nanotechnology so that they can relate these opportunities to their students, and assist the RETs in introducing nanotechnology into their science classroom.

Program Activities/Accomplishments

- The NNIN RET program has had a 3-year total of 60 diverse participants: 33 females (55%), 27 males (45%) and 42% from underrepresented populations. NNIN sites leveraged the RET award with NNIN funds to support additional participants each year for a total of 15 additional RET participants over the three years. We achieved our goal of having teachers from minority populations. We have also been highly successful in having teachers who teach at schools with high-minority populations—71% of the schools have a high percentage of underrepresented populations.

- Post-experience survey results from 2008 program participants are as follows; values indicate average responses on a 1 to 4 Likert scale with 1 corresponding to “not at all” and 4 corresponding to “great extent.”
  - Program was responsive to professional development needs: 3.4
  - Program provided opportunities to engage in inquiry/research activities that I will adapt for classroom use: 3.8
Program increased interest in research and ways that STEM can be applied: 3.7
Program stimulated thinking about ways to improve my teaching: 3.5
Program increased my interest/ability in networking with teachers and other professionals: 3.8
I believe I will be a more effective teacher: 2.8
Mentor’s knowledge of roles and responsibilities of teachers in STEM: 3.5
Mentor’s interest in helping you develop a plan to improve education in STEM: 3.8

Summary of survey results: The results indicate that teachers were actively engaged in research, were stimulated to improve their teaching, and that nanotechnology should be included in the science classroom. An overwhelming majority of participants indicated that they learned about nano-education, learned about materials and resources for use in the classroom, learned about professional development opportunities, and learned how to include nano in their classroom. The project mentors showed that they had an understanding of teacher roles and responsibilities and wanted to help the teachers in improving education. Interviews with teachers followed up on the lower response rating for the “more effective teacher” question. RETs indicated that they believe they were already quite effective in their classroom and the program just supported their efforts in effective classroom practices. Similar responses occurred for the “improving teaching” question.

- Each site is required to provide one week of classroom support to assist the teacher in refining his/her lesson. One of the goals of our program has been to develop a collaborative community between the site and the school. Sites report a variety of additional activities with the RETs which include classroom visits, field trips to site, remote AFM characterizations, presentations at state science teacher associations annual meetings, science fair/student research projects, school/district workshops, science fair mentor/judges. At Georgia Tech and UCSB, 2–3 RETs will be hired to run NanoCamps and assist in the mentoring of the new RETs. Georgia Tech has done this for two years and has found it a very rewarding experience for the former RETs and UCSB will adopt this approach.

- Our culminating experience occurs at the annual meeting of the NSTA conference. All participants of a year attend the NSTA and participate in the NNIN Share-A-Thon, a half-day event where teachers share their experiences and the lessons developed. This has been extremely successful and teachers have been very excited to know of other units and other teachers doing nano in their classrooms. RETs have presented their lessons in NSTA workshops. Our RETs have indicated (anecdotally) that the NSTA has been a very rewarding professional development experience for them (the majority had never attended an NSTA convention).

- One of the goals or the NNIN RET is to build a library of classroom activities. We have been successful in assisting our RETs in developing a variety of units that are used in their classrooms. Once tested in their classrooms, the units are provided to NNIN which has the units reviewed and edited and then placed on the NNIN education portal.
Theme IV: Programs designed to investigate and implement innovative pedagogical techniques

The projects classified in this category give students working with faculty members on these projects very strong opportunities for both theoretical and experiential learning. Depending upon the project, this knowledge may be relevant to the k-12 arena, higher education, or both.

Additionally, these projects provide excellent opportunity for Tech to Teaching programming to provide students who may be working on these projects with background knowledge needed to be successful in working on the project. Courses and workshops specifically addressing the needs of these programs should be an integral part of the ongoing content development effort for the CETL courses and workshops (described below in section 3).


Project Focus/Goals

The question that this project addresses is whether the new online publishing paradigm represented by Wikis can be successfully leveraged for science education? In this research, collaborative software that extends Wiki technology to support science learning by high-school students will be created. Students will learn about science content and method by collaboratively researching and writing about controversial science topics, supporting their writing with strong citations, and publishing their writing on the Internet. [quote taken from NSF website]

Project Activities and Accomplishments

• Pilot study:
  o The goal of this study was to inform design and to understand what barriers exist with respect to investigating students’ perceptions of their potential audience, their process for writing, and how interacting online influenced their performance on the assignment.
  o In the semester-long pilot, 47 freshman students used a wiki to publish essays regarding public policy issues. Data collected including log file data that recorded all changes made to the wiki, student demographics, student attitudes toward a variety of writing tasks, and interviews with a selection of 12 students.
  o Results:
    ▪ We found evidence that students considered sources critically and reflected on their audience as they published on the wiki. They authored documents that the course’s regular instructor reported were of high quality.
Large variability existed in engagement with the site, which was assessed by number of edits, number of pages edited, and other related variables. The researcher also discovered that number of edits was uncorrelated with number of contributions, so this metric is not ideal for assessing overall participation in this type of activity.

Interview data led to the following conclusions: 1) Student’s online interactions helped improve their writing; 2) Students failed to view their contributions to the site as public, despite frequent clues to the public nature of their work throughout the study; 3) Students’ writing was impacted by the fact that their classmates would be reading their work.

- Technology and Curriculum Design Activities:
  - Customization of the MediaWiki platform in order to support critical academic writing skills and classroom use; tools include reference, student, and teacher tools.
  - Usability testing on this platform was conducted in Summer, 2006.

- Second Study Iteration:
  - 2006-2007 school year: 2 high school AP environmental science classes (19 total students participated) used the Science Online Wiki to write articles.
  - Our goals in examining classroom and online activity are threefold: 1) to understand the ways that the wiki construction kit creates a social landscape for classroom writing activities and possibilities for reflection, interaction and learning; 2) to contribute to the design dialogue in the wiki community and help further sensitize other researchers and developers to critical design issues in classrooms; and 3) to assess student learning.
  - Data collection involved student and teacher interviews, in-class observations, and pre- and post-tests to assess student learning.
  - Results:
    - Preliminary results indicated barriers to collaborative work with the wiki, in terms of the tools available through the wiki, teacher’s ability to assess collaborative wiki work, and resistance from the students towards depending on others to get their own work done. Preliminary results also indicated that, unlike with the pilot study, students were aware of the public nature of their work and excited at the prospect of others using it.

- Third Study Iteration:
  - Spring, 2008: AP organic and biochemistry class used the Science Online Wiki to create their own user page and to write an article about the biochemistry of a human disease; 14 students participated.
  - A total of 35 student (students were interviewed multiple times) and 2 teacher interviews were conducted.
  - Data analysis is ongoing.

- Several conference presentations and proceedings, as well as several journal publications, have come from this project.
**Project Focus/Goals**

- **Project summary:** This project seeks to provide a laboratory-like experience in ECE courses which do not have a lab component. Low-cost, portable experiments are designed to be conducted in the classroom or at students’ homes. A center, The Center for Teaching Enhancement using Small-Scale Affordable Labs (TESSAL), was initiated for this project.

**Project Activities/Accomplishments**

- **Experiments used in this project (descriptions available within the annual report):**
  - Measurement Noise and Aliasing
  - Random Signals
  - Digital Filtering with LEGO kits
  - Digital Filtering with the Speedy 33
  - Quadrature Measurements
  - Audio Signals
  - Motor Control Demo with LEGO
  - Motor Control Project with LEGO
  - Motor Control and Frequency Response with the PIC Processor
  - Radio Frequency Identification (RFID) Introduction
  - RFID Design Project
  - Digital Logic for Binary Addition
  - State Machine
  - Solar Energy
  - Power Generation and Efficiency
  - Robotics

- These experiments either have been or will be used in the following courses: ECE 2025, 2030, 3025, 3065, 3070, 3075, 3085, 3090, 6561, and ME 2016, 4053.

- **Assessment procedures were designed to address these student outcomes:**
  - Student achievement on tests will be higher in classes that provide opportunities for collaborative learning using hands-on modules.
  - Student interest in course material will be greater in courses that incorporate hands-on experiments.
  - Increase opportunities for students to work on teams and learn to solve problems with other students.

- These experiments are also being used in similar courses at Georgia Southern University.

- **Presentations of this work were held at the 2008 ASEE Frontiers in Education Conference and the 2008 CCLI PI meeting. Future presentations will occur at the 2009 American Control Conference and the National Instruments NI Week.**

- **Outreach activities:**
Members of this project participated in four middle and high school camps during 2008, and also ran the experiments in science K-12 classrooms. A total of 266 K-12 students participated in these outreach activities.

Additional Information

- Future plans:
  - Three summer pre-college camps
  - Introduction of experiments on random signals and electromagnetic into ECE courses
  - Create web support materials for the experiments
  - Implement use of experiments at partner schools
- Four publications/presentations have resulted from this project.


Project Focus/Goals

- This project is a partnership between research teams at Georgia Tech and Rutgers University. The two teams collaborate on most project functions, with GT taking the lead in the development of learning technologies and Rutgers taking the lead in implementing and evaluating the technologies.

Project Activities/Accomplishments

- Research and Education Activities:
  - The central component of this project is the development and evaluation of an interactive learning environment called ACT (for Aquarium Construction Toolkit). ACT is intended to support middle-school children in establishing and maintaining classroom aquaria based on multiple lesson plans used by middle-school teachers for teaching science. The goal is to facilitate learning about complex biological systems, and thereby foster learning about complex systems more generally.
  - Design/development of ACT (10/2006 – 1/2008)
    - Developed design requirements and use case scenarios for the ACT pertaining to middle school students and teachers as well as researchers.
    - Integrated several components (SBFAuthor, a preliminary tool for building structure-behavior-function models of complex systems, NegLogo, an off-the-shelf simulator, and an electronic notebook for use by middle school students) into a preliminary version of ACT
    - Conducted ACT usability studies.
    - Showed the ACT program to middle school teachers.
  - Development/implementation of ACT (1/2008 – present)
Trained Rutgers partners on use of ACT and provided support for implementation of ACT in middle schools by Rutgers partners.

- Debugged and refined the design of ACT based on feedback.

- Findings
  - The development of the ACT tool led to insights regarding relationships between mental models and mental simulations and design principles for flexible learning environments.
  - Middle school classroom use of the ACT tool led to richer discussions and deeper understanding of complex systems.

- Potential implementation of a newer version of the ACT in the Georgia Aquarium has been discussed with the Georgia Aquarium vice president.

- This research has generated two journal publications.


**Report Focus/Goals**

- Purpose: The purpose of this report, therefore, is to catalyze a conversation within the U.S. engineering community on creating and sustaining a vibrant engineering academic culture for scholarly and systematic educational innovation—just as we have for technological innovation—to ensure that the U.S. engineering profession has the right people with the right talent for a global society.

**Report Contents**

This report focuses on “how”, “who”, and “what” with regard to innovation in engineering education:

- “How”: The report’s authors advocate the adoption of a model for educational innovation based on a continual cycle of research and practice; this type of a model would produce better-educated students through a dual purpose of advancing the body of knowledge on learning in engineering and implementing effective and efficient educational innovations.
  - The report emphasizes the notion that the rigorous and scholarly approach applied to technological innovations within engineering should be applied to educational innovations within engineering.
  - The report discusses the need for support for individuals who wish to engage in research on engineering education in terms of financial resources, appropriate facilities, educational research and development centers, reputable journals and conferences, etc.
  - Endorse research in engineering education as a valued and rewarded activity for engineering faculty as a means to enhance and personalize the connection to undergraduate students, to understand how they learn, and to appreciate the pedagogical approaches that excite them (National Academy of Engineering, 2005, p. 54).
“Who”: The responsibility for providing innovative engineering education rests with engineering faculty and administration. In order to have a faculty prepared to carry out scholarly research on engineering teaching and learning, professional development in this arena must be encouraged. This type of training should begin in doctoral programs that produce engineering faculty. Furthermore, institutional variables such as recruitment and hiring criteria and reward structures provide incentives for achievement in educational innovation.

- When engineering faculty members enter the academy, many—through no fault of their own—are not fully prepared for their role as educators. Although graduate schools have begun to focus more attention on developing teaching skills, the main focus continues to be on creating researchers. As a result, when most faculty members enter the academy, they are, as Kuh and associates note (2005), “well intentioned gifted amateurs” when it comes to teaching. (Ambrose and Norman, 2006)

“What”: There are three critical components in engineering education: curriculum, instruction, and assessment. The current approach to these is driven by a narrow conception of learning and their implementation is carried out through fragmented educational techniques. The new approach should be “derived from a scientifically credible and shared knowledge base on engineering learning and employed in more contemporary approaches to education, such as inquiry-based learning and experiential curricula.”

17. Middle School Science Curriculum Materials: Meeting Standards and Fostering Inquiry through Project-based Inquiry Science Units (2009 Annual Report)

Project Focus/Goals

- Project goals: Our goals for this project were to integrate project-based inquiry curriculum units for middle school science that were developed in 3 different places into a full three-year comprehensive project-based inquiry middle school science curriculum.

Program Activities/Accomplishments

- Characteristics of the units:
  - 15 total units; 3 each in earth, life, and physical science
  - Engage learners in sustained inquiry
  - Goal is to answer a “driving question” or solve a “design challenge”
  - Scientific content for the unit is reflected in the question/challenge
  - Questions/challenges designed to be meaningful within students’ lives
  - Questions/challenges designed to elicit behaviors similar to those performed by scientists, “Practices of Scientists”
    - Communication and collaboration practices
    - Problem-solving practices
    - Designing investigations
    - Measuring, collecting, recording and analyzing data
Explaining scientifically
Making claims and supporting them with evidence
- These practices are repeated throughout the curriculum to facilitate learning

Activities involved in preparing the individual units, which were developed in three different sites, for collective use in a 3-year middle-school curriculum:
- Figuring out how to connect the distinct units into a cohesive curriculum (and modifying the units as needed in order to do this)
- Selecting themes to run through all the units (and modifying the units as needed in order to accomplish this)
- Identifying critical science standards not covered by any of the units and making adjustments to include them
- Deciding which units would and would not be useful within the context of the full three-year curriculum
- Developing an organizational structure to be applied to all the units
- Making necessary changes to locally developed units to make them nationally applicable (i.e., re-working things that apply uniquely to Georgia)
- Piloting and field testing the curriculum
- Offering professional development to teachers did the piloting and field testing
- Working with a publisher to publish and market the curriculum and accompanying professional development criteria
- Writing student textbooks and teacher planning guides
- Creating materials kits to go along with the curriculum

Publication: 13 units have been published (publisher is It’s About Time) and will be available for adoption on 8/1/2009.

Results:
- 2004-2005 academic year: on tests designed to approximate state standardized tests, PBIS (Project-Based Inquiry Science) students performed better on PBIS topics than on non-PBIS topics
- 2005-2006 academic year: students showed gains across all PBIS units and all teachers, although gains were smaller than expected in inquiry skills and earth science
- Quote from external project evaluator:
  - The evaluation hypothesis focused on whether students’ opportunity to learn was a greater predictor of performance than the quality of students involved in the program (see Table 19 on page 16). Students’ prior achievement and interest in a science career were significant predictors of pretest performance on each of the subject area assessments. However, students achieved significant learning gains at an equal rate. In other words, PBIS units were effective regardless of race, gender, socioeconomic status, prior achievement, and interest in a science career.
- Data collected from teachers during the 2005-2006 pilot in NYC schools (77 teachers at 38 schools participated in the pilot; 25 teachers from 20 schools participated in the focus groups) revealed the following:
Teachers provided extremely positive comments about their students’ experiences with the PBIS units
Teachers reported that the PBIS units were engaging to all types of learners
Teachers reported that the inquiry-based approach was novel to many students, and as such required extra time
Teachers said that students enjoyed the PBIS work and as such were motivated to behave better so they could do the work
Teachers felt that they did not have sufficient time to do all of the curriculum they had planned to do – there were issues with institutional factors (i.e., not enough time allotted to science, testing interfering with teaching, etc.) but also some teachers thought the units were too long
Teacher recommendations also led to proposed adjustments to the professional development:

• Professional development training was provided to over 100 middle school teachers in 5 cities through this study.
applying it to achieve the design challenge. In the best of enactments of a
design-based approach, learning is active, expertly facilitated by the teacher,
and includes a variety of opportunities for publicly articulating science
understanding, debating understandings, explaining phenomena, and
debugging those explanations.

- Project goals:
  - Technology-based goals: to understand (i) the functions simulation and
    modeling software should have when integrated with physical design,
    building, and testing that will promote better science learning in the context of
    design and build activities and (ii) guidelines for designing the interactions
    between learners and the software for ease of use and to promote personal
    connections and curiosity among learners.
  - Learning-based goals: to understand which practices for interleaving physical
    design and testing with computer simulation, modeling, and explanation
    scaffolding will result in deep science learning among more learners
    participating in design-based learning.
  - Efforts focused on middle-school (grades 6-8) learners.

Project Activities/Accomplishments

- Hovercraft Software (Hovering around Georgia)
  - Developed to teach physics concepts related to working hovercrafts and the
    practices of designers and scientists, all in the context of designing and
    building small hovercraft.
  - One-week unit with four design challenges, increasing in complexity.
  - Software offers a “simulation-based virtual design environment in which
    learners can explore variations of the four hovercraft designs mentioned
    above.”
    - Includes a design area and a test area

Year 1:
- Development of software to be used in a design-based learning environment
  - Focus of this software is teaching children about forces and motion by having
    them design a series of mini-hovercrafts
  - Software features include the capacity to show the effects of manipulating
    single variables and scaffolding for explaining trends in data/
- Development of a one-week long hovercraft curriculum to accompany the software
- Summer, 2006: strength/weakness assessment of the software at a GT summer science
  camp; 20 students used the software

Year 2:
- Improvement of the hovercraft design software, now called Jackets’ Garage; has
  features of earlier version plus:
  - Better scaffolding for experimental design
  - Visualizations of invisible phenomena and hovercraft behavior
  - Presentation of additional scientific phenomena
  - Game-like feel to the software
  - Improved integration of various components of the program
• Summer, 2007: strength/weakness assessment of the software at a GT summer science camp; 20 students used the software
  o 3 1-week sessions, each with different students
• Fall 2007: further software revisions based on summer feedback; started an after-school hovercraft club at a middle school – students in the club will do similar activities to the summer camps plus prepare for a Hovercraft Olympics/

Year 3:
• 2007-2008 academic year: graduate students ran an after-school hovercraft club at a middle school
  o Students used the Jackets’ Garage software
  o The club entailed 20 sessions of 1.5 to 2 hours each
  o Researchers added paper and pencil materials to supplement the scaffolding that existed in the program
• Based on all prior findings about the software, an additional software resource, the Creativity Clubhouse, was created
  o Includes interactive science articles and case studies of hovercrafts made from household materials

Year 4:
• Further design experimentation on the two software components used together

• Findings from one of the summer camps (not sure which year):
  ▪ Due to software issues during the 1st week, the 1st week students did not use the software while the 3rd week students did (the 2nd week students were eliminated from the comparison because they differed from the 1st and 3rd week students in motivation and background knowledge).
  ▪ Based on analysis of verbal discourse during the week, researchers concluded that “participants in Week 1 offered more impoverished explanations with respect to science content and focused primarily on the designed artifact. The verbal discourse of participants in Week 3, on the other hand, was more sophisticated in form and content.”
    ▪ Week 3 students provided explanations of their work/statements more frequently
    ▪ A more coherent structure within explanations was shown by Week 3 students
    ▪ Week 3 student’s explanations contained more elaborate content with more intermediary causal concepts


Project Focus/Goals:

• In this project, we’ve been seeking to see how development of scientific reasoning happens in a learning environment in which nearly all of the practices important to transferable learning (see, e.g., Bransford et al., 2000) are carried out. This literature tells us that practices that engage students actively in focusing attention on critical
issues, features of problems, abstractions and principles, and evaluating their own understanding, are important to promoting transferable learning, and that learners need repeated deliberative practice of targeted skills and using targeted content to learn well. Learning by Design [the classroom curriculum developed as part of this project] provides enactments of Project-Based Inquiry that carry all of these out. We sought to find out what typical paths of that development look like under these circumstances and what effects those paths.

Project Activities/Accomplishments:

- Focus is on middle-school students in science courses.
- Years 1-2: Classroom data was collected in order to record students’ cognitive and participatory development.
- Years 3-4: Classroom data was analyzed in order to yield descriptions of students’ scientific reasoning development, assessment of variability in this development, and identification of factors that promote development.
- Year 3: Case studies were prepared for individual students, groups of students, and classes; these case studies led to the identification of characteristics both positively and negatively impacting development of students’ scientific reasoning.
- Years 4-5: Efforts were made to explain the development of scientific reasoning; differences in students’ scientific reasoning development between two seemingly similar classes were observed and the factors causing such differences were investigated.
  - Factors identified as causing the difference were number of students exhibiting “scientific” ways of thinking and demonstrated these early on, as well as leadership/facilitation shown by the teachers.
- Year 4: The focus was on changes in disposition/identity of students resulting from use of this curriculum.
- Several conference papers and book chapters have resulted from this work; journal publication efforts are ongoing.

Theme V: Programs aimed to increase interest and involvement in certain content areas

The programs placed in this category are both related to computing. However, the general concept of addressing STEM fields applies. These projects provide opportunity for students participate in outreach activities where formally planned teaching and learning experience are sometimes integral to the effort. These programs would benefit tremendously by using students who participate in Tech to Teaching activities as part of the research and outreach teams due to the knowledge these students will posses about how the target audiences may be likely to interact with the materials. The Tech to Teaching project can provide the highest level of benefit if elements of the programming are designed to specifically address the needs of these programs and these connections are made explicit during the delivery of these content elements.
Project Focus/Goals

The Using Media Computation to Attract and Retain Students in Computing project is using research on why women have avoided computing to develop an alternative path to introductory computing...This project is developing a course which is presenting the same concepts as found in typical introductory computing courses, but it is using new examples based on media computation...The media computation approach is proving to be particularly successful at attracting and retaining women, and at motivating non-CS majors to succeed in computing. It is creating a path to computing that appeals to a broader group of students. Initial results are indicating that students on this path are achieving the same learning and performance levels as those on traditional paths. Ultimately, greater diversity in computing will result in a more technologically literate and globally competitive citizenry. [quote taken from NSF website]

Project Activities/Accomplishments

- Support for evaluation: the instruments for assessing introductory computing courses developed for this project have been used by faculty around the country.
- Implementation of the “CS0.5” course using media computation, which is intended for CS majors who lack the necessary prior preparation in order to succeed in their 1st CS course, was associated with large increases in student success and motivation.
- At Columbus State University, a comparison was conducted in which CS1 classes were taught using media computation or using the previous approach. The class using media computation was associated with higher levels of student success and motivation. Students from both CS1 classes took equivalent CS2 courses the following semester; no significant differences on grades or success rates were seen.
- At University of California, San Diego, teachers are preparing to use the media computation approach. Researchers took a baseline measure of CS1 student motivation and attitudes to compare with those of students taking the CS1 using media computation. In addition, a teacher journaling project is being implemented in order to gather teacher opinions about the media computation approach over the course of the semester.
- Updates were done on the program used in Media Computation with Python, JES 3.1.
- A semester-long study of the GT CS2 media computation data structures course was conducted; data was collected with interviews and surveys. The goal was to further understanding of the strengths and weaknesses of the media computation approach.
- A textbook was written for the Media Computation Data Structures course (expected publication date 12/2008).
- A faculty development workshop was conducted in June, 2007; 23 faculty attended. Post-workshop surveys indicated satisfaction with the usefulness of the workshop.
- A workshop on the Python Media Computation workshop was conducted at the SIGSCE 2008 conference; 17 conference attendees participated. Post-workshop surveys indicated largely positive evaluations of the workshop.
Findings:
  - The Media Computation approach to CS courses is linked to higher retention and student attitudes toward CS.
  - In a study of variables influencing teachers’ adoption or non-adoption of the media computation approach, researchers found that the most significant factor influencing adoption was teacher excitement, and the most significant factor influencing non-adoption was social/organizational barriers.

Overall contribution: “CS education is in a crisis of declining enrollments. Media Computation is an approach that attracts students (particularly the non-traditional students who mostly do not participate in computing classes, such as women and members of under-represented groups), improves retention in CS1, and improves attitudes toward computer science.”


Project Focus/Goals
- To improve the quality of computing education throughout the pipeline and across the state, and in so doing, broaden and increase the flow of qualified students in undergraduate and graduate computing programs.

Project Activities/Accomplishments

- Focus on pre-undergraduate students:
  - Education and research activities:
    - Work with Girl Scouts of Northwest Georgia – nearly 1100 Girl Scouts participated in Georgia Computes activities (summer camps and workshops) during 2008-2009.
    - Work with Young Women’s Leadership Academy: 15 girls participated in a FIRST LEGO League team.
    - Work with Cool Girls: two workshops of 15-20 girls each were run through the Cool Girls after-school program for low-income middle school students.
    - Work with Refugee Resettlement and Immigration Services of Atlanta: 14 girls participated in a workshop.
    - Work with Boys and Girls Clubs: approximately 10 children per school participated in Georgia Computes activities (the report indicated that these numbers were disappointing).
    - AP CS Students: An AP Bowl was held in Spring, 2009. The AP Bowl involved solving AP problems in a competitive setting with prizes; approximately 50 students participated.
  - Summer camps:
    - 8 weeks of summer camps were run at GT, including a 1st-time camp for 4th and 5th graders and a 1-week camp with the Boy Scouts.
    - Support was provided for camps being run at Mercer, UGA, Georgia Southwestern, and Georgia Gwinnett College.
- Social computing: A new program was started in an effort to engage students in computing by having them design social networking sites. Early work on this project was carried out at the Atlanta Girls School and the Computer Clubhouse; further studies are planned for Fall, 2009 - Spring, 2010.
- Affiliation with computing: Research was conducted in AP CS classes in order to assess the extent and malleability of students’ affiliation with computing and their likelihood of continuing in computing. Efforts to increase affiliation with computing focused on engaging students with specific subfields of computing and having undergraduate mentors further enhance this affiliation.
  - Results:
    - Participants in several of the activities described above were administered an 8-item Likert scale measuring their attitudes toward computing both before and after their participation in the activity. Attitudes shifted from agreement to disagreement with items related to “Computer jobs are boring”; attitudes shifted towards more agreement with the item “I am good at computing.” Comparisons of data from each activity type allow for conclusions about which activity types are more or less effective in changing attitudes toward computing.
    - Pilot study efforts regarding the social computing aspects of the project suggested that immediate and familiar transparency and disruption of familiar patterns of use are important in increasing engagement with computing. The method of having students develop their own social networking site did not work well; changes will be made for the next phase of this study.
- Focus on pre-undergraduate teachers:
  - Education and research activities:
    - Three teacher workshops were conducted in Summer, 2009: AP CS A, Computing in the Modern World, and Beginning Programming. A total of 57 teachers participated in these workshops.
    - An in-service Alice workshop was run in Spring, 2009; 19 teachers attended.
    - LEGO NXT robots were loaned to teachers 8 times during the school year.
  - Findings:
    - Teachers participating in the workshops listed above thought they were of high quality and believed that their participation in the workshops would positively influence their teaching of computing.
    - Results suggested that after workshop participation, some negative teacher attitudes toward computing persisted (i.e., computing is boring, programming is hard).
    - Researchers concluded that the key is to get teachers into workshops for which they have appropriate background preparation; if teachers go to workshops at too high a level for them, they will most likely leave with negative perceptions of the workshop content. The researchers
stressed communicating to teachers that in order to teach computing well, they will most likely need to participate in additional coursework or workshops – most do not have the necessary background knowledge to teach computing.

- Focus on undergraduate teachers:
  - Education and research activities:
    - Two faculty workshops, one at GT and one at Wayne State University were conducted in Summer, 2009. A total of 37 teachers attended.
  - Findings:
    - Participants thought the workshops were of high quality and worthwhile. Teachers reported learning new ways to motivate students and improve homework. They expressed resistance to change and reluctance to adopt a new course.

Additional Programs: programs useful for informing the implementation and evaluation of Tech to Teaching

These types of programs provide useful context for the Tech to Teaching team in designing and implementing all levels of programming. In addition, Tech to Teaching itself may be studied by programs such as these, to the mutual benefit of both parties.


Project Focus/Goals

- This project involves researchers from the School of Public Policy and the Center for Education Integrating Science, Mathematics, and Computing (CEISMC).
- The objectives of this research project are:
  - “To review how partnership performance is evaluated in the STEM educational community and also in a variety of other settings drawn from other policy contexts, industry, and not-for-profits; and
  - To develop and test a model exploring how degrees of embeddedness among partners influence the process by which STEM educational outcomes are pursued and achieved.”

Project Activities/Accomplishments

- The report for this project is more like a review paper, without participants/activities directly related to Tech to Teaching.
- The research conducted within this project has yielded 2 dissertations, 8 papers submitted for publication, and 12 invited presentations.
Appendix B. Materials used in CETL 4001 and 4002 courses.
Exhibit A. Checklist for educational philosophy paper in CETL 4001 course

CETL 4001: Educational Philosophy Paper Checklist

<table>
<thead>
<tr>
<th>Category</th>
<th>Specific Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose of Education</td>
<td></td>
</tr>
<tr>
<td>Core Beliefs</td>
<td></td>
</tr>
<tr>
<td>Teacher Roles and Responsibilities</td>
<td></td>
</tr>
<tr>
<td>Classroom Approaches to Learning</td>
<td></td>
</tr>
<tr>
<td>Diversity</td>
<td></td>
</tr>
<tr>
<td>Linkage to Theorists</td>
<td></td>
</tr>
</tbody>
</table>
Exhibit B. Observational template for classroom observations in CETL 4001 course

INFORMAL CLASSROOM OBSERVATION

Teacher_________________________         Subject_______________________
Date/Time_______________________
Standard(s)

<table>
<thead>
<tr>
<th>I. Observations</th>
<th>Yes</th>
<th>No</th>
<th>Not Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. ENVIRONMENT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean/orderly environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course-related bulletin boards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student work and rubrics are displayed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B. STUDENT BEHAVIOR (Students…)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entered the room orderly and were seated without delay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are attentive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have necessary learning tools</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are actively engaged in the lesson</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have completed homework assignment(s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete assignment/activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assist other students with problem solving</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>C. INSTRUCTIONAL FOCUS (Teacher…)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduces learning objective(s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gives multiple real world explanations/examples</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varies methods of instruction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilizes technology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Involves all students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moves among students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilizes Multiple assessments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilitates learning and supports more self-reliant learners</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asks questions to check for understanding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provides positive feedback</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervenes positively in class disruptions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provides homework activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provides lesson closure</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

Source: Mr. Rodney Ray, Principal, The School of Technology, The New Schools of Carver, Atlanta Public Schools, 2005
II. Physical Diagram of Classroom

III. Relationship of Observation to Course Material
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organization</strong></td>
<td>Audience cannot understand presentation because there is no</td>
<td>Audience has difficulty following presentation because student</td>
<td>Student presents information in logical sequence which audience</td>
<td>Student presents information in logical, interesting sequence</td>
<td><strong>Total Points:</strong></td>
</tr>
<tr>
<td></td>
<td>sequence of information.</td>
<td>jumps around.</td>
<td>can follow.</td>
<td>which audience can follow.</td>
<td></td>
</tr>
<tr>
<td><strong>Subject Knowledge</strong></td>
<td>Student does not have grasp of information; student cannot</td>
<td>Student is uncomfortable with information and is able to answer</td>
<td>Student is at ease with expected answers to all questions, but</td>
<td>Student demonstrates full knowledge (more than required) by</td>
<td></td>
</tr>
<tr>
<td></td>
<td>answer questions about subject.</td>
<td>only rudimentary questions.</td>
<td>fails to elaborate.</td>
<td>answering all class questions with explanations and elaboration.</td>
<td></td>
</tr>
<tr>
<td><strong>Graphics</strong></td>
<td>Student uses superfluous graphics or no graphics</td>
<td>Student occasionally uses graphics that rarely support text and</td>
<td>Student's graphics relate to text and presentation.</td>
<td>Student's graphics explain and reinforce screen text and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>presentation.</td>
<td></td>
<td>presentation.</td>
<td></td>
</tr>
<tr>
<td><strong>Mechanics</strong></td>
<td>Student's presentation has four or more spelling errors and/or</td>
<td>Presentation has three misspellings and/or grammatical errors.</td>
<td>Presentation has no more than two misspellings and/or grammatical</td>
<td>Presentation has no more than two misspellings or grammatical</td>
<td></td>
</tr>
<tr>
<td></td>
<td>spelling errors and/or grammatical errors.</td>
<td></td>
<td>errors.</td>
<td>errors.</td>
<td></td>
</tr>
<tr>
<td><strong>Eye Contact</strong></td>
<td>Student reads all of report with no eye contact.</td>
<td>Student occasionally uses eye contact, but still reads most of</td>
<td>Student maintains eye contact most of the time but frequently</td>
<td>Student maintains eye contact with audience, seldom returning to</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>report.</td>
<td>returns to notes.</td>
<td>notes.</td>
<td></td>
</tr>
<tr>
<td><strong>Elocution</strong></td>
<td>Student mumbles, incorrectly pronounces terms, and speaks too</td>
<td>Student's voice is low. Student incorrectly pronounces terms.</td>
<td>Student's voice is clear. Student pronounces most words correctly.</td>
<td>Student uses a clear voice and correct, precise pronunciation of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>quietly for students in the back of class to hear.</td>
<td>Audience members have difficulty hearing presentation.</td>
<td>Most audience members can hear presentation.</td>
<td>terms so that all audience members can hear presentation.</td>
<td></td>
</tr>
</tbody>
</table>

Source: [www.ncsu.edu](http://www.ncsu.edu)
### Unit Plan Template

<table>
<thead>
<tr>
<th>1. Unit Author</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First and Last Name</strong></td>
</tr>
<tr>
<td><strong>Electronic Portfolio URL</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Unit Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit Title</strong></td>
</tr>
<tr>
<td><strong>Unit Summary</strong></td>
</tr>
<tr>
<td><strong>Subject Area</strong></td>
</tr>
<tr>
<td><strong>Grade Level</strong></td>
</tr>
<tr>
<td><strong>Approximate Time Needed</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Unit Foundation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Targeted Content Standards and Elements</strong></td>
</tr>
<tr>
<td>Essential Questions</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enduring Understandings</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Interdisciplinary Connections (Describe how the unit will connect to at least two additional content areas).</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Assessment Plan</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>Before task (s) work begins.</td>
</tr>
<tr>
<td>5. Unit Details</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td><strong>Prerequisite Skills</strong></td>
</tr>
<tr>
<td><strong>Instructional Procedures</strong></td>
</tr>
<tr>
<td><strong>Accommodations for Differentiated Instruction</strong></td>
</tr>
<tr>
<td>Resource Student</td>
</tr>
<tr>
<td>Non-native Speaker</td>
</tr>
<tr>
<td>Gifted Student</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td><strong>Materials and Resources Required for Unit</strong></td>
</tr>
<tr>
<td>Technology Hardware</td>
</tr>
<tr>
<td>Technology Software</td>
</tr>
<tr>
<td>Printed Materials</td>
</tr>
<tr>
<td>Supplies</td>
</tr>
<tr>
<td>Internet Resources- cited APA style</td>
</tr>
<tr>
<td>Other Resources</td>
</tr>
</tbody>
</table>

Modified from Intel Teach Program, Essentials Course CD, Unit Plan Template, Module 1, page 1.10.
February, 2008
Exhibit E. 5-E Instructional Model Template

**Topic/Concept:**

<table>
<thead>
<tr>
<th>Engage</th>
<th>How can I get students interested in this?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explore</td>
<td>What tasks/questions can I offer to help students puzzle through this?</td>
</tr>
<tr>
<td>Explain</td>
<td>How can I help students make sense of their observations?</td>
</tr>
<tr>
<td>Elaborate</td>
<td>How can my students apply their new knowledge to other situations?</td>
</tr>
<tr>
<td>Evaluate</td>
<td>How can I help my students self-evaluate and reflect on the learning?</td>
</tr>
</tbody>
</table>

**Standard(s):**

**Materials:**