An Overview of the Academic Pathways Study:

Research Processes and Procedures

Technical Report #CAEE-TR-09-03

Summer 2003 – Fall 2008

Authors:
Sheri Sheppard, Cindy Atman, Lorraine Fleming, Ron Miller, Karl Smith,
Reed Stevens, Ruth Streveler, Mia Clark, Tina Loucks-Jaret, Dennis Lund

August 2009
revised May 2010

Overview of APS Research Processes and Procedures
Table of Contents

Figures and Tables

Reader's Guide to *APS Processes and Procedures*

The Center for the Advancement of Engineering Education (CAEE) began in January 2003 with a grant from the National Science Foundation (ESI-0227558). Two NSF Directorates, Engineering and Education and Human Resources, oversee the Center's work. The Academic Pathways Study (APS) is part of the Scholarship on Learning Engineering element of the CAEE.

This document provides a picture of APS study design and implementation activities. Descriptions of the APS analysis methods, findings, and the more technical aspects of the research such as methodological background, sampling calculations, statistical methods, etc. are being reported elsewhere. An up-to-date listing of papers and reports emanating from the APS research as well as contact information can be found at http://www.engr.washington.edu/caee/.

The chapters in this document progress more or less chronologically. The following descriptions of each chapter provide a quick overview to orient the reader to the content of this document.

- Chapter 1 presents the overall goals and background for the APS research. This chapter includes information such as research and leadership team description, study design, participating school descriptions, data storage and analysis plans, and study terminology.
- Chapters 2 through 5 cover the longitudinal portion of the study, one chapter for each of the four years of longitudinal research on a cohort of 160 engineering undergraduates. These chapters contain information on recruitment, study group assignments, changes to original study design, data collection using four primary methods, and miscellaneous notes and reflections.
- Chapter 6 covers the Broader Core Sample (800+ students from the schools participating in the longitudinal study) and Chapter 7 covers the Broader National Sample (4200+ students from 21 institutions around the country). These two chapters describe CAEE's use of the APPLE (Academic Pathways of People Learning Engineering) survey to confirm findings from the longitudinal work discussed in Chapters 2 through 5. The two chapters include information about IRB approval, recruitment, sampling plan, data collection/survey deployment, and miscellaneous notes and reflections.
- Chapter 8 covers the school-to-work transition with the Workplace Cohort, describing the general methodology and the three threads of workplace data collection and analysis.
- The extensive appendices listed at the end of this document include study materials ranging from data access guidelines to sampling plans to data collection instruments.

It is important to acknowledge the incredible team of APS researchers and staff, many of whom continued with the project for its entire six-year run, with time on either end of that period for ramping up and wrapping up. This document represents our collective knowledge about the APS research. It is offered as the foundational underpinnings of the Academic Pathways Study, and as a set of practices and strategies that may be of use to future researchers.

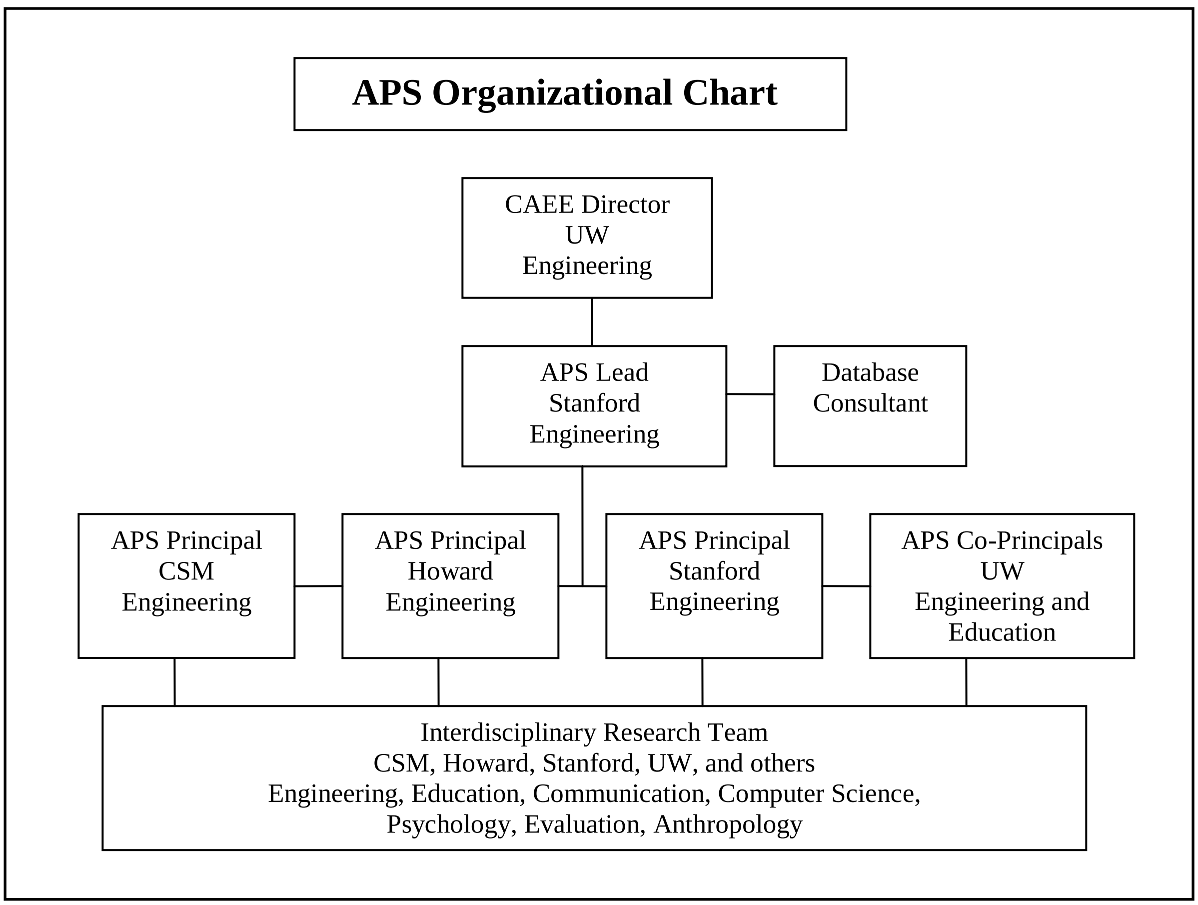
1 Background and General Information

1.1 CAEE and APS Overview

In 2003 the National Science Foundation funded the Center for the Advancement of Engineering Education (CAEE), dedicated to advancing the scholarship of engineering learning and teaching. CAEE is a collaboration of five schools: Colorado School of Mines, Howard University, Stanford University, University of Minnesota, and University of Washington.

The largest component of CAEE was the Academic Pathways Study (APS), a multi-method study to describe how people navigate their undergraduate education to become engineers. The Academic Pathways Study was led by a senior researcher from Stanford University, with the principal co-investigator from each of the four core partner institutions serving on the leadership team (Figure 1.1).

Figure 1.1 APS Organizational Chart



As a working body, the APS leadership team had several major categories of responsibilities:

- Developing policies, standards and procedures for handling the data, reporting findings (including publication and authorship protocols), dissemination, etc.
- Coordinating the development of the research methods and their consistent implementation on the various campuses
- Leading the data collection process, including Institutional Review Board applications
- Monitoring the effectiveness and progress of the APS research team

Each principal co-investigator was responsible for supervising the APS researchers at his/her school and championing a set of research instruments to be used across schools. In this capacity, each principal co-investigator oversaw the development, training, data processing and data analysis related to their instrument(s) for all campuses. Howard University served as champion for structured interviews, the UW for the ethnographic tools and engineering design tasks, Stanford for survey instruments, and the CSM for academic transcript information (to verify majors and provide data about coursework).

Monthly conference calls and periodic face-to-face meetings facilitated the work of the APS leadership team.

The full research team was drawn primarily from the four core partner institutions, and also included area-experts from other institutions. Although specific campuses were designated to lead different components of the research, the team collaborated on all aspects of the project including subject recruitment, instrument design and implementation, and data processing and analysis. Teamwork was fostered by face-to-face workshops of the entire APS research team, as well as smaller targeted cross-institutional meetings and conference calls. Such collaboration contributed to the robustness of research processes across campuses, domains and perspectives.

1.2 Academic Pathways Study Design

APS research was focused on the following questions:

1. How do students' engineering **skills and knowledge** develop and/or change over time?
2. How does one's **identity** as an engineer evolve? More specifically, how does student appreciation, confidence, and commitment for engineering change during the undergraduate educational experience? How do these changes impact student decisions about pursuing engineering after graduation?
3. What elements of engineering **education** contribute to the students' skills/knowledge and identity? What do students find difficult and how do they deal with the difficulties they face?
4. What skills do early career engineers need as they enter the **workplace**? Where did they obtain these skills? Are any skills missing?

To address these research questions, the overall study design included four cohorts and a variety of data collection methods. The study design as originally conceived is shown in Table 1.2, with notes indicating later modifications to the design. Figure 1.3 shows the design for the

Longitudinal Cohort research. In addition to the data sources listed in the figures, key statistics such as SAT scores and major status were collected for the Longitudinal Cohort.

It is important to note that certain aspects of the study design changed over the course of the study to maximize the use of resources and respond to conditions and lessons that surfaced along the way. These changes are described throughout the document, as they occurred.

The primary goals for each cohort* were:

- Longitudinal Cohort – Identify and characterize the pathways and decisions involved in becoming an engineer
- Broader Core Sample – Validate Longitudinal Cohort findings with a broader set of engineering students at the same institutions
- Broader National Sample – Validate Longitudinal Cohort findings at a broader set of institutions nationally
- Workplace Cohort – Learn what goes into becoming an engineer that is not taught or learned as part of the academic training

Table 1.2 Design of the Research Cohorts (Original Design with Modifications)

Longitudinal Cohort: Students who expressed interest in majoring in engineering upon admission at four institutions, followed from their freshman through junior years (2003-2006). *Later modified to extend through senior year (2007).*Study group n=160 (40 per school, including 8 for ethnographic study)

How do students' engineering **skills and knowledge** develop and/or change?	• Interviews* (once per year) • Surveys (twice per year) • Skill and concept-based tests and interviews (once per year) • Ethnographic observations of a subset of students in classes (variable)
How do students develop an **identity** as an engineer?	• Interviews* (once per year) • Surveys (twice per year) • Ethnographic observations of a subset of students in various environments (variable)
What **education** challenges do students face? What resources do they draw upon?	• Interviews* (once per year) • Surveys (twice per year) • Ethnographic observations of a subset of students in various environments (variable)

Broader Core Sample: Engineering undergraduates at the four Longitudinal Cohort institutions who are not in the Longitudinal or Workplace Cohorts, at one point in time (2006-07); n>2000 (original design). *Actual number of participants: 842. Survey administration in April 2007.*

Are Longitudinal Cohort findings representative of other engineering students at the school?	• Cross-sectional surveys developed from the evolving research results

* In some APS publications the cohorts are numbered: cohort 1 is the Longitudinal Cohort, cohort 2 is the Workplace Cohort, cohort 3 the Broader Core Sample, and cohort 4 is the Broader National Sample.

Broader National Sample: Undergraduate students from engineering programs at approximately 20 institutions across the country, at one point in time (2006-2007); n>=3000 (original design). *Later modified to n>1080; actual number of participants: 4266. Survey administration at 21 institutions during January to March, 2008.*

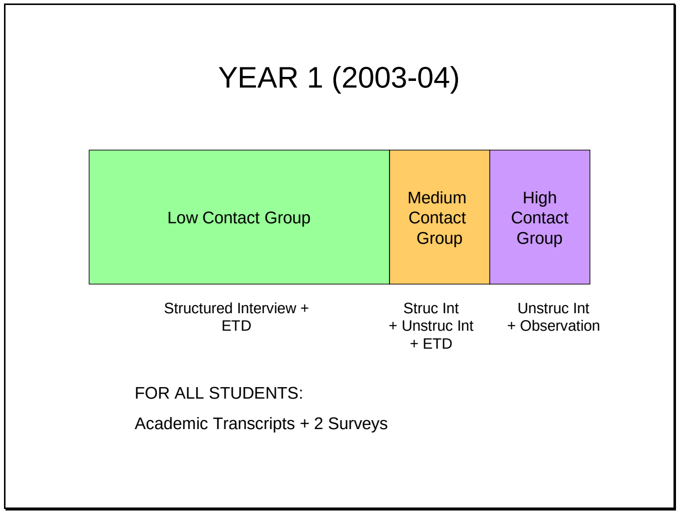
Are Longitudinal Cohort findings representative of other schools?	• Cross-sectional surveys developed from evolving research results

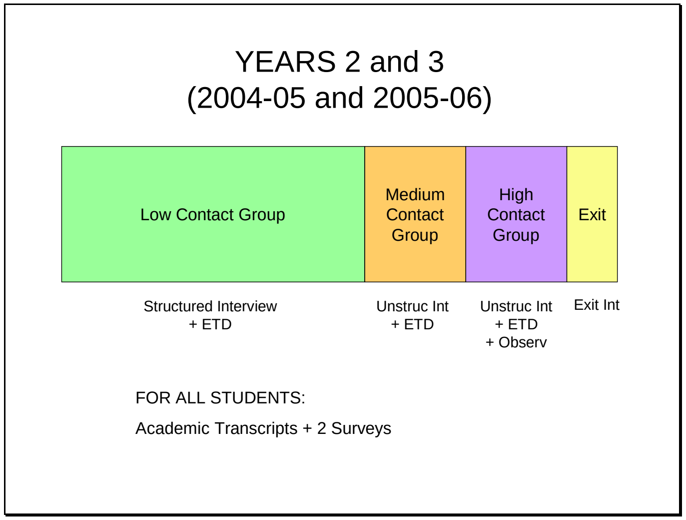
Workplace Cohort: Students majoring in engineering at two institutions, from the end of their junior year through their first two years post-B.S. (2005-2007); n=16, 8 in each of two schools (original design). *Later modified to be a cross-sectional investigation of new professional engineers employed in various settings; actual number of participants: 111.*

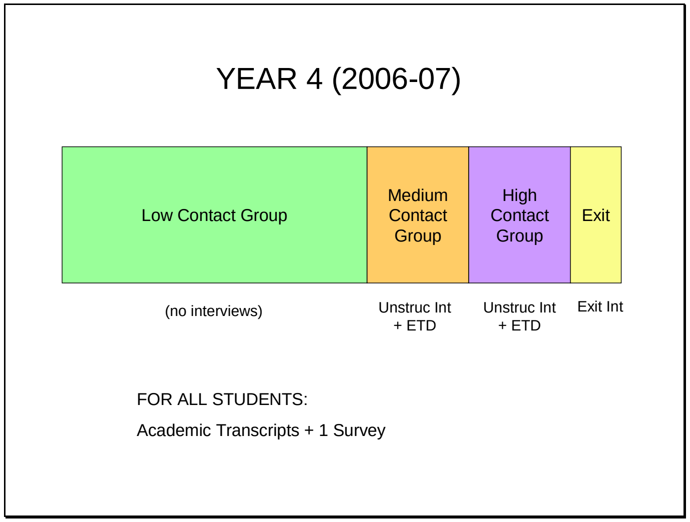
What skills do early career engineers' need as they enter the **workplace**?	• Ethnographic observations and comparative analyses of skills and knowledge used in school and at work. • Interviews
How do students develop an **identity** as an engineer?	• Interviews

* To help researchers gain deeper insights, a subset of Longitudinal Cohort participants was designated to receive semi-structured ethnographic interviews, in lieu of the structured interviews most participants received.

Figure 1.3 Longitudinal Cohort research design (see Study Terminology in Section 1.9)







1.2.1 Participating Institutions

Four diverse institutions provided the student base from which subjects were recruited for the Longitudinal Cohort and Broader Core Sample. A fifth institution provided subjects for the Cross-sectional Cohort which was added to the original APS design and conducted in 2005-2006. The five schools, identified by pseudonym, are described below.

Use of School Pseudonyms

Pseudonyms were adopted to describe the participating schools for use in publications and presentations (including this document). The rationale for using pseudonyms was to protect these institutions from any possible negative implications or perceptions that might come out of the research. Pseudonyms evolved over the course of the research with the final decision being to use pseudonyms that were broadly descriptive and not easily traceable to the real school names. School pseudonyms include Technical Public Institution (TPub), Urban Private University (UPri), Suburban Private University (SPri), Large Public University (LPub), and Large Midwestern Public University (LMPub).

Participating Institution Pseudonyms and Descriptions

Technical Public Institution (TPub) is a public research university devoted to engineering and applied science (2004 Carnegie Classification: Specialized Institution-Engineering). In 2004-2005, 75 percent (2,500) of its 3,350 students were enrolled in undergraduate programs, with approximately 600 of those being entering freshmen. Students face a rigorous curriculum and high academic standards. In 2002, TPub graduated a total of 539 undergraduates, 440 of whom received degrees in engineering majors (i.e., Chemical Engineering, (General) Engineering, Geology and Geological Engineering, Geophysics, Metallurgical and Materials Engineering, Mining Engineering, Petroleum Engineering, and Engineering Physics).

Urban Private University (UPri) is a comprehensive, historically Black private university (2004 Carnegie Classification: Doctoral Research-Extensive). UPri offers an abundance of extracurricular associations and activities, promoting a sense of family among the student body. Of the 10,000 students at UPri in 2004-05, approximately 1400 were freshman, with 180 entering the engineering program each year. Freshmen are accepted into the engineering program upon enrollment. Engineering majors offered include Chemical, Civil, Systems and Computer Science, Mechanical, and Electrical Engineering. In 2002, UPri graduated a total of 108 students from engineering programs.

Suburban Private University (SPri) is a private research university, with an enrollment of about 14,000 students, divided equally between graduate and undergraduate students (2004 Carnegie Classification: Doctoral Research-Extensive). SPri attracts students from around the nation and the world, with fifty percent of students classified as non-Caucasian. Of the 1600 freshmen entering each year, 320 to 350 self-identify as being interested in engineering. (Entering freshmen do not formally declare majors.) In 2002, a total of 373 students graduated from undergraduate engineering programs, including 154 students in Computer Science.

Large Public University (LPub) is a very large public research university (2004 Carnegie Classification: Doctoral Research-Extensive). Over 40,000 students attend LPub. The main campus offers a variety of outdoor activities in close proximity. Students tend to form associations and friendships based on shared academic interests. Of the 7,000 entering freshmen each year, approximately 650 are designated pre-engineering prior to their arrival. Admission into the highly competitive undergraduate engineering program typically occurs during the summer before the junior year and many potential applicants move into other fields before then. In 2002, undergraduate engineering programs at LPub graduated a total of 659 students.

Large Midwestern Public University (LMPub) is a very large public research university (2004 Carnegie Classification: Doctoral Research-Extensive) with over 50,000 students (2008). Seven engineering departments are combined with mathematics and the physical sciences under the umbrella of one technical college. First and second year engineering students take foundation math and science courses in this technical college. At the end of their second year they must petition for admission to the upper division and a specific engineering department. In 2008, approximately 3,300 of 4,600 undergraduates in the technical college were engineering students.

1.2.2 Ensuring Diversity

Including students from diverse backgrounds was a key element of the research plan. In the Longitudinal Cohort, we paid special attention to understanding how underrepresented students navigate their initial years in engineering education. We accomplished this by employing over-sampling strategies for gender (male/female) and underrepresented minority[*] students, including African American/Black, American Indian/Alaska Native, Mexican American/Chicano, Puerto Rican, other Latino groups. In the Broader Core and National Samples, recruitment targets for females and underrepresented minorities, plus strategic recruitment efforts, ensured that diversity considerations carried through to these cohorts also.

1.2.3 Protecting Identities of Participants

Longitudinal Cohort participants were assigned study ID codes that contained no personal identification information. These IDs consisted of the school code, the cohort code (01), a single-digit gender code (M or F) and a five-digit number assigned by the local research team. In addition, the students who participated in the ethnographic study were assigned pseudonyms for ease of reference among the research team. To avoid influencing how these participants may be treated by advisors and faculty, participants were not identified to faculty or other students, including those involved in the research.

Participants in the Broader Core and National Samples submitted data anonymously. The only identifying information was the email address subjects provided in order to claim their incentive. These addresses were released only to the payments coordinator for the purpose of issuing incentives.

---

[*] We defined underrepresented minorities as those traditionally underrepresented in engineering education relative to their representation in the general population. See Chubin, D., May, G., and Babco, E. "Diversifying the Engineering Workforce" *Journal of Engineering Educatio*n, Vol. 94, No. 1, 2005, pp. 73-86, and May, G., Chubin, D. "A retrospective on Undergraduate Engineering Success for Underrepresented Minority Students*" Journal of Engineering Education*, Vol. 83, No. 1, 2005.

1.2.4 Incentives to Participate

Students in the Longitudinal Cohort received $175 per year of participation. In Year 1, they also received a donated scientific calculator. Students designated for the control group (described in section 1.9) were to receive $25 annually, but the group was disbanded in Year 2. Subjects in the Broader Samples were offered $4 through a popular online financial transaction company.

1.3 Data Storage, Organization and Access

APS employed a database consultant to oversee all aspects of data storage, organization, security and access. Data were stored on secure servers on one of the partner campuses. The database consultant participated fully with the research team to stay abreast of research activities and generally ensure the smooth functioning of all data-related systems.

1.3.1 Technology Infrastructure

APS used an online collaboration system, the APS Workspace that functioned as a secure database allowing team members to coordinate data collection activities and share datasets and analysis activities. Consistent with IRB privacy concerns and the sensitive nature of the data, access and sharing were facilitated and carefully controlled to maintain security. A secure, web-based infrastructure built on wiki technology enabled researchers to quickly view and share information from anywhere via the internet. Furthermore, the Workspace was organized in a fashion that allowed it to grow organically, making it possible to add file storage areas, blogs and private workspaces.

1.3.2 Security and Backup

Like most research, the value of the APS is inextricably tied to the data. Accordingly, extreme care and attention were devoted to data security and backup. On an hourly basis, data from the APS Workspace were backed up to a primary computer and a secondary backup computer. Nightly backups were made to a secure off-site storage machine.

1.3.3 Data Collection and Inventory

The APS utilized a detailed file naming convention that included codes for school, cohort, gender, individual ID, research method, and more (Appendix 1-A). This file naming system allowed researchers to quickly identify a file's origin, purpose and status. Given the different needs of the different research methods, not all data were stored in a single database. As a result database queries were possible within a given database, but not system-wide or across databases.

1.3.4 Access Policy

To protect the privacy of APS participants and facilitate adherence to Institutional Research Review Board (IRB) procedures and obligations, access to APS research data was governed by criteria set forth in the APS Data Access Guidelines, included in Appendix 1-B. The goal of these guidelines was to minimize the likelihood for accidental data sharing with those for whom data access may constitute conflicts of interest or violate IRB approved research protocols and privacy laws.

Basically, researchers from each of the core partner schools had access to their school's data, and members of each method team had access to their method's data. Beyond that, researchers could request data according to the Guidelines, whereby the "owner" of the data (either the school or the method lead) granted access.

1.4 Data Analysis Plan and Processes

APS generated a number of distinct data sets corresponding to different data collection instruments and different cohorts. For all data sets, the first line of analysis was instrument-specific; only data from that instrument were used in the analysis. The champion institution (i.e., the one leading development and implementation of the instrument) also led the instrument-specific data analysis for all schools.

A second line of analysis extended across instruments and methods, utilizing data from more than one APS data set.

Access to and sharing of data was managed through the online APS Workspace with a secure database system. Access to APS data was carefully controlled to ensure that IRB guidelines were observed and data was used appropriately.

1.5 Study Terminology

Below is a listing of terms as they apply to the APS.

APPLES	Academic Pathways of People Learning Engineering Survey (APPLES), derived from the PIE Survey. This web-based survey was the primary data collection instrument for the Broader Core and National Samples. Also called the **APPLE survey**.
Control group	A sub-group of the Longitudinal Cohort who would not receive surveys or interviews. Due to unanticipated difficulties in recruiting adequate numbers of study participants, the control group was disbanded in Year 2. Also called the **comparison group.**
Core (partner) institutions	The four educational institutions that conceived and executed the APS research.
Engineering design task	Short problem-oriented question administered to subjects in the Longitudinal Cohort as part of the annual interview. Responses contributed to the ETD data set. Also called **scoping task**, **performance task** or **engineering task**.
ETD	The Engineering Thinking and Doing (ETD) component of the APS research, designed to uncover frameworks students bring to engineering problem-solving. ETD included the engineering design tasks and specific survey questions focused on engineering design.

Ethnographic methods	Semi-structured ethnographic interviews, field observations, and informal conversations.
Exit interview	An ethnographic interview administered to Longitudinal Cohort participants who declared a non-engineering major.
High Contact Group	A sub-group of Longitudinal Cohort participants who were studied using ethnographic observations and semi-structured ethnographic interviews, in addition to surveys. This group was also referred to as the **Ethnography group**, the **Ethno 8** (8 students per school) or the **Ethno 32** (total of 32 students in the group).
Low Contact Group	A sub-group of Longitudinal Cohort participants consisting of 24 students from each school who participated only in structured interviews, engineering design tasks and surveys (i.e., no semi-structured ethnographic interviews or observations). Also called **The 24.**
Medium Contact Group	The eight Longitudinal Cohort participants at each school who received semi-structured ethnographic interviews but no ethnographic observations. Because these students received both structured and semi-structured ethnographic interviews in Year 1, they were sometimes called the **combo group**.
Participating institutions	Universities from which student participants were drawn for the Longitudinal Cohort, Broader Core Sample, and Cross-sectional Cohort.
Persister	A student who had entered university with intent to study engineering and whose declared major at the end of the study period was in the school of engineering at that student's institution. Engineering majors varied by institution (e.g. some schools placed computer science in the school of engineering while others did not). See Appendix 1-C for related definitions.
PIE survey	Persistence in Engineering (PIE) survey, patterned after existing surveys of engineering students for web-based administration to Longitudinal Cohort participants.
Non-persisters	Individuals who declared a non-engineering major after indicating intent to major in engineering.
Structured interview	A series of questions designed to address specific research topics. Structured interviews were used with Longitudinal Cohort participants who did not receive the semi-structured ethnographic interview. Also called **formal interview**.

Semi-structured ethnographic interview	A series of questions or prompts open-ended in nature designed to elicit free-flowing accounts of participants' perspectives and experiences. The questions were designed to enable students to reflect upon their past, present, and future life-world experiences related to engineering. Semi-structured, ethnographic interviews were used with the High and Medium Contact Groups. Also called **informal interview, unstructured interview** or **ethnography interview.**
Underrepresented ethnic groups	Ethnic groups traditionally underrepresented in undergraduate engineering programs in the U.S., including African American/Black, Latino/a, and Native American. Also called **underrepresented minorities** or **URM**.

2 Research Year 1: Fall 2003 – Spring 2004

2.1 Tasks and Goals

The main tasks for Year 1 were to:

- Recruit and enroll 320 freshmen (160 in the study group and 160 in the control group) at the four core institutions. Students would be followed through the end of their junior year.[*]
- Administer surveys (winter and spring) and interviews (spring) to all Longitudinal Cohort participants, and conduct ethnographic observations of the High Contact Group throughout the academic year.

2.2 Recruitment

2.2.1 Methods

Recruitment activities varied at each of the four institutions, as described below. Recruitment efforts were tied to school calendars, with the semester schools (Technical Public Institution and Urban Private University) beginning in late summer and the quarter schools (Suburban Private University and Large Public University) starting up in early fall. Recruitment activities continued throughout the first school term.

All study participants were required to sign a consent form approved by the Institutional Review Board (IRB) at their institution (see Appendix 1-D). To boost recruitment, a national electronics company donated scientific calculators to give to study participants in Year 1, in addition to the $175 incentive per participant per year.

<u>Technical Public Institution</u>

Recruitment efforts began during summer 2003, at four summer campus events that constituted "Explore TPub":

- The Information Fair in August
- Two campus events sponsored by the Minority in Engineering Program (MEP)
- An event sponsored by Society of Women Engineers (SWE)
- An all-campus event held in the first two weeks of school.

Once classes had begun, a member of the TPub research team made presentations at Chemistry lectures attended by all first-year students. She also met with residence hall assistants. Further outreach was planned through fraternity and sorority houses, but this step was not needed.

<u>Urban Private University</u>

Recruitment activities included:

- A presentation about the study in July at a summer program for incoming freshmen ("Pre-Freshmen Summer Experience"). Interested students submitted information forms.

[*] In September of 2005, the National Science Foundation provided supplementary funds to allow researchers to follow participants in the High and Medium Contact Groups for an additional year.

- Presentation and brochures at student orientation in August, where more student interest forms were collected.
- Advertisement of the APS informational session in September through:
    - Flyers in the Engineering and Architecture buildings
    - Invitational emails to students who had previously expressed interest in the study
    - An announcement in the “Intro to Engineering” class, which all engineering students attend
- A second recruitment drive in October consisting of:
    - A table with flyers and brochures in the Engineering Building
    - A follow-up visit to the “Intro to Engineering” class
- Contacting students who had previously expressed interest, via phone and e-mail, through mid-November.

Students who decided to participate in the study signed consent forms at the information session in September, or in the course of recruitment activities during October and November. For students under 18, parents were contacted to sign the consent form.

Suburban Private University

Potential participants were contacted using the following methods:

- Personalized letters to students who had listed engineering as a preliminary academic interest (September)
- New Student Orientation presentations (September)
- Flyers in dorms, classrooms, libraries, engineering buildings, etc. (September)
- Group information session (October)
- Individual e-mails to students who had expressed interest in engineering and/or in the study (November)
- Mass e-mails to campus engineering societies and freshman engineering seminars (October, November, and December)
- Individual information sessions (October, November, and December)
- Engineering society meetings (October and November)

Consent forms were signed at group and individual information sessions.

Large Public University

The initial attempt to recruit Longitudinal Cohort participants took place from late October through mid-November 2003. Activities included:

- In-class presentations for courses in the math sequence, chemistry sequence, and physics sequence, as well as in ENGR 100, an introductory engineering class open to freshmen. Interested students completed "statements of interest."
- Notices posted to the email list-server for pre-engineering students (weekly posts during November).
- Information sessions, to which interested students from the above two activities were personally invited. Information sessions were held several times a week throughout November and into early December, drawing from one to four students.

2.2.2 Diversity Considerations

A recruitment objective of APS was to over-sample certain populations to gain information about a broad range of students. To this end, sampling goals were set forth, including:

- Obtain a **gender** balance of 50/50 (equal numbers of women and men)
- Adjust sampling to include at least 25% **underrepresented** ethnic populations (African Americans, Native Americans, and Latinos)
- Over-sample students who exhibit a **keen interest** in engineering (i.e., possess indicators that they are very likely to succeed and be retained as engineers). The intent was to maximize the number of persisters in the study.

The original sampling plan for the Longitudinal Cohort is shown in Appendix 2-A.

Urban Private University, which is predominately African-American, drew about 20 percent of its freshman engineering class from international (non-U.S.) students. The sampling goal for underrepresented students at UPri was to obtain a 50/50 balance of U.S. and non-U.S. students.

At TPub and LPub, initial recruitment efforts yielded fewer women than men. At both schools, targeting women via e-mail communications helped increase the number of female participants. TPub researchers used e-mail to invite female students to two additional information sessions, while LPub researchers increased their female participation with a list-server announcement targeting women. Relatively few women study engineering at SPri and this was reflected in SPri's recruitment numbers.

No African-American students attended information sessions at TPub. In fact, there were only six African American students in the freshman class of 750, and only five of them were eligible for APS. Various remedial strategies for recruitment were considered, including having upper-class students contact these first-year students. However, it was decided not to pursue them for fear of making students uncomfortable. Furthermore, since there were few females at TPub from ethnic minority groups, ethnic-minority males were over-sampled instead.

Figure 2.1 illustrates the gender breakdown of the 160 students who began the study, while Figures 2.2 and 2.3 show the ethnic make-up of the 156 students who completed the first survey.[*] Gender and ethnicity data were obtained from demographic questions on the survey; non-responders are not represented in the figures. Further demographic details are included in Appendix 1-E.

[*] Ethnicity data was obtained from a multiple-choice question that was periodically included as part of the APS survey. Students could select multiple responses. For purposes of this document, Mexican American /Chicano, Puerto Rican, and Other Latino have been combined into one category, "Latino".

Figure 2.1 Gender distribution (Year 1)

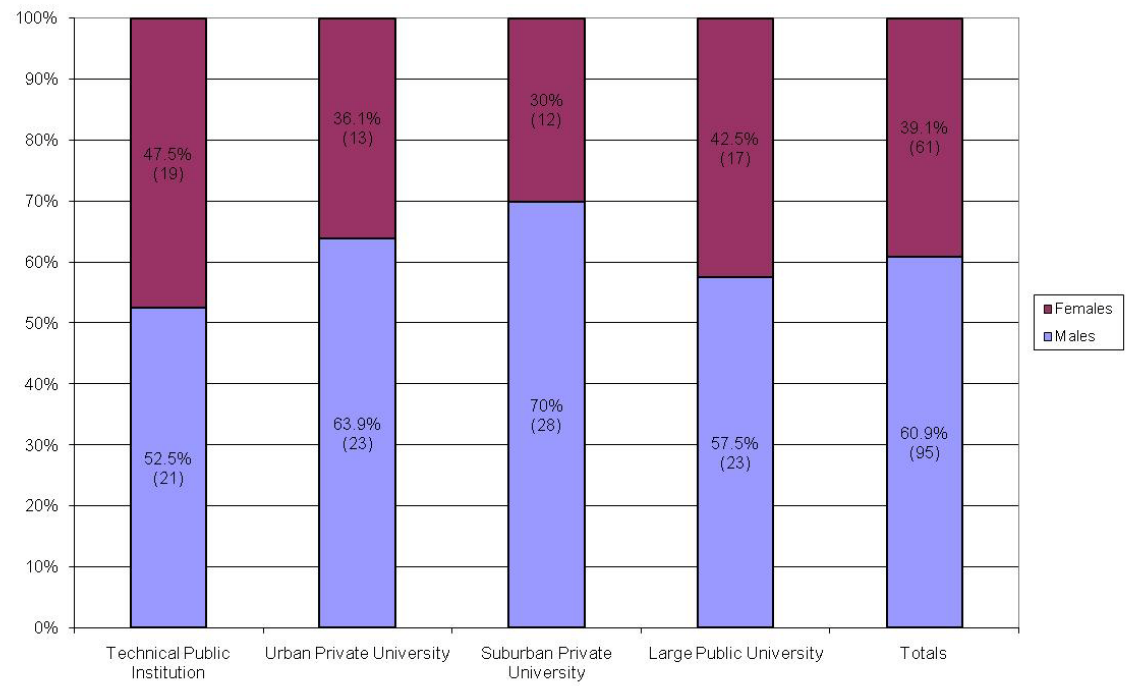


Figure 2.2 Ethnicity distribution by school (Year 1)

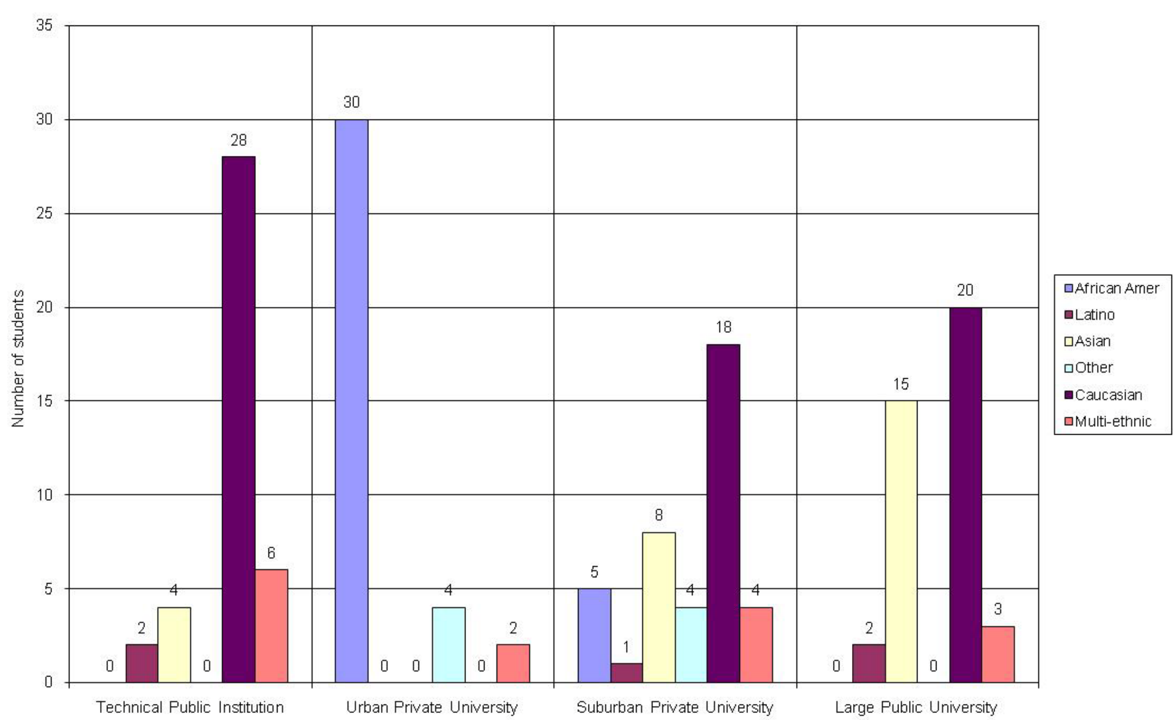
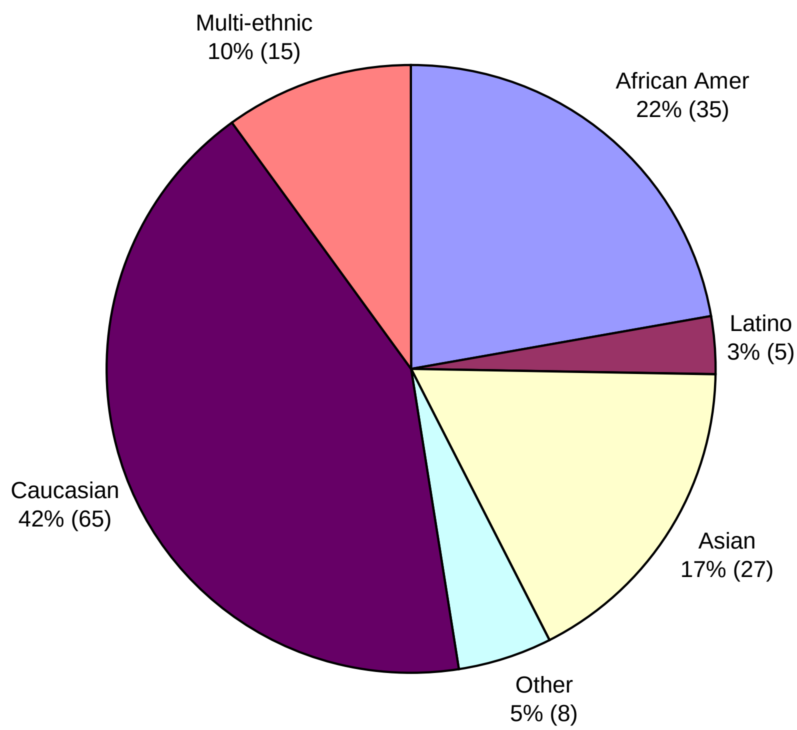


Figure 2.3 Ethnicity distribution for all schools (Year 1)



2.3 Group Assignments

Each school was responsible for randomly assigning participants to control and study groups, bearing in mind sampling goals with respect to gender, ethnicity, and likelihood for persisting in engineering. The original research design called for:

- A study group of 40 students per school
    - 8 students assigned to a High Contact Group (survey, semi-structured ethnographic interview and ethnographic field observation)
    - 32 students assigned to a Low Contact Group (survey, structured interview and engineering design task)
- A control (comparison) group of 40 students

Academic transcripts and declared major would be collected for all groups.

Prior to beginning data collection, the research team decided to increase the number of participants receiving the semi-structured ethnographic interview (see section 2.4.1). As a result, 8 students from the Low Contact Group were reassigned to form a new group, the Medium Contact Group, which did both structured and semi-structured ethnographic interviews in Year 1, as well as surveys and the engineering design task.

Of the four schools, only TPub was able to recruit enough participants in Year 1 to fully populate a control group. This resulted in a decision not to have a control group as part of the Longitudinal Cohort at any school.

2.3.1 Methods

Each of the four institutions developed their own procedure for assigning participants to the various Longitudinal study groups.

Technical Public Institution

Thirty Caucasian male participants were selected from a sample of 56 students. The first division was geographical (out of state, Big City metropolitan, other State areas). The next division was based on the questionnaire students had completed assessing their level of interest in the study. Students were eliminated if (a) their primary motivation was the cash incentive, or (b) they preferred a limited level of participation (i.e., monitoring of academic records only). One student was eliminated who had missed several recruiting sessions despite confirming by email beforehand. Finally, the remaining students were geographically balanced for metropolitan Big City area of origin and other State areas. Because one major city was heavily represented, these students were also balanced by major.

Of 32 Caucasian female students, one student was eliminated whose questionnaire indicated preference for a limited level of participation, and one more student was eliminated who had a non-engineering major, resulting in a group of thirty white females for the study.

For ethnic minority participants (male and female), the initial sample population consisted of 14 minority males and 8 minority females. One student was eliminated because of several eligibility factors which could not be verified: U.S. citizenship, ethnicity, and gender. Two ethnic male students were eliminated because they listed “money” as the primary motivation for participating in the study. Students who did not choose to be a participant in the “whole show” were also eliminated.

Urban Private University

The dataset of 62 student names was sorted by 1) participation in Pre-Freshmen Program, 2) citizenship, and 3) gender. The objective was to have 31 students in the detailed study group and 31 students in the control group. Each group was to contain three Pre-Freshmen participants (two males and one female) and 28 non Pre-Freshmen participants (ten male and seven female U.S. citizens, eight male and three female non-U.S. citizens).

A systematic method was used to assign students to the study group and control group. Working from a numbered list, students with odd numbers by their names were placed in the control group and the even numbered students were placed in the study group, resulting in 31 study participants and 31 control participants.

The eight participants for the High Contact Group were systematically selected from the study group. The objective was to obtain two Pre-Freshmen participants (one female, one male), two U.S. citizen participants (one female, one male), and four non-U.S. citizen participants (two female, two male). The only female Pre-Freshmen participant and first male were selected from the Pre-Freshmen participants. For U.S. citizen participants, the first female and the fourth male were selected. For non-U.S. citizen participants, the first and third female and the second and sixth male were selected.

With equal participants in the detailed study and control group, it was recommended that nine students in the control group be added to the study group, to bring the total to 40. A systematic method was employed. From the Pre-Freshman Program, the first male was selected (no female students remained to be selected). From the U.S. citizen pool, every third female was selected, for a total of two females, and every fifth male was selected, for a total of two males. From the non-U.S. citizen pool, the first and third female was selected, for a total of two females, and every fourth male was selected for a total of two males.

Suburban Private University

A total of 44 students signed consent forms, including one student who declined to participate in the study. Forty students were selected to participate in the study group, and the remaining 3 were assigned to the control group.

The 3 students assigned to the control group were not selected randomly. One student declined to participate in any of the research methods, with the exception of the collection of the student's academic information. Two students had not responded to updating their consent forms.

Participants were selected for the High Contact Group based on the following criteria:

- Gender representation: 4 females, 4 males (desired 4/4)
- Ethnic representation: 2 ethnic minority students (desired 2-4)
- Engineering Bridge Program: 1 student who participated in the SPri Summer Science Engineering Academy program during the summer before their freshman year (desired 1-2)
- Academic intent: Which majors has this student indicated an interest in based on individual meetings with research team and preliminary academic interest information:
    - Engineering only: 6 (desired 5-6)
    - Engineering or Computer Science: 1 (desired 0-1)
    - Engineering or Physical Sciences: 1 (desired 0-1)
    - Engineering or Social Science/Humanities: 0 (desired 0-1)

Additional qualities of the group were considered to help decide between multiple students who clustered together after the initial criteria were considered:

- Extracurricular activity: students involved in a time-intensive extracurricular activity such as athletics: 2 selected (1 walk-on athlete, 1 varsity athlete)
- Residential assignment: students from a freshman dorm or other special residential considerations: 2 selected (1 freshman/sophomore dorm, 1 whose roommate is also in the study)
- Engineers in family (students whose parent is an engineer): 1 selected
- Relationship with ethnographer: all selected students had some connection to ethnographer
- High School academic information: student who had lower Math SAT scores (below 700) than others in the group

Large Public University

Initially, students had been randomly assigned to the study group and to the control group. However, because of drop-outs and lack of response from some students in the study group, all students who expressed interest in participating in the study were eventually selected for the study group.

During information meetings, students were asked to indicate in which groups they would be interested in participating. Five women and 15 men expressed an interest in being considered for the High Contact Group.

Of the five women, two indicated they are members of underrepresented minority groups, and were immediately invited to participate in the High Contact Group. Two of the remaining three women were randomly selected for invitations to this group. One accepted and one declined so was reassigned to the Low Contact Group. The remaining woman also declined. In mid-January, a woman who had been assigned to the study group was asked if she would consider switching to the High Contact Group, on the basis of her enthusiasm for the study. She accepted, resulting in four women being assigned to the High Contact Group.

Of the 15 men, two Caucasian males were selected for the High Contact Group on the basis of the researchers' judgment that they would make good ethnographic informants. A third, an Asian-American, was chosen because he was the only Asian male to volunteer for the High Contact Group. The fourth, a direct admit to the Electrical Engineering department, was invited because it was expected that the experiences of directly admitted students would differ from those of students competing for admission to departments.

2.3.2 Numbers

Table 2.4 shows gender and ethnic breakdowns by school and study group.

Table 2.4 Gender and Ethnic Breakdowns (Year 1)

Citizenship and Race/Ethnicity data were obtained directly from subjects' responses on Survey 1 (Winter 2004). Total N=156 (4 of the original subjects did not take Survey 1 and are therefore not represented in these tables)

	Gender		Citizenship		Race/Ethnicity							
	Female	Male	US Citizen	Non-Citizen	Afr-Am/ Black	Native Amer	Asian Amer	Latino*	Cauc	Other	Multi	URM**
TPub	19	21	40	0	0	0	4	2	28	0	6	2 5%
UPri	13	23	21	15	30	0	0	0	0	4	2	30 83%
SPri	12	28	34	6	5	0	8	1	18	4	4	6 15%
LPub	17	23	35	5	0	0	15	2	20	0	3	2 5%
Total	61 39%	95 61%	130 83%	26 17%	35 22%	0 0%	27 17%	5 3%	66 42%	8 5%	15 10%	40 26%

	Gender		Citizenship		Race/Ethnicity							
	Female	Male	US Citizen	Non-Citizen	Afr-Am/ Black	Native Amer	Asian Amer	Latino*	Cauc	Other	Multi	URM**
High Contact	16	16	26	6	8	0	5	3	14	0	2	11 34%
Medium Contact	16	16	25	7	9	0	5	1	11	2	4	10 31%
Low Contact	29	63	79	13	18	0	17	1	41	6	9	19 21%
Total	61	95	130	26	35	0	27	5	66	8	15	40 26%

* Latino combines Mexican, Puerto Rican and other Latino
** URM = underrepresented minority groups including African American/Black, Native American, and Latino

2.3.3 Replenishing Study Groups

Each school developed a plan for replenishing study groups in case of attrition in future years of the study.

TPub planned to replace students in the study groups, as needed, with students from the control group. Because of the time-intensive nature of recruiting and uncertain value of maintaining a control set, students in the control group would not be replaced. During Year 1, TPub replaced two male students who left the study with two male students from the control group. One of these was selected because he stood out as being especially talkative during the recruitment process. The other replacement student had expressed specific interest in being in the study when he was assigned to the control group.

UPri planned to post flyers advertising the study in the College of Engineering, Architecture, and Computer Sciences. Brochures would be distributed to students and faculty, and members of the research team would make presentations in sophomore level physics and engineering courses. Also, the study would be publicized during the weekly meetings of student engineering societies, such as the National Society of Black Engineers, the Society of Women Engineers, American Society of Mechanical Engineers, and American Society of Civil Engineers.

SPri planned to recruit subjects for the control group who in turn could replace subjects in the study group if needed. There were concerns about the demographics of the study group and whether there would be at least 30 study participants with declared engineering majors at the end of year 2. The recruitment plan included 1) contacting professors of targeted courses and introductory seminars, 2) posting flyers in key building areas on campus, 3) emailing of announcements to engineering societies and sophomore dorm mailing lists, 4) announcements during class lectures and society meetings, and individual meetings with interested students.

LPub planned to replenish subjects in the High Contact Group with ones from the Medium Contact Group, and subjects in the Medium Contact Group with ones from the Low Contact Group. If further replacements were needed, they would be drawn from the control group. The primary consideration in selecting students would be their willingness to participate and a sense that the student would be a good informant. Within this plan, attempts would be made to replace withdrawing subjects with demographically similar subjects. Additional recruitment was planned if more subjects were needed.

2.4 Changes to Study Design

During the recruitment phase of the study, several unanticipated developments caused the research team to reexamine and ultimately modify certain aspects of the original study design. These changes included:

- Designating a Medium Contact Group
- Ending recruitment efforts before the full 80 students per school had been recruited

The rationale and implications for these changes are discussed below.

2.4.1 Medium Contact Group

Researchers became concerned about losing participants from the High Contact Group, which would diminish this very rich source of data. In order to offset any such losses, eight students from the Low Contact Group at each school were designated to constitute a new group of participants – the Medium Contact Group – which would receive both structured and semi-structured ethnographic interviews. These students would not receive ethnographic observations except in cases where a student from the High Contact Group migrated out of the study and was replaced by a student from the Medium Contact Group.

2.4.2 Recruitment Goals

All schools except TPub experienced difficulties in identifying and recruiting adequate numbers of APS eligible students. Recruitment efforts were extended into November 2003 in hopes of increasing participant numbers. This was successful to a point. Each school was able to recruit at least 40 students—enough to comprise a study group. Rather than prolong the recruitment period further, the research team decided to cease recruitment activities at this point and commence with the data collection phase of the study.

2.5 Data collection

2.5.1 Methods

The APS used multiple methods to collect data on participants. The main methods included survey, structured and semi-structured ethnographic interviews, engineering design tasks and ethnographic field observations. Surveys, structured interviews, and engineering tasks provided data on a large set of participants, while ethnographic methods (e.g., semi-structured ethnographic interviews and field observations) yielded deeper, richer information on a more limited number of students. In addition, academic transcripts were collected for all subjects. Each method provided a set of insights that informed the other methods and allowed emerging findings to be explored with the broader study population. Interpreted and analyzed together, data from the various methods resulted in rich descriptions of students' academic pathways, as well as the critical factors, challenges, and strategies related to navigating these pathways.

The APS survey – also called the **Persistence in Engineering (PIE) survey** – was used to identify and characterize the fundamental factors that influenced students' intentions to pursue an undergraduate engineering degree and, upon graduation, practice engineering as a profession. It covered a broad range of issues including students' attitudes about engineering, confidence in their abilities, aspirations, perceptions about the engineering education climate, and perceptions of their behaviors and experiences inside and outside the classroom.

Survey design began with development of conceptual constructs and survey questions generated from a review of engineering education literature and previous national surveys of undergraduate education. The development team piloted the survey and conducted internal consistency analyses to validate survey constructs. In the course of the APS longitudinal research, survey items and constructs were iteratively evaluated and refined as successive survey administrations revealed new information.

There were 26 specific survey constructs, which included persistence in engineering, motivation, satisfaction with collegiate experience, curriculum overload, and more. PIE survey constructs are delineated in Appendix 4-B.

The web-based PIE survey was administered to all 160 Longitudinal Cohort participants twice per academic year for Years 1 through 3 of the study, and once during Year 4. Based on findings from the Longitudinal Cohort, the survey was refined and shortened for administration to the Broader Core and National Samples. Copies of the PIE surveys are included in Appendix 4-A.

Structured interviews had a set format with pre-defined questions, allowing for collection of specific information related to engineering education and identity and skills development. Interviewers could prompt participants to expand on their answers, thereby adding depth and texture to individual responses. While interviewers controlled the content of the interview, students were able to provide as much information and detail as they needed to tell their stories. Structured interviews were administered once per academic year to the Low Contact participants; interviews were recorded and transcribed. The interview was approximately one hour in length. Copies of all structured interview protocols are included in Appendix 3-A.

Engineering Design Tasks provided data specific to skill development. These tasks were problem-oriented activities administered in written form. The Year 1 task consisted of a free-response question asking respondents what factors they would consider in approaching a specific engineering design problem. Then an interviewer asked respondents a number of follow-up reflection questions. Data gathered from this activity were used to assess how broadly students perceived basic engineering problems, and how this changed over time. An engineering design task was administered annually at the end of the structured interview.[*] Copies of all engineering design tasks and administration protocols are included in Appendix 3-B, along with a table of other data sources that contribute to Engineering Thinking and Doing (ETD).

Ethnographic methods allowed for collection of rich, in-depth descriptions of the culture and experience of engineering education through the eyes of students. By capturing individual student narratives, researchers were better able to discover and describe student perceptions and motivations, and how these contributed to educational decisions and pathways.

Ethnographic methods helped APS researchers answer questions relating to identity development in undergraduate engineering majors, including the role engineering education plays. Identity has been cited as a key factor in retention of students in the discipline.

- **Ethnographic field observation** of participants occurred during activities that were significant to their educational experiences such as: project work in lab-type engineering courses; examination periods; senior design/capstone projects; and extra-curricular activities. To get a sense of the day-to-day experiences of students, researchers conducted "day in the life" observations of students. Observations were conducted by trained APS researchers and recorded principally as field notes for subsequent analysis. Originally, each High Contact participant was to be observed for approximately 30 hours per

[*] After Year 1, an engineering design task was administered to all study participants after either the structured or semi-structured interview.

academic year – a goal that was later modified due to the time intensive nature of the activity (see section 2.6.4).

- **Semi-structured (ethnographic) interviews** used interviewing methods that enabled researchers to glean aspects of culture and everyday life experiences through open-ended questions. APS researchers developed ethnographic interviews to reflect engineering student perceptions about past, present and future experiences. This approach allowed students to describe the culture of engineering education through their own eyes and impart what meaning it had for them. The annual semi-structured ethnographic interview was approximately 2 hours in length. Interview guides for conducting semi-structured interviews are included in Appendix 3-D.

- **Informal conversations** were conducted throughout the study, to varying degrees at each of the four schools. Informal conversations allowed researchers to check in with students as needed to stay abreast of any changes in student status. These conversations added to the understanding and description of individual participants.

Academic Transcripts were collected for all subjects from their respective institutions. Academic transcripts were the final determinant of major(s) and persistence in engineering. Transcripts also provided information about coursework, GPA and date of graduation.

2.5.2 Interview Protocols and Training

During the fall and winter (2003-2004), the research team compiled a manual and detailed protocols and guides for conducting interviews (Appendix 3-C), tailored to the institution and type of interview (structured vs. semi-structured/ethnographic). In addition, members of the research team who would be serving as interviewers underwent a group training in February 2004 and several practice sessions before conducting interviews with study participants.

All interviews (structured and semi-structured) were recorded, uploaded to the database, and transcribed.

2.5.3 Ethnography Observation Training

In summer (2003) APS researchers participated in ethnography observation training. The two-day training was conducted by CAEE researchers, and included practice observations and write-ups that were reviewed as a group.

2.5.4 Summary of Data Collected

Table 2.5 summarizes Year 1 data collection activities, including numbers of participants engaged in each method. Academic transcripts were collected but are not included in the table.

Table 2.5 Data collection summary by school for Year 1 (2003-2004)

	Surveys (n=40)		Structured Interviews (n=32)				Semi-structured Ethnographic Interviews (n=16)				Ethno Obs (n=8)	
	Dates	#	Dates	#	Length (min.)	# Eng. Act'y	Dates	#	Length (min.)	# Eng. Act'y	#	Hours spent
TPub	1/20-2/19/04	40										
	4/1-5/3/04	40	3/11-4/22/04	32	19-51	32	3/11-4/6/04	16	n/a	0	34	34
UPri	1/20-3/8/04	36										
	4/7-6/16/04	36	3/23-5/4/04	28	20-55	28	3/23-5/11/04	16	45-105	0	15	30
SPri	1/20-2/9/04	40										
	5/10-5/23/04	40	4/9-4/30/04	32	18-60	32	4/17-5/12/04	16	54-165	0	30	34.5
LPub	Winter '04	40					Dec '03	2 (pilot)				
	Spring '04	40	Apr-May '04	32	n/a	32	Apr-May '04	16	n/a	0	55	85+

2.6 Notes and Reflections on Year 1

2.6.1 Recruitment Challenges

Recruiting students into the study proved more difficult and time-consuming than expected. The specific challenges varied by school, as described in reports submitted by each school's primary recruiter.

Technical Public Institution

The principal challenge at TPub was recruitment of African-American students. The goal was to have at least one female and one male High Contact participant who was African American. However, researchers at TPub were unable to recruit any African Americans into the study.

A secondary challenge at TPub was recruiting adequate numbers of women into the study. Although exactly forty women signed consent forms to proceed with the study, two were eliminated because of ineligible majors or lukewarm interest. Furthermore, there were insufficient ethnic minority females to meet sampling goals. As a result, the subject pool at TPub included more minority men and fewer women overall.

Urban Private University

The main challenge at UPri was recruiting a relatively large number (80 students to fill both study and control groups) from a small incoming class (107 engineering students). It was difficult to generate interest among this small student pool.

It was also difficult getting students to come in to sign the consent forms. Of the 85 students who initially expressed interest in participating, only 62 signed consent forms.

Suburban Private University

Students were more available (responsive) during the very beginning of the quarter and at the end of the quarter, just before leaving for break. In between, it was difficult to reach freshmen because attendance at extracurricular activities and response to mass emails diminished greatly.

Arranging individual meetings with the students was time-consuming but paid off in the long-run. The individual meetings allowed the students to ask questions and establish a connection with the research team.

Large Public University

Surprisingly few students expressed an interest relative to the number of freshman engineering and pre-engineering students. It was very difficult to arrange meetings with students, both for the information sessions and for signing informed consent. What was expected to be a month-long recruitment process took nearly 3 months.

2.6.2 Consistency of Methods and Procedures across Schools

Because of the inherent differences between the four core schools, study methods and procedures were not completely consistent across schools. Some of these institutional differences included:

- **Academic calendars.** TPub and UPri operated on the semester system, while SPri and LPub used the quarter system. This meant the timing of study activities was slightly different at each of the four schools.
- **Freshman orientation activities.** Recruitment plans for this study took advantage of freshman orientation activities to publicize the study and recruit students. However, differences in orientation schedules and programs among the schools meant that recruitment methods and timelines had to be customized per school.
- **Entry into engineering.** The identification of engineering students for the study was complicated by the fact that the four schools followed different timelines and procedures for declaring majors. TPub and UPri students could declare an engineering major at any point during their freshman and sophomore years. SPri students typically did not declare a major during the freshman year, but rather named a broadly defined area of interest. At LPub, students must apply and be accepted into the engineering program (typically following the sophomore year) and many students are turned away. Recruitment and eligibility criteria were adjusted to accommodate these differences.
- **Diversity.** The participating schools differed in terms of ethnic and gender mix among their students, making diversity goals difficult to achieve across all schools. UPri students were predominately African-American with a high percentage of international students. Therefore, UPri introduced diversity into their study population by over-sampling students who were not U.S. citizens. TPub had less ethnic diversity compared to the other schools, while SPri had relatively fewer female students in engineering.

2.6.3 Non-Random Assignment to Study Groups

Random assignment of participants into study and control groups as defined in the original sampling plan (Appendix 2-A) was possible only at TPub and UPri, where sufficient numbers had been recruited. At SPri and LPub, virtually everyone who signed a consent form was assigned to the study group in order to reach the goal of 40 study (non-control) participants per school.

Since the goal of the Longitudinal Cohort was to describe a range of academic pathways for engineers, students were not randomly assigned to the high, medium or low contact groups. Instead, group assignments were based on a variety of factors, of which ethnicity and gender were only two.

Students who were unique in some way, or had a proclivity for sharing their stories, were considered desirable candidates for the high and medium contact groups. This approach was intended to yield a wide and rich array of personal stories.

Another consideration when making group assignments was whether the student was likely to stay in engineering for the duration of the study. In order to achieve study goals, it was important to have a large majority of participants graduate with an engineering degree. On the other hand, it was desirable to also include the stories of students who left the field; who were they and what factors drove their decision to leave?

2.6.4 Insufficient Ethnography Resources

By the end of Year 1, it became apparent that resources for scheduling, conducting and recording field observations were limited at most campuses. Maintaining contact and scheduling observations with students in the High Contact Group was more difficult and time-consuming than anticipated. In addition, each hour of observation in the field required two to three more hours of writing up field notes. As a result, virtually no field observations were conducted in spring 2004 when researchers were conducting interviews.

2.6.5 Recording and Transcribing Semi-structured Ethnographic Interviews

Following the first year of data collection, the ethnography group at LPub hired a transcriber to transcribe the semi-structured ethnographic interviews from all four partner schools. Over the four years of data collection, the research team used a variety of individual transcribers and businesses to process the raw files.

3 Research Year 2: Fall 2004 – Spring 2005

3.1 Tasks and Goals

The main tasks for Year 2 were to:

- Manage the Longitudinal Cohort study pool to maintain size and diversity of the study groups as much as possible
- Administer surveys (fall and spring) and interviews (spring) to all participants in the study group
- Conduct exit interviews with students who declared majors other than engineering

3.2 Changes to Study Design and Procedures

3.2.1 Control Group

Because of the unforeseen difficulty of recruiting adequate numbers of students for the study, the research team decided not to further pursue or maintain a control group whose only purpose was to provide demographic comparison with the study subjects. Existing control subjects were tapped to offset attrition of the study groups, as described in Section 3.3. The remaining controls were disbanded in the fall of 2004, as described here:

<u>Technical Public Institution</u>

After replenishing the study group, students remaining in the control group were sent a letter informing them they would no longer be followed as part of the study. The text of the letter appears below.

> *Dear Academic Pathways Participant:*
>
> *The Control Group for the Academic Pathways Study will no longer be followed after November 3, 2004, the expiration date for our current signed consent. Thank you for your participation in our research. We hope to keep your name on file; if our research plan changes we will invite you to participate again. If you wish to be removed from our mailing list, please reply to this email.*
>
> *Thank you again for your participation.*

<u>Urban Private University</u>

Only 12 of the 22 control subjects returned to sign consent forms in the fall of 2004. All 12 of these students were placed into study group slots vacated by departing study group subjects.

<u>Suburban Private University</u>

In anticipation of attrition among study group participants, the three control group subjects were invited to join the study group. One student agreed, increasing the study population at SPri to 41. Of the other two control students, one declined to participate further and the other did not respond, ending their participation.

Large Public University
There were no control subjects to disband at LPub.

3.2.2 Types of Data Collected

The research team decided that in Year 2 and beyond, structured interviews would not be administered to subjects in the Medium Contact Group. (This group had received both semi-structured ethnographic and structured interviews in Year 1.) Since there was considerable overlap between the two interviews, this move was intended to reduce undue burden on participants and interview staff.

In Year 2 and beyond, the engineering design tasks were administered to all participants, including those in the High Contact Group. (Students in this group did not do an engineering design task in Year 1.) Data gathered from engineering tasks would help researchers analyze how students' perceptions of engineering and approaches to engineering problems developed as they progressed through the college years. In Year 2, the engineering task was administered immediately following the spring interview.

3.2.3 Transcription of Structured Interviews

Beginning in Year 2, the research team at Howard University took over the responsibility for transcribing structured interviews, except for the engineering task, which would be transcribed by a consultant.

3.3 Migration between Study Groups

There were three main reasons for migrations of study participants between groups:

- **Departures** from the study caused by students declining to complete surveys and interviews, or leaving school.
- **Reallocation** of students among study groups as a result of departures.
- **Switching** to non-engineering majors, which triggered an exit interview.

As can be expected, the APS study pool experienced some attrition during Year 1. A total of eighteen students left the study after Year 1, four of whom had never provided data. Since the number of subjects was not large to begin with, researchers drew from their control group subjects to replenish study groups during Year 2. These and other migrations are described in section 3.3.1.

3.3.1 Year 2 Migration and Replenishment

Technical Public Institution

Five students left TPub and the study.[*] One was in the Medium Contact Group, and the four others were in the Low Contact Group. Five students from the control group were reallocated to fill the vacant slots, maintaining gender and ethnic diversity as much as possible.

Urban Private University

Eight students left the study before the 2004-2005 academic year, in addition to four who failed to take even the first survey. Of the eight who left, one student transferred to another school, two declined to participate further, and five declared non-engineering majors. This created a total of twelve open slots that were filled with students from the control group.

Suburban Private University

All 40 study participants returned for Year 2 in their original groups. In addition, one student from the Control Group was added to the Low Contact Group, bringing the total number of participants in that group to 25.

Large Public University

One student (Asian-American female) switched to a business major and left the university. Her slot was not refilled in Year 2.

3.3.2 Exit Interviews

Exit interviews were administered to participants who declared a major in a field other than engineering. There was institutional variation in which majors were considered engineering. Data from exit interviews contributed to understanding why and how engineering was not meeting student needs, or conversely, why and how other majors may be better at meeting those needs. The exit interview guide is included in Appendix 3-G.

During Year 2, Urban Private University conducted 5 exit interviews. UPri participants who exited the field of engineering in Year 2 were dropped from the study. (This procedure changed for Year 3, as described in section 3.5.1.)

By the end of Year 2, 14 SPri participants had declared non-engineering majors and received exit interviews. All of these students were retained in the study in their original study groups.

3.3.3 Study Group Demographics

Figures 3.1, 3.2 and 3.3 show the gender and ethnicity distributions of study participants in Year 2. For subjects who were added to the study in Year 2, ethnicity was determined from an item on the spring 2005 survey. Subjects continuing from Year 1 retained the ethnicity identification they had indicated the previous year. Additional demographic details are included in Appendix 1-E.

---

[*] Because the Technical Public Institution is focused exclusively on engineering and applied science, study participants who wished to pursue other majors had to transfer to another institution

Figure 3.1 Gender distribution (Year 2)

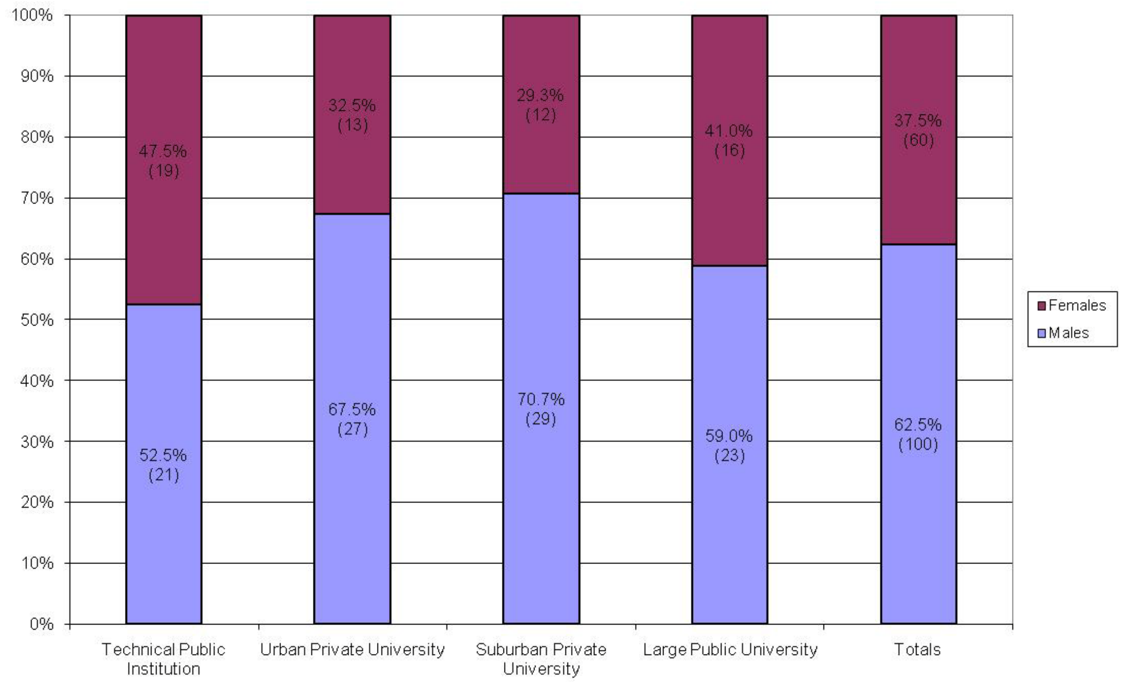


Figure 3.2 Ethnicity distribution by school (Year 2)

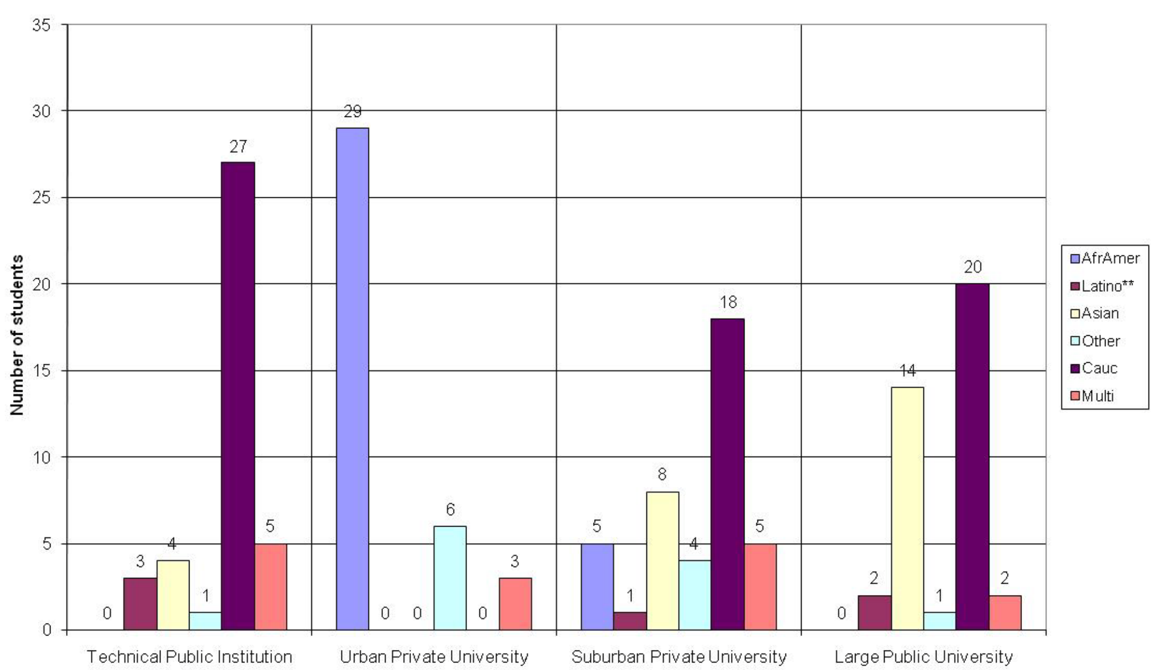
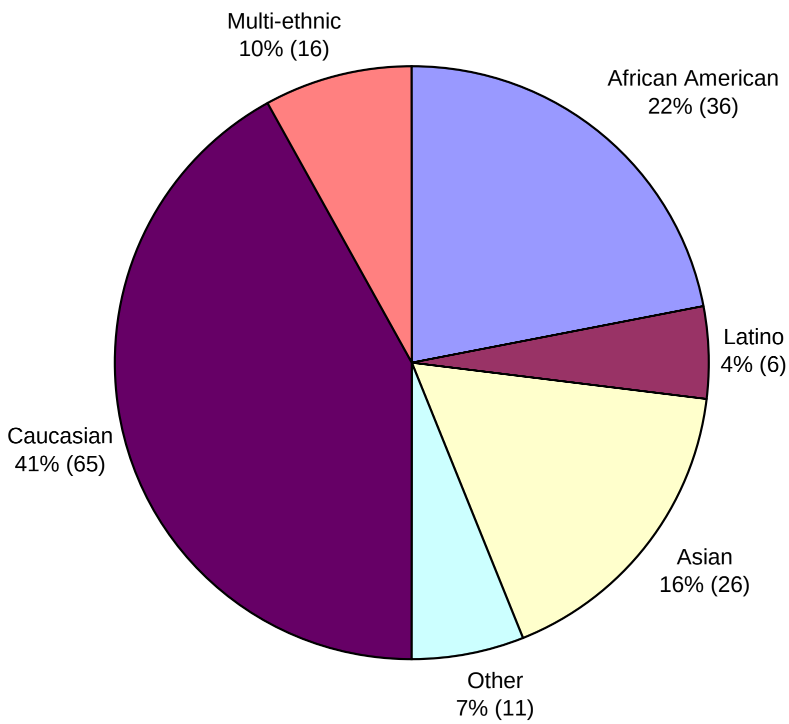


Figure 3.3 Ethnicity distribution for all schools (Year 2)



3.4 Data Collection

3.4.1 Methods

The methods for data collection in Year 2 followed similar protocols as were used in Year 1. Informed consent was obtained from each participant before any surveys, interviews, or observations were conducted. Copies of representative consent forms are included in Appendix 1-D.

Minor revisions were made to the Year 2 interview protocols and guides based upon questions emerging from Year 1 findings. These changes were reflected in an updated interviewer manual (Appendix 3-C). Similarly, the survey was refined to improve internal consistency (Cronbach's Alpha scores) of the variables.

3.4.2 Summary of Data Collected

Table 3.4 summarizes what data was collected by each school during Year 2. Academic transcripts were collected for Year 2 but are not reported in this table.

Table 3.4 Data collection summary by school for Year 2 (2004-2005)

	Surveys (n=40)		Structured Interviews (n=24)				Semi-structured Ethnographic Interviews (n=16)				Ethno Obs (n=8)		Exit Interv
	Dates	#	Dates	#	Length (min.)	# Eng. Act'y	Dates	#	Length (min.)	# Eng. Act'y	#	Hours spent	#
TPub	Fall 2004	40											0
	Spring 2005	40	n/a	24	27-59	24	n/a	16	71-179	16	25	25	0
UPri	Fall 2004	39											5
	Spring 2005	38	3/10-5/12/05	23	30-60	23	3/9-5/5/05	14	73-102	14	0	0	0
SPri	Fall 2004	41											
	Spring 2005	41	4/18-5/13/05	25	31-74	25	4/18-6/8/05	16	88-163	16	16	22	11
LPub	Fall 2004	39											0
	Spring 2005	39	4/18-5/20/05	23	40-120	23	Apr-May '05	14	90-120	14	40	120	0

3.5 Notes and Reflections on Year 2

3.5.1 Non-engineering Majors

In Year 2, five students from Urban Private University switched from engineering majors at the beginning of the academic year and were dropped from the Longitudinal Cohort. The one student from LPub who switched majors mid-year was also dropped.

To better understand or characterize students who declared non-engineering majors, researchers sought to retain participants who exited engineering during Years 3 and 4.

- Students in the Low Contact Group would receive an exit interview and surveys.
- Students in the Medium and High Contact Groups would receive exit interviews, surveys, semi-structured ethnographic interviews and engineering design tasks.

The above procedures were applied to the 14 SPri students who declared non-engineering majors in spring 2005.

3.5.2 Non-enrolled Students

Two SPri participants were on leave for one academic term for personal reasons. However, this did not impact data collection.

3.5.3 Missing Data

Failing to complete a survey or interview did not automatically eliminate a participant from the study. Students who studied abroad fell into this category, as did others. Following a single participant for the duration of the study period was deemed valuable even if one or more data points were missing. Students who missed surveys or interviews because of disinterest or other factors were dropped at the discretion of each school's research team, on a case-by-case basis.

4 Research Year 3: Fall 2005-Spring 2006

4.1 Year 3 Tasks and Goals

The main tasks for Year 3 were to:

- Manage study pool to maintain size and diversity of the study groups as much as possible
- Administer surveys (fall and spring) and interviews (spring) to all participants in the study group
- Conduct exit interviews with students who declared majors other than engineering
- Plan for the Workplace Cohort and the Broader Core and National Samples
- Begin analyzing data

4.2 Changes to Study Procedures

4.2.1 Non-engineering Majors

Study participants who declared majors other than engineering were interviewed about their decision in an exit interview (Appendix 3-G). These students were not dropped from the study, as had been the case during part of Year 2. Instead, they continued in their assigned groups and participated in surveys and interviews, although many chose not to.

4.2.2 Transcription of Semi-structured Ethnographic Interviews

By the beginning of Year 3, it became apparent that the transcription of semi-structured ethnographic interviews was lagging. To help deal with this backlog, transcription responsibilities were distributed among the CAEE research groups.

4.2.3 Extended Data Collection and Analysis

In addition to supplemental NSF funds awarded in September 2005, another NSF supplement was awarded in September 2006. These two awards, totaling about $2,000,000, allowed Longitudinal Cohort data collection and analyses to extend to Year 4. The Longitudinal Cohort would be followed during the 2006-2007 academic year with one survey for all participants (spring 2007), plus semi-structured ethnographic interviews and engineering design tasks for the High and Medium Contact Groups, also in spring 2007.

4.3 Migration between Study Groups

4.3.1 Year 3 Migration and Replenishment

<u>Technical Public Institution</u>

Two students left the study during Year 3:

- One Caucasian student from the High Contact Group transferred to a different institution to study engineering in a more diverse environment. A non-Caucasian student from the Low Contact Group was moved into the vacated slot, creating a vacant slot in the Low Contact Group that was not filled.
- One student from the Low Contact Group left TPub. This student was not replaced.

One student from the Medium Contact Group transferred to another institution after Year 3 to pursue a teaching degree. This student remained in the study for all of Year 3, and completed an exit interview at the end of the year.

<u>Urban Private University</u>
A total of six students left the study during Year 3:

- Two students did not enroll at UPri: one from the Low Contact Group and one from the High Contact Group
- Three students, all from the Low Contact Group, did not respond to survey/interview requests
- One student from the High Contact Group declined to participate because she was studying abroad

Vacancies created by these departures were not filled.

<u>Suburban Private University</u>
One student from the Low Contact Group withdrew from the study and was not replaced.

<u>Large Public University</u>
A total of seven students left the study during Year 3:

- Six students were either not accepted into engineering or switched out of the program
- One student was lost to follow-up (failed to respond)

Of the seven students who left the study, three were from the High Contact Group and four were from the Low Contact Group. Three students from the Medium Contact Group were moved to the High Contact Group to fill the vacancies there. No other replenishment occurred.

4.3.2 Exit Interviews

<u>Technical Public Institution</u>
Exit interviews were difficult to obtain because students who do not declare an engineering major typically leave TPub. Of the five participants who left TPub between Year 2 and Year 3, only two were reachable for exit interviews, and those were conducted in January and March of 2006.

One participant informed researchers of her intent to transfer after Year 3, and completed her exit interview prior to leaving.

<u>Urban Private University</u>
Exit interviews were conducted for three students who declared majors other than engineering. Two interviews were done in December 2005, and one in April 2006.

<u>Suburban Private University</u>
Exit interviews were completed for three students in March 2006. One study participant who had declared a non-engineering major in Year 2 returned to engineering in Year 3.

Large Public University
Six exit interviews were completed in October 2005, for students who had declared non-engineering majors, including some who had applied but not been accepted to an engineering major.

4.3.3 Study Group Demographic Summary

The gender and ethnic distribution of subjects remained fairly consistent between Year 3 and previous years. There was only modest attrition and no new subjects were added to the sample. Demographic details are included in Appendix 1-E.

4.4 Data Collection

4.4.1 Methods

The methods for data collection in Year 3 followed similar protocols as in previous years. Informed consent was obtained from each participant before any surveys, interviews, or observations were conducted. Copies of representative consent forms are included in Appendix 1-D.

Minor changes were made in the interview guides and are reflected in an updated interviewer manual (Appendix 3-C). The spring survey was modified to include questions that had arisen as a result of the dozen or so exit interviews completed prior to that point. To prevent the survey from becoming too lengthy, several items deemed less central to the APS research were dropped from the survey in order to accommodate the new questions (see Appendix 4-A).

4.4.2 Summary of Data Collected

Table 4.1 summarizes the data collected at the four core schools during Year 3. As in previous years, academic transcripts were collected but are not reported in this table.

Table 4.1 Data collection summary by school for Year 3 (2005-2006)

	Surveys		Structured Interviews				Semi-structured Ethnographic Interviews				Ethno Obs		Exit Interv
	Dates	#	Dates	#	Length (min.)	# Eng. Act'y	Dates	#	Length (min.)	# Eng. Act'y	#	Hours spent	#
TPub	Fall 2005	38											2
	Spring 2006	38	3/6-5/24/06	22	n/a	22	3/9-4/20/06	15	65-168	15	0	0	1
UPri	Fall 2005	32											2
	Spring 2006	32	4/10-5/25/06	18	25-55	17	4/13-5/24/06	12	60-120	11	12	24	1
SPri	Fall 2005	40											
	Spring 2006	40	3/23-6/26/06	17	26-74	17	3/26-5/25	15	87-209	12	3	4	3
LPub	Fall 2005	34									20	60	6
	Spring 2006	34	4/24-5/20/06	19	60-90	19	Apr-May '06	13	90-150	13	40	120	0

As mentioned earlier, one SPri participant who had completed an exit interview in Year 2 returned to engineering. A "return to engineering" protocol was developed, and administered to this student at the same time as his structured interview.

4.4.3 Cross-sectional Cohort

As a result of collaborative relationships between APS researchers and colleagues at the Large Midwestern Public University (LMPub), LMPub researchers adopted the PIE survey for use with a cohort of engineering students there. This group became the Cross-sectional Cohort. Although the LMPub project was not formally part of APS, the two groups maintained a cooperative and mutually beneficial relationship.

The goal for the Cross-sectional Cohort was to recruit 40 students from each undergraduate class (freshmen, sophomore, junior, senior), for a total of 160 participants. Students were recruited via e-mail, using enrollment lists from the engineering school. Rather than following students longitudinally, LMPub students were offered two discrete opportunities to participate: fall 2005 and spring 2006. The fall survey included only those students who had entered LMPub as freshmen. The spring survey was offered to additional students including transfer students. Participating students received a gift card at the LMPub book store in the amount of $15 for one survey and $25 for both (fall 2005 and spring 2006).

LMPub researchers customized the APS survey to reflect majors at LMPub. Two questions directed at transfer students were added to the spring survey (Appendix 4-E). Otherwise, the LMPub protocols were very similar to those used for Longitudinal schools during Year 3.

As already noted, the main differences between the APS Longitudinal Cohort and LMPub Cross-sectional Cohort were that the sampling at LMPub was cross-sectional rather than longitudinal, and it allowed for the inclusion of transfer students.

Figures 4.2 and 4.3 summarize the gender and ethnicity distributions of the Cross-sectional Cohort.

Figure 4.2 Cross-sectional Cohort gender distributions

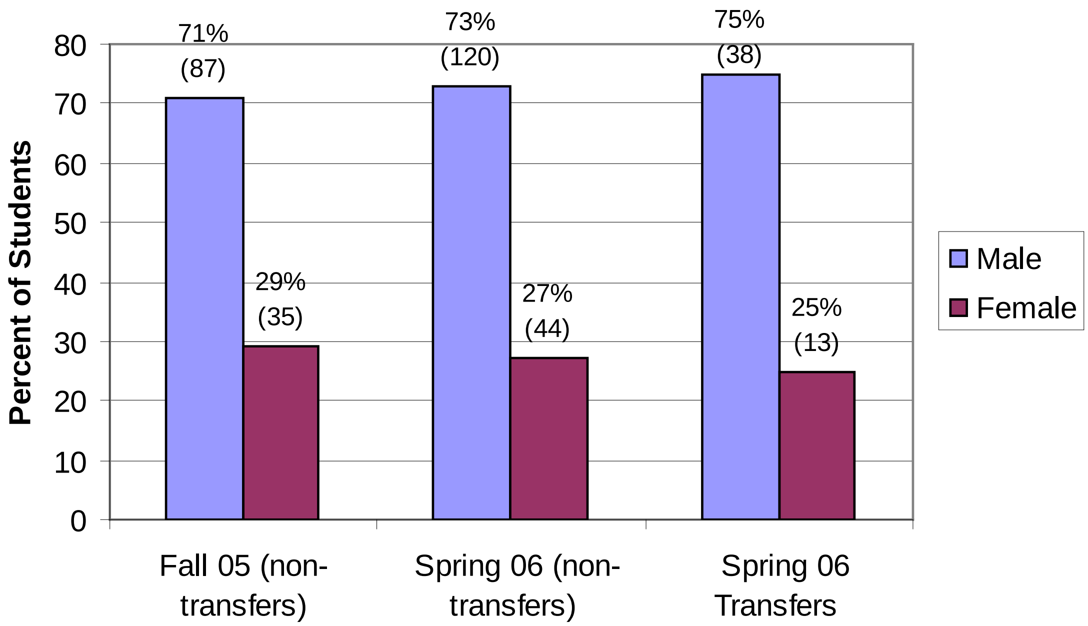
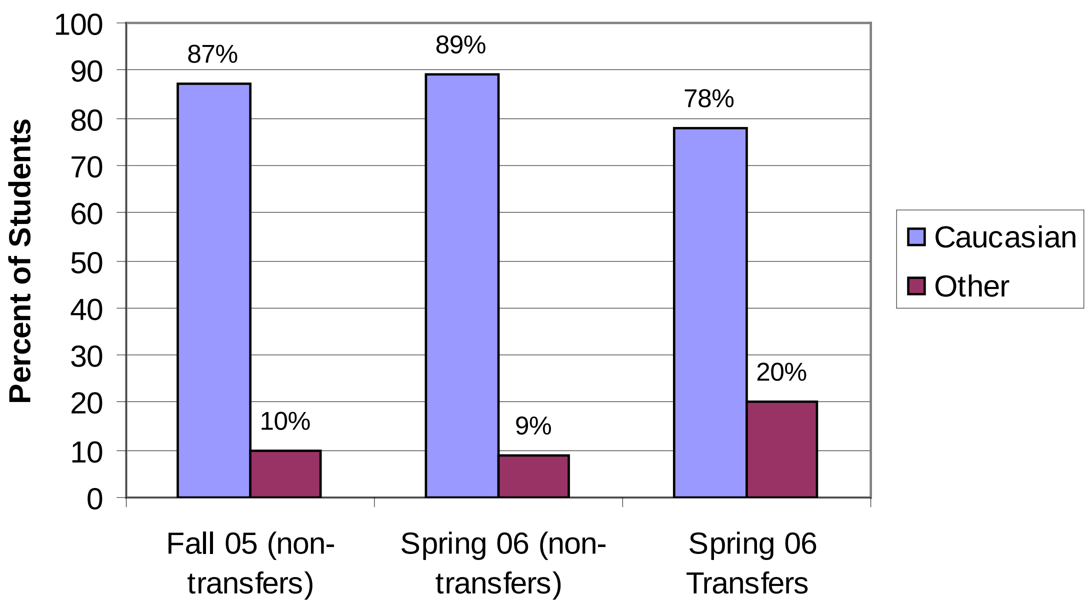


Figure 4.3 Cross-sectional Cohort ethnicity distributions

Note: Some respondents chose not to provide ethnicity data, so totals may not equal 100%.



4.5 Notes and Reflections on Year 3

4.5.1 Difficulty Securing Exit Interviews

Obtaining exit interviews with participants who declared non-engineering majors proved difficult because these subjects either lost interest in the study or failed to provide alternate contact information, especially if they left the university.

4.5.2 Students Absent from Campus

Several SPri students were not present on campus during Year 3. One took a term off for personal reasons, and another took the entire academic year off to work. Both students were able to complete their surveys and interviews as usual. Four other SPri students went abroad during the spring term and completed surveys remotely; two of them completed their interviews before leaving and two received semi-structured ethnographic interviews by phone while they were away. In sum, data collection was not impacted by the absences.

4.5.3 Structured Interview Transcriptions

Structured interviews were transcribed as in previous years of the study. However, the digital versions of the transcriptions were lost and had to be recreated by scanning working copies in paper version.

5 Research Year 4: Fall 2006-Spring 2007

5.1 Year 4 Tasks and Goals

The main tasks for Year 4 were to:

- Administer one survey (spring) to all participants in the Longitudinal Cohort
- Conduct informal conversations (fall-winter) and semi-structured ethnographic interviews (spring) with students in the Medium and High Contact Groups (Longitudinal Cohort)
- Conduct exit interviews with Longitudinal Cohort students who declared majors other than engineering
- Intensify efforts to analyze data and report findings
- Conduct Workplace Cohort interviews (see Section 6)
- Recruit Broader Core Sample participants and administer survey (see Section 7)
- Plan for Broader National Sample and begin recruiting schools (see Section 8)

5.2 Changes to Longitudinal Cohort Procedures

5.2.1 Extended Data Collection

As previously mentioned, supplemental NSF funds made it possible to extend Longitudinal Cohort data collection to Year 4. All Longitudinal Cohort participants received one survey (spring 2007). Students in the High and Medium Contact Groups received semi-structured ethnographic interviews and engineering design tasks in spring 2007, as well as informal conversations during the preceding fall and winter months. Low Contact participants did not receive structured interviews in Year 4.

NOTE: Structured interviews were conducted at UPri but not as part of APS activities.

5.2.2 Informal Conversations

Informal conversations allowed researchers to check in with subjects as needed to stay abreast of changes in student status. Such conversations occurred as needed in prior years of the study but were not recorded in the APS database. In Year 4, researchers had the option of uploading informal conversations to the database.

Informal conversations were arranged with students in the Medium and High Contact Groups, and generally focused on the question, "How are things going for you at this point?" The goal was to hear from students about their classes, feelings about engineering, life at their institution, and life in general.

5.3 Data Collection

5.3.1 Methods

The data collection methods in Year 4 followed similar protocols as in previous years. As already mentioned, informal conversations were just that: loosely defined one-to-one conversations about how things were going for students in the Medium and High Contact Groups.

As in previous years, informed consent was obtained from each participant before any data were collected.

5.3.2 *Summary of data collected*

Table 5.1 summarizes Longitudinal Cohort data collection in Year 4.

Table 5.1 Data collection summary by school for Year 4 (2006-2007)

Shaded cells indicate time periods when no data collection of that type was scheduled or conducted.

	Surveys		Informal Conversations		Unstructured Interviews				Exit Interv	Acad Trans
	Dates	#	Dates	#	Dates	#	Length (min.)	# Eng. Tasks	#	#
TPub			10/12-10/19/07	8					0	
	Spring 2007	35			3/20-4/25/2007	12	69-192	12	1	34
UPri*			---	0					0	
	Spring 2007	21			4/6-5/4/2007	11	25-92	11	0	22
SPri			10/13/06-1/19/07	14					0	
	Spring 2007	39	3/15-4/8/07	11	5/4-6/5/2007^	16	91-289	16	0	38
LPub			10/2-10/30/2006+	13					0	
	Spring 2007	31			4/16-5/23/2007	13	120	13	0	31
Total		126		46		52		52	1	125

* UPri did not conduct informal conversations.

+ One of the informal conversations at LPub was conducted on January 22, 2007.

^ One of the unstructured interviews at SPri was initiated early (March 26, 2007) because the student was going overseas.

5.4 Data Analysis

A workshop in September 2006 brought APS researchers together to stimulate discussion of possible analyses across instruments and institutions. The meeting resulted in a number of papers reporting cross-instrument findings. Method-specific analyses continued to generate findings that were reported in papers and presentations. (See http://www.engr.washington.edu/caee/ for an up-to-date listing of papers and reports from the APS research.)

5.4.1 *Data Sets Used for Analysis*

The overall APS data set consists of data from surveys, interviews, engineering design tasks, ethnographic observations and academic transcripts. A detailed student-by-student accounting of all longitudinal data (Years 1-4) is available from the APS database, as are the total numbers of students for whom data is available in each dataset, by year and by institution.

The portions of this overall data set used in a particular analysis vary depending on the focus of the analysis. For example, one analysis may focus on data associated with a particular method, whereas another may focus on data associated with a particular study group (such as high contact vs. low contact subjects). As such, the numbers of APS subjects reported in various documents and papers may differ.

5.4.2 Processing of Academic Transcript Data

Following the completion of the spring 2007 term, the four core institutions submitted cumulative academic transcripts (i.e., 2003-2007) for longitudinal study participants. Academic transcripts were collected in previous years also, but the final collection was used for analysis.

Academic transcripts were processed to normalize the data between institutions.

- At the two schools (SPri and LPub) operating on the quarter system, credit hours were converted to semester units by multiplying by a factor of two-thirds (i.e., 3 quarter units = 2 semester units.)
- All grades were mapped to a 5-point scale (A, B, C, D, F).
    - TPub and UPri both use a 5-point grading system so no conversions were necessary.
    - At SPri, which issues plus/minus grades (A+, A-, B+, B-, etc.) in addition to straight letter grades (A, B, C, D), the plusses and minuses were dropped. So A+ and A- converted to A; B+ and B- converted to B; and so on. SPri's grade of NP (not passed) was converted to F.
    - LPub uses a 0 to 40 grading scale. These grades were converted to the 5-point scale as follows: 35-40=A, 25-34=B, 15-24=C, 7-14=D, and 0-6=F.
- Each course listed on transcripts was categorized as:
    - Engineering (eng)
    - Science, medicine (sci/med)
    - Humanities, social sciences, fine arts (hum/ss/fa)
    - Math, computer science (math/cs)
    - Physical education, freshman success seminar, etc. (other)
- Courses were also assigned a design code whereby: 0 indicates no design elements; 1 means non-engineering design (e.g., art classes); 2 denotes some engineering design (such as a class project); and 3 indicates a major focus on engineering design (e.g., courses defined by a single class project.)

Academic transcripts were used to determine persistence in an engineering major, and the semester during which non-persisters declared non-engineering majors.

5.4.3 Engineering Persistence Data

Persistence in an engineering major was determined from academic transcripts; persisters were those whose transcript listed a major or minor in an engineering field at the time of graduation, or in spring 2007, if they had not yet graduated. Non-persisters were those who declared a non-engineering major after initially intending to study engineering.

The question of persistence in engineering was a central focus of the APS. Tables 5.2 and 5.3 provide a summary of engineering persistence among APS participants at the end of the study period. The categories are defined as follows:

- **Persisters –** students who entered the study with interest in engineering and whose academic transcripts at the end of the study period (spring 2007 or upon graduation) listed an engineering major or minor.
- **Non-persisters –** students who entered the study with interest in engineering but subsequently declared a non-engineering major. Some non-persisters continued in the study through Year 4 while others chose not to.
- **Other –** students who did not meet the criteria for either persister or non-persister.
- **Lost to follow-up –** students who left the study without sufficient data to determine persistence status.

Table 5.2 Persisters at end of Year 4: Subjects who enrolled in Year 1 (n=160) and Year 2 (n=18)

	Persisters	Non-persisters	Other	Lost to Follow-up
TPub	33	8	2*	2
UPri	29	8	0	15
SPri	27	13	1**	0
LPub	32	6	0	2
Total	121	35	3	19

Table 5.3 Persisters in Longitudinal Cohort at end of Year 4: Only subjects who enrolled in Year 1 (n=160)

	Persisters	Non-persisters	Other	Lost to Follow-up
TPub	29	8	1*	2
UPri	20	7	0	13
SPri	26	13	1**	0
LPub	32	6	0	2
Total	107	34	2	17

* Non-engineering students from the beginning of the study.
** Student left school to work in high-tech start-up company, with intention of returning to school eventually. He continued to participate in APS surveys and interviews but did not return to school during the study period.

Various APS analysis teams may define their data sets differently, so the numbers in Figure 5.2 may not be consistent across all APS papers and reports.

5.5 Notes and Reflections on Year 4

5.5.1 Attrition in Numbers

The Longitudinal study group was essentially unchanged from Year 3. However, attrition is apparent in the numbers of completed surveys and interviews for Year 4. Reasons include waning interest among subjects, early graduation, and permanent or temporary leaves from school. These factors contribute to ambiguities about the number of students completing the study. As mentioned in the previous section of this chapter, different analysis teams may report different numbers depending on how they choose to define their datasets.

6 Broader Core Sample

6.1 Research Goals and Description

The goal of research using the Broader Core Sample was to confirm that findings from the Longitudinal Cohort were representative of the larger undergraduate engineering population at the four Longitudinal Cohort institutions: Technical Public Institution, Urban Private University, Suburban Private University, and Large Public University. The Broader Core Sample research pursued key questions that emerged from the longitudinal work:

1. How are students who persist in an engineering major similar and different from students who do not persist?
2. How do experiences of engineering students change as they progress through their undergraduate careers as freshmen, sophomore, juniors and seniors?
3. How do men and women differ in their experiences in engineering education?

The sole data collection tool was an online survey, the Academic Pathways of People Learning Engineering Survey (APPLES), derived from the PIE survey instrument administered to Longitudinal Cohort. A major consideration in the design of APPLES was to reduce the length of the survey while retaining comparability of the two instruments so that generalizability of PIE findings could be tested.

Because the Broader Core Sample and Broader National Sample both involved cross-sectional research to validate longitudinal findings using the APPLES instrument, these two cohorts are sometimes referred to as APPLES1 and APPLES2 respectively, although the survey instruments were not identical (see Chen et al. 2008).

Broader Sample research activities were carried out by the APS researchers at Stanford.

6.2 Institutional Review Board (IRB) Approval

Local IRB approval for (non-medical) human subjects research was required for each of the four institutions participating in the Broader Core Sample because each school had active APS researchers. The Stanford University APS team took the lead in drafting the protocols and coordinating the IRB submissions. UPri incorporated TPub into their IRB application since TPub doesn't have an Institutional Review Board.

As with the PIE survey, design of APPLES was guided by universal IRB requirements: subjects were not required to answer survey questions, and all students had access to the incentive. In other words, students could claim the incentive without completing the survey, and regardless of whether they were part of the targeted student groups. However, the survey was designed so that researchers could identify such submissions and exclude them from data analysis.

6.3 Recruitment

6.3.1 Sampling and Stratification

To address the key research questions for the Broader Core Sample, recruitment efforts targeted three groups of undergraduate students:

- **Engineering students** who had declared an engineering major or committed to engineering programs at their universities
- **Pre-engineering students** who intended to declare an engineering major
- **Non-persister students** who were interested in engineering at one time but had since decided to pursue another field of study.

Persistence, along with academic level (freshman, sophomore, junior, senior) and gender, constituted the primary strata for setting recruitment targets. Secondary strata included enrollment status (part-time or full-time), transfer status, ethnicity and citizenship. Each stratum required 10 to 25 subjects per school to run statistical t-tests. Recruitment targets were set accordingly, as shown in Figure 6.1.

A response rate as high as 30 percent per school was anticipated, based on the National Survey of Student Engagement (NSSE), a similar survey in terms of length and content, but one which offers no incentive for participation.

6.3.2 Recruitment

Each of the participating institutions named a coordinator for recruitment efforts at their school. Coordinators secured local IRB approvals with assistance from Stanford, and oversaw local recruitment during the survey deployment.

A combination of approaches was used to recruit students for the Broader Core Sample. These included:

- Posters hung in locations frequented by undergraduate engineering students (Appendix 2-C)
- Emails to students from their engineering dean, using targeted distribution lists (Appendix 2-D)
- Advertisements in the student newspaper and, for one institution, a directed advertisement on a social networking site.

All recruitment materials and communications carried a red apple logo designed for the study, and provided the dates and URL for accessing the survey. Each institution had its own APPLE Survey URL that included the institution's name to enhance credibility and avoid being mistaken for spam.

Recruitment Plans were developed jointly with the local campus coordinator and a liaison from the research team at Stanford (see Appendix 2-B). On the recruitment planning form, Plan A shows the initial strategies for the institution; Plan B delineates targeted strategies in case responses in any stratum lagged. Campus coordinators implemented Plan B only if they perceived one or more of their strata to be lagging during survey deployment.

6.3.3 Incentive for Participation

To encourage participation, a $4 electronic payment through PayPal was offered to every individual who filled out the survey. The $4 payment best met budgetary and other criteria, including:

- Broad student appeal
- Available online almost immediately
- Scalable with minimal logistical effort for large or small, geographically distributed audiences
- Redeemable without compromising student confidentiality
- Payments could be tracked to meet university disbursement requirements
- Unclaimed incentives could be returned to the project after a period of time.

Other incentive options that were considered included a chance at a raffle prize and various gift card options (books, coffee, sandwiches, music, etc.).

6.4 Data Collection

6.4.1 The Survey Instrument

The APPLE Survey is comprised of a focused subset of questions from the PIE survey used with the Longitudinal Cohort. The instrument underwent two rounds of pilot testing to ensure its effectiveness for a single cross-sectional administration that would include non-engineering majors. The first round of piloting involved 10 researchers and graduate students who were associated with the project. The goal was to refine the survey questions for clarity and identify questions that could be eliminated. The second round of pilot testing involved 58 undergraduate students from five external institutions (i.e., schools not affiliated with APS). This round of testing was aimed at paring down the survey so it would take only ten minutes to complete, as compared to the 30-minute completion time for the PIE survey.

The resulting APPLES1 instrument consisted of 52 questions, representing 26 constructs (also called variables) and five demographic items. These constructs are described in detail in Appendix 4-B, which also maps the three APS survey instruments (PIE, APPLES1/Broader Core Sample, APPLES2/Broader National Sample) against one another. The survey is included in Appendix 4-C.

6.4.2 Survey Administration

APPLES1 was deployed at all four campuses from April 2 through April 9, 2007. The deployment period was extended two-and-a-half weeks (until April 27) at Urban Private University in an attempt to better meet strata targets with its small pool of engineering students and infrastructure constraints in reaching students by email.

Response to the online deployment was monitored in real time, allowing for remedial measures to be taken to attract survey-takers in strata that might be lagging. Response reports were sent daily to institution liaisons in the late afternoon. A sample report is included in Appendix 5-A.

6.4.3 Summary of Data Collected

There were a total of 914 survey responses from the four schools, of which 842 were included for analysis. The 72 submissions that were omitted were determined to be ineligible (i.e., submitted by graduate students or students from non-participating universities) or fraudulent. Fraud was defined as "blind clicking" or otherwise attempting to claim the incentive without filling out the survey, and represented approximately 3 percent of submissions. Blind clicking was assumed for submissions with completion times of less than five minutes, a cut-off derived from pilot testing.

Table 6.1 provides a summary of the cleaned (eligible) data set by strata and by institution.

Table 6.1. Summary of Broader Core Sample Response Targets and Eligible Responses

Strata	*Target per school*	TPub	UPri	SPri	LPub	Totals
All	*140*	239	67	217	318	**842**
Freshmen*	*25*	67	14	77	31	**189**
Sophomore*	*25*	60	15	33	49	**157**
Juniors*	*25*	48	14	62	122	**246**
Seniors*	*25*	56	20	38	90	**204**
5th Yr Senior or more	*(not set)*	8	2	6	25	**41**
Transfer students	*10*	24	9	8	74	**115**
Returning or Non-traditional student	*(not set)*	12	2	1	17	**32**
Non-persisters	*25*	12	13	36	28	**89**
Male students*	*70*	157	35	124	223	**539**
Female students*	*25*	81	31	91	93	**296**
Ethnic minority students+	*25*	21	57	37	19	**134**
International students^	*25*	11	23	22	45	**101**
Part-time students	*10*	5	0	1	4	**10**

* Primary strata
+ Ethnic groups traditionally underrepresented in undergraduate engineering programs in the U.S., including Native American, African American/Black, Hispanic/Latino
^ Students who do not hold U.S. citizenship

Of the total 914 survey responses, 137 declined the incentive. Ultimately, 562 subjects (72 percent of subjects who accepted the incentive) collected the $4 incentive.

Response rates, i.e., the number of respondents relative to the undergraduate engineering enrollment, were as follows:

TPub	10%
UPri	12%
SPri	34%
LPub	21%
Overall	17%

6.5 Notes and Reflections

6.5.1 Pilot Testing

Pilot testing proved to be an invaluable resource for refining the survey instrument. For this reason, piloting of the APPLES instrument was extended to two rounds despite short timelines. In addition to providing feedback about readability and comprehension, pilot data helped guide the difficult decisions about which items and constructs to keep or delete so respondents could complete the survey in ten minutes. Comparable surveys, including the National Survey of Student Engagement (NSEE), strive for a ten-minute take-time to maximize response rates. Pilot testing also helped determine a minimum completion time (five minutes) below which "blind clicking" could be reasonably assumed.

6.5.2 IRB Approvals

Obtaining IRB approval took longer than expected at all institutions, and requirements were not consistent across institutions. For example, LPub's IRB called for a confidentiality disclaimer statement and UPri's IRB wanted wording changes in the recruiting materials. Although researchers had hoped to offer survey-takers the option of online or paper surveys, confidentiality requirements made this option unfeasible, particularly when it came to claiming the incentive.

6.5.3 Recruitment Challenges

None of the participating institutions met their targets for all strata. For the most part, this had to do with the particular characteristics of the schools (e.g., difficulties locating non-persisters at TPub, UPri and SPri and weaknesses in the campus email system at UPri).

Reaching non-persisters required special recruitment efforts. For example, at SPri, Longitudinal Cohort data suggested that students who had opted out of engineering commonly went into Math and Computational Sciences, Physics, Symbolic Systems and Economics. Therefore, the non-persister stratum target was successfully met by emailing students in these departments and asking them to participate in the survey. As with the recruitment email that went to engineering undergraduates, the email seeking non-persister respondents went out over the signature of a dean (Appendix 2-E).

6.5.4 Repeat Claims for Incentive

Researchers had considered limiting responses to one per IP address in order to discourage respondents from making repeat claims for the incentive. However, this would have excluded participants who may share a computer or use a computer lab. It turned out that a number of eligible survey responses from UPri came from a single IP address.

For more information about APPLES design and development, see:

Donaldson, Krista M., Helen L. Chen, George Toye, Sheri D. Sheppard. 2007. Targeting Undergraduate Students Interested in Engineering for Surveys: Lessons from the Academic Pathways of People Learning Engineering Survey. *Frontiers in Education Annual Conference, Milwaukee, WI, October 10-13, 2007*.

Chen, Helen L., Krista M. Donaldson, Ozgur Eris, Debbie Chachra, Gary Lichtenstein, Sheri D. Sheppard, George Toye. 2008. From PIE to APPLES: The Evolution of a Survey Instrument to Explore Engineering Student Pathways. *American Society for Engineering Education Annual Conference, Pittsburg, PA, June 2008.*

7 Broader National Sample

7.1 Research Goals and Description

The goal of research with the Broader National Sample was to corroborate and extend findings from the Longitudinal Cohort and the Broader Core Sample with an expanded set of undergraduate engineering students and institutions nationwide. The sole data collection instrument was the APPLE survey, administered cross-sectionally during January to March 2008. Power calculations indicated a minimum of 1,080 respondents from 18 institutions were required to ensure a nationally representative sample of undergraduate engineering students.

7.2 The Research Team

All aspects of research with the Broader National Sample were conducted by the Stanford APS research team. Each member of the Stanford team served as liaison to several (four to six) participating institutions. Liaison duties vis-a-vis their assigned schools included:

- Extending and following-up on invitations to participate
- Keeping the schools appraised of study timelines and procedures
- Working with each institution to devise and execute a recruitment plan appropriate to the school and its students
- Monitoring the school's response rates during survey deployment, including creating and sending daily response reports (see sample response report in Appendix 5-A)
- Serving as the primary contact person for and with the institution

7.3 Institutional Review Board (IRB) Approval

Umbrella IRB human subject approval was obtained from Stanford University and covered all participating students and institutions except for two institutions with APS researchers on staff. Those two institutions submitted applications to their respective IRBs, and both were approved. As it turned out, four other participating institutions voluntarily chose to obtain approval from their local IRB, and did so with assistance from the Stanford team.

7.4 The Survey Instrument

Based on results from the Broader Core Sample, the APPLES1 instrument underwent minor modifications to:

- Ensure that demographic questions were appropriate and detailed enough to capture institutional and respondent diversity
- Improve the internal reliability of several constructs
- Address intrinsic (psychological) motivation, which was mentioned in the open-ended comments from APPLES1 respondents

The resulting APPLES2 instrument was pilot tested with a sample of 52 undergraduate engineering students from three external institutions (i.e., schools not participating in or affiliated with APS research).

The survey constructs are described in detail in Appendix 4-B, which also maps the three APS survey instruments (PIE, APPLES1/Broader Core Sample, APPLES2/Broader National Sample) against one another. For a more in-depth review of the APPLES instrument, see the technical report CAEE TR-09-02, Exploring the Engineering Student Experience: Findings from the Academic Pathways of People Learning Engineering Survey (APPLES).

7.5 Sampling Plan

Schools were identified and invited to participate in the Broader National Sample according to stratification criteria that would yield a diverse pool of students for the survey. The institutional characteristics that drove the stratification process were:

1. Carnegie 2000 classification
2. Student body ethnic composition, gender balance and enrollment status (full-time vs. part-time)
3. Institution size, type (public vs. private), geographic location, presence/absence of religious affiliation and number of transfer students

The number of institutions was driven by the calculated number of respondents (1,080) needed for statistically meaningful results. A slightly higher number of institutions were recruited to provide a cushion in case of last-minute withdrawals. Tables 7.1 and 7.2 summarize the institutional sampling stratifications, as well as the numbers of institutions that were ultimately recruited in each stratum.

Table 7.1. Summary of Primary and Secondary Stratification Characteristics

Type of Institution	Required	Participated
Primary Stratifications		
Doctoral/Research – Extensive	5	7
Doctoral/Research – Intensive	2	4
Specialized Institutions – Engineering	2	3
Master's Colleges and Universities I	2	3
Specialized Institutions – Other	1	0
Baccalaureate Colleges – General	1	2
Baccalaureate Colleges – Liberal Arts	1	2
Secondary Stratifications		
Historically Black Colleges and Universities	1	2
Hispanic-Serving Institutions	1	2
Single-Gender Institutions	1	1
Part-Time Student Population > 30%	1	4
Recruiting Redundancy	3-7*	3
TOTAL	**21-25**	**21**

*We estimated we needed to recruit 3-7 additional institutions should one or more institutions be unable to participate in APPLES late in the process.

Table 7.2. Summary of Tertiary Stratification Characteristics

Tertiary Stratification Considerations	National Picture (2007)*	Participating Institutions
Institution size (based on enrollments)	Large = 54% Medium = 43% Small = 3%	Large = 33% (7) Medium = 38% (8) Small = 29% (6)
Geographic diversity		17 states represented
Funding type	Public = 63% Private = 37%	Public = 67% (14) Private = 33% (7)
Religious affiliation	14% of institutions 4% of population	5% (1 institution)
Transfer student population	(Information not available)	Two 3+2 completion institutions

*Percentage of national sample of 319 institutions

7.6 Institutional Selection and Recruitment

Guided by the sampling plan, researchers strategically selected schools to invite into the Broader National Sample research. Invited schools were required to have at least one ABET-accredited engineering major in addition to the characteristics laid out in the sampling plan. A total of 319 institutions met these criteria. Furthermore, schools where APS researchers had personal contacts were favored in case we encountered institutional hurdles that an insider might help us understand and overcome. As previously stated, researchers sought to err on the conservative side by inviting more schools than were required by the sampling plan.

Beginning in spring 2007, the research team mailed letters of invitation to the engineering deans at 25 institutions. Stanford liaisons followed-up by telephone and e-mail to answer questions and secure commitment to participate. In addition, researchers held a special session at the American Society of Engineering Education annual conference in June 2007 to further describe the research, answer questions and secure commitments from the targeted institutions.

As an incentive to participate, each institution received a report summarizing the data submitted by its students relative to those from the other participating schools.

Twenty-one institutions accepted the invitation to participate in the Broader National Sample, as illustrated in Figures 7.1 and 7.2. Invitations were extended to three different military academies, none of which accepted, leaving us without representation from Carnegie 2000 classification *Specialized Institutions—Other*.

Participating schools were asked to appoint a local coordinator to assist researchers in understanding local campus culture, provide institutional data (such as school calendars and enrollment figures), and plan and implement local student recruitment. Appendix 2-B includes sample forms that were used to plan recruitment efforts.

7.7 Subject Recruitment

7.7.1 Diversity Goals and Strata Targets

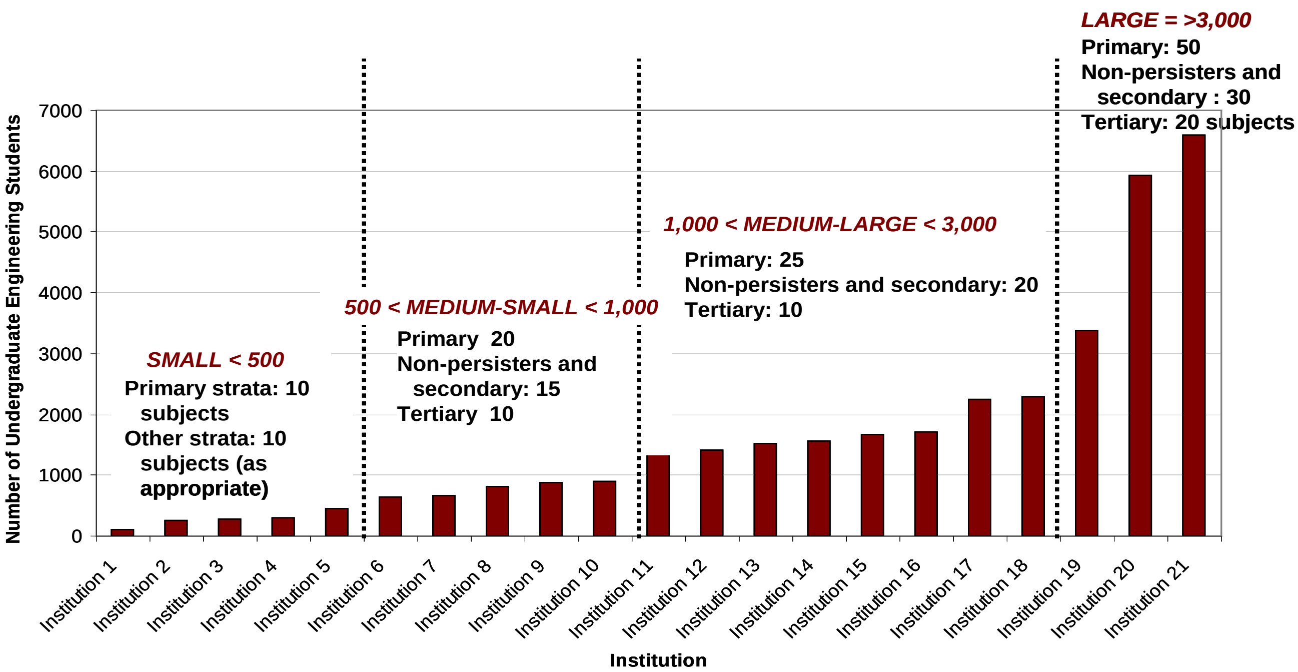
In keeping with our research goals, student recruitment was planned to ensure a diversity of participants, including over-sampling of specific groups (strata). The strata, in order of importance, were defined as follows:

- Primary strata: academic level (freshmen, sophomores, juniors, seniors), engineering persisters/non-persisters, and men/women
- Secondary strata: ethnic minority and international students
- Tertiary strata: part-time and transfer students

Ethnic minorities included those traditionally underrepresented in the undergraduate engineering population nationally: African Americans, Latinos, and Native Americans. International students were defined as those not holding U.S. citizenship.

Strata recruitment targets were set for each participating institution by visually-binning according to their undergraduate engineering enrollment: small (less than 500 students), medium-small (500-1000 students), medium-large (1000-3000 students), and large (more than 3000 students) (Figure 7.3).

Figure 7.3. Strata Targets by Institutional Undergraduate Engineering Enrollment



The local coordinator and Stanford liaison adjusted strata targets depending on the student composition of the school. For example, if a small school had fewer than ten international students, this stratum (and target) was eliminated. Similarly, if a school had a large proportion of Latino students, the target for ethnic minorities was increased.

7.7.2 Incentive for Participation

As in the Broader Core Sample, students were offered a $4 electronic payment through Pay Pal for their participation in the Broader National Sample.

7.7.3 Recruitment Methods

The main methods for recruiting students to take the APPLE survey were:

- Email messages to undergraduate engineering students from a senior administrator (such as a dean). Coordinators were encouraged to send the email on the first day of survey deployment.
- Posters customized to the institution. Posters typically went up the weekend before deployment at locations frequented by engineering students. (See Appendix 2-C for sample poster.)

A third recruitment method, advertisement on a popular social networking site, was used as needed to bolster response rates mid-deployment. This step was required at seven (33%) of the schools.

In November 2007, prior to deployment, local coordinators developed strategic recruitment plans for strata that may be more difficult to fill, such as non-persister, ethnic minority or part-time students. Strategic recruitment was implemented based on the daily response reports prepared by Stanford liaisons during the week of survey deployment. A sample response report is shown in Appendix 5-A.

7.8 Survey Deployment

7.8.1 Deployment Procedures

APPLES deployments for the Broader National Sample were scheduled to last five days (Monday through Friday), consistent with response patterns from the Broader Core Sample deployment. Participating institutions could choose from three deployment weeks, ranging from late January to late February 2008. A fourth deployment week in March 2008 was added to accommodate two institutions that were unable to schedule deployment earlier.

The survey was "turned on" at 12:01 AM on Monday, and "turned off" at 11:49 PM on Friday. At nine institutions where response rates were low and strata targets were unmet, the survey was kept live for up to one week longer.

Participants accessed the survey using a URL that included the school name or abbreviation (e.g., schoolname.applesurvey.org). The school reference was incorporated in the URLs to enhance the credibility of the survey and encourage participation.

7.8.2 *Data Collection Summary*

Table 7.4 summarizes the data collected by stratum.

Table 7.4. Summary of Eligible APPLES Responses by Stratum

School	UG Eng Enrollm't	APPLES Responses	Fr	So	Jr	Sr+5th Yr Sr	M	F	Ethnic Minor'y	Int'l	Part-time
1	99	47 (47%)	13	11	13	10	0	47	5	6	0
2	251	95 (38%)	19	28	22	26	75	20	7	10	1
3	286	116 (41%)	29	21	37	29	64	51	5	7	0
4	310	87 (28%)	24	22	22	19	41	45	2	4	0
5	546	84 (15%)	25	17	20	22	71	12	9	9	0
6	634	155 (24%)	29	35	43	47	101	54	122	39	8
7	666	54 (8%)	10	13	13	18	42	12	52	1	2
8	823	131 (16%)	11	25	38	54	92	35	6	14	14
9	874	153 (18%)	30	14	41	65	109	44	43	38	18
10	896	57 (6%)	12	18	14	12	46	11	1	3	1
11	1,397	160 (11%)	41	39	49	31	89	70	7	12	0
12	1,405	261 (19%)	64	71	68	58	148	113	26	40	0
13	1,517	101 (7%)	21	24	27	28	70	28	42	48	6
14	1,563	136 (9%)	48	33	28	26	80	54	112	10	2
15	1,623	635 (39%)	177	104	148	203	481	146	19	63	15
16	1,674	361 (22%)	71	84	90	114	268	91	44	36	26
17	1,723	242 (14%)	18	96	83	45	110	131	31	19	0
18	2,245	99 (4%)	26	6	29	37	79	18	6	17	5
19	2,290	391 (17%)	57	67	99	168	303	83	26	17	3
20	5,930	445 (7%)	97	127	120	101	260	183	25	90	1
21	6,591	456 (7%)	115	112	117	111	261	194	62	39	7
Totals	33,343	4,266 (13%)	937	967	1,121	1,224	2,790	1,442	652	522	109

There were 4,597 eligible (non-fraudulent) responses in the Broader National Sample, which was reduced to 4,266 after data cleaning. Approximately 3,900 (85%) of eligible respondents indicated they wished to claim the incentive, of whom 2,958 (64% of eligible respondents) actually did so.

7.9 Notes and Reflections

7.9.1 Controlling Incentive Outlays

Prior to deployment, the research team considered the financial burden of issuing incentives in case of an unexpectedly high response rate, such as the 30 percent that the NSSE surveys garner. This concern was addressed in several ways:

- Emphasis was placed on strategic recruitment aimed at meeting strata targets, with little to be gained (statistically) from grossly exceeding targets.
- Daily monitoring of responses would allow researchers to know if numbers were getting too large, in which case the survey could be turned off once strata targets were comfortably met.

Furthermore, approximately 61 percent of respondents in the Broader Core Sample ended up collecting their incentives, and there was no reason to expect differently in the Broader National Sample.

As it turned out, response rates were similar in the two Samples (17% for the Broader Core Sample and 14% for the Broader National Sample), as were incentive collection rates (61% vs. 64%).

7.9.2 Fraudulent Responses

There were two cases of attempted large-scale fraud, defined as a large number of ineligible submissions. The first case was detected by an unexplained surge in responses halfway through the deployment week. This surge was traced to two "free money"-type websites to which the APPLES URL had been forwarded. The second case of fraud was the result of two individuals repeatedly taking the survey, one taking it 14 times and the other 38 times. Multiple submissions were detected using a combination of IP tracking and timing data. As in the Broader Core Sample, the minimum time for taking the survey without blindly clicking through fell at the five-minute mark. Submissions that were clearly fraudulent were removed from the data set.

7.9.3 Recruitment Challenges

As with the Broader Core Sample, researchers experienced difficulty recruiting non-persisters, transfer students and part-time students. Non-persisters were most successfully recruited via email sent to technical non-engineering departments such as Physics. However, not all institutions had such majors and some institutions faced internal constraints in contacting students outside engineering. Transfer students were most easily recruited at large public institutions and those that enrolled 3+2 students (i.e., students who completed three years at another institution in order to transfer to complete their last two years in engineering).

7.9.4 Lessons Learned

Despite the experience gained from the Broader Core Sample, researchers learned additional lessons about survey recruitment and deployment from the Broader National Sample.

- There were advantages to using institution-specific URLs for accessing the survey, including more thoroughly protecting the identity of participating institutions from each other; facilitating the tracking and remediation of technical problems; and allowing researchers to isolate large-scale fraud without impacting the larger deployment or data sets.
- The last question on the survey, "Is there anything else you want to tell us that we didn't already cover?" was a rich source of data. Many students revealed passions, concerns and experiences that were not otherwise captured in the survey.
- The amount of researcher attention required by the participating institutions varied. Researchers generally spent more time communicating with and assisting institutional coordinators than was anticipated. In at least one case, a researcher had to step in to locate and recruit students at a school that did not have experience or knowledge to do so themselves.
- Similarly, managing incentive payments required more time and effort than anticipated, largely due to student requests for help and demands for payment.
- Staggering deployments relieved considerable pressure on the research team to better address the needs of participating institutions, provide for last-minute survey extensions and resolve anomalies with incentive claims.

For more information about survey development for the Broader National Sample/APPLES2 please see:

Donaldson, Krista, Helen Chen, George Toye, Mia Clark, and Sheri Sheppard. 2008. Scaling Up: Taking the Academic Pathways of People Learning Engineering Survey (APPLES) National. Presented at the *38th ASEE/ISEE Frontiers in Education Conference, Saratoga Springs, NY, October 22-25, 2008.*

8 Workplace Cohort

The goal of the Workplace Cohort research was to address research questions about the school-to-work transition of new professional engineers. Of particular interest were those aspects of becoming an engineer that are not taught or learned as part of academic training. By studying new engineers and their supervisors, researchers explored technical and social factors and skills that contributed to a successful transition into the workplace.

The original design of the Workplace Cohort consisted of 16 students (8 on each of two campuses) who had participated in the Longitudinal Cohort research. The plan was to follow these 16 students from the end of their junior year through the first two years post-B.S. However, this original design of the Workplace Cohort was expanded to eventually include over 100 participants in three distinct studies. We call these sets of archived interviews:

1) The Workplace Cohort: Researcher#1. These interviews were conducted by a CAEE research scientist at the University of Washington under the supervision of a CAEE Lead at UW.
2) The Workplace Cohort: Researcher#2. These interviews were conducted by a CAEE research scientist at the University of Minnesota (at the time a CAEE-funded PhD student), under the supervision of two CAEE Leads at Stanford and University of Minnesota.
3) The Workplace Cohort: Researcher#3. These interviews were conducted by a CAEE research scientist at the University of Washington under the supervision of a CAEE Lead at UW.

Each of these Workplace Cohorts is described below.

8.1 Workplace Cohort: Researcher#1

This dataset consists of eight interviews with engineering graduates from one of the APS core schools. All eight were Longitudinal Cohort students, and completed their degrees in 2008. Three of the interviewees are female and five are male. The interviews were conducted between April 2008 and November 2008, and ranged in length from approximately 20 minutes to an hour. At the time of the interview, four of the engineering graduates were employed in medium to large sized engineering firms, three in small firms, and one was not in the workplace. The overall intent of these interviews was to explore the transition from engineering educational institutions to actual engineering workplaces. The topics of interest included: the use of mathematics in the workplace, differences in learning experience in school and work, and aspects of engineering education that were important in the workplace but not covered in school.

8.2 Workplace Cohort: Researcher#2

This dataset consists of 96 transcripts of interviews of engineering graduates employed as engineers or engineering supervisors at one of four organizations (see Table 8.1 for descriptions of organizations). The data collection was mainly focused on understanding the socialization of newly graduated engineers who had been employed at the organization from 6-12 months, addressing such questions as:

- How do newly hired engineers practice engineering in the workplace?
- How do newly hired engineers learn the specific job requirements and social norms of the workplace?
- What are the factors affecting how newly hired engineers begin practicing engineering in the organizational setting?

The interview protocol (based on a critical incidence methodology) is contained in Appendix 3-E. The interviews were conducted between January and April 2007, and were nominally an hour in length.

Table 8.1. Four organizations participated in the Workplace Cohort: Researcher #2

Organization #1—is a large, global vehicle manufacturing company. They had recently reorganized and began hiring new engineering talent primarily to develop new technologies. There was much flux in the organization and they had delegated new hire onboarding to the managers of work groups without a structured plan to follow. Therefore, each work group onboarded new hires according to the preferences and conditions of the work group—meaning that there was a high level of variance in the experiences of new hires—from good to bad. This dataset includes semi-structured interviews with 30 newly hired engineers and 6 supervisors conducted in January and February of 2007. The new hires had from 6 months to 18 months experience at their jobs. Each supervisor had at least one of these new hires in his or her work group. **Organization #2**—is a large national food manufacturing company. They had a highly structured onboarding program including a rotational program for newly hired engineers. While new hires were assigned to different production plants, the experiences were relatively similar. New hires received detailed plans for meeting with others (developing relationships and networks) and the organization explicitly expected managers at all levels to meet with new hires and expected work groups to provide learning experiences to new hires. New hires also moved across three different engineering jobs and work groups during their rotations. This structured process enabled new hires to quickly learn the culture of the company and make important contacts early, as well as learn about different processes and functions in the company. This dataset includes semi-structured interviews with 18 newly hired engineers conducted in January through April of 2007. The new hires had from 6 months to 18 months experience at their jobs.

Organization #3—is a smaller manufacturing company of computer components. They provided a structured and systematic onboarding process comprised of training courses and meeting various experts in the company. They did not have a rotational program and the experiences of new hires depended on the efforts of the work groups to help new hires learn and integrate into the organization.

This dataset includes semi-structured interviews with 19 newly hired engineers and 4 supervisors in February of 2007. The new hires had from 6 months to 18 months experience at their jobs. Each supervisor had at least one of these new hires in his or her work group.

Organization #4—is a state-government agency for transportation. This organization had a highly structured, rotational program providing new hires with in-depth background information and the opportunities to rotate among various work groups/experiences. The experiences of new hires varied among work groups depending on the efforts of coworkers and managers to facilitate learning.

This dataset includes semi-structured interviews with 19 newly hired engineers conducted in January through April of 2007. The new hires had from 6 months to 18 months experience at their jobs.

8.3 Workplace Cohort: Researcher#3

This dataset consists of seven audio files of interviews of recently graduated engineers (all were out of school for less than 12 months at the time of their interview). The companies at which these engineers work were identified through discussions with staff in engineering departments at one of the APS core schools as companies that recruit the school's graduates.

Five of these interviews were with individuals at a county public works department. These individuals were identified and recruited through a list provided by the department's director and the head of the training program for new engineers.

One interview was conducted with an engineer at a state transportation agency who was selected from a list provided by a manager in the agency.

One interview was conducted with an engineer at a small aerospace firm, who was recruited from a list of recently hired engineers provided by one of the directors. The company is an engineering firm focused on providing innovative and entrepreneurial aerospace products to commercial, civil, and military customers.

One of the interviewees is female and six are male. The interviews were conducted between the months of November 2006 and May 2007, and ranged in length from 33 minutes to 74 minutes. The interview guide used for these interviews is included in Appendix 3-F.

Issues explored in these interviews include:

- The new engineers' retrospective views of formal education
- The degree to which their work permeated home life
- The extent to which the new engineers felt that engineering should be in the service of others
- How these engineers learned new technical skills at work
- How they learned new social skills at work
- Their satisfaction in practicing the craft of engineering

A listing of papers and reports from the Workplace Cohort research can be found at http://www.engr.washington.edu/caee/.

List of Appendices

Identifier	Name of Appendix	Cohort
1. Process Documents		
1-A	• APS File Naming System	
1-B	• APS Data Access Guidelines	
1-C	• APS Persistence Definitions	
1-D	• APS Informed Consent Forms	Longitudinal
1-E	• APS Longitudinal Cohort Demographics Table	Longitudinal
2. Recruitment Documents		
2-A	• Original APS Longitudinal Cohort Sampling Plan	Longitudinal
2-B	• Sample APPLES Institution Overview and Recruitment Plan	Broader National
2-C	• Sample APPLES Poster	Broader National
2-D	• Sample APPLES Recruitment e-mail	Broader National
2-E	• APPLES Recruitment e-mail for Non-persisters	Broader National
3. Interview and ETD Instruments/Documents		
3-A	• APS Structured Interview Protocol Example	Longitudinal
3-B	• APS Engineering Task Protocols and ETD Data Sets	Longitudinal
3-C	• APS Interviewer Manual Example	Longitudinal
3-D	• APS Semi-structured Ethnographic Interview Guide Examples	Longitudinal
3-E	• Workplace Interview Guides: BCC	Workplace
3-F	• Workplace Interview Guide: County-State-Aerospace	Workplace
3-G	• APS Longitudinal Cohort Exit Interview Guides	Longitudinal
4. Survey Instruments		
4-A	• Longitudinal Cohort (PIE) Surveys	Longitudinal
4-B	• Mapping PIE to APPLES	Longitudinal and Broader Core
4-C	• APPLES1 Survey Questions	Broader Core
4-D	• APPLES2 Survey Questions	Broader National
4-E	• Cross-sectional Cohort Survey and Focus Group Questions	Cross-sectional
5. Other		
5-A	• Sample APPLES Response Report	Broader National
5-B	• APS Research Team	

Appendix 1-A
APS File Naming Protocol

Data File Naming

Names of data files within the APS database as proposed here have 6 standard components (plus one optional component) organized in the following order:

1. StudentID: coded per CAEEID
2. MethodType: instrument or method
3. EventID: event_sequence or event_date, or combination
4. ItemID: item_type, item_number and revision_number
5. ResearcherID: name initials
6. (optional) Pseudonym: reference subject's "name"
7. FilenameExtension: document_type

To improve readability and facilitate accurate computer-based parsing, filename components are separated by hyphens. By design, the resultant filename will uniquely identify the context of each data file in the APS database. This filenaming convention would result in filenames that look like

StudentID-MethodType-EventID-ItemID-ResearcherID-Pseudonym. FExt

This document is a work in progress and may be revised to reflect new needs and functions of the APS database. It is important that this proposed filenaming protocol not only meet the immediate needs related to the current study of the Longitudinal Cohort (Cohort 1), but can also be carried forward to integrate data for future APS cohort studies.

StudentID

In the APS database, we must avoid identifying our study's student participants by real names or other recognizable real-world information, in association with collected data. To abstract a participant's identity, we have developed a coding scheme. This CAEE Student ID code uniquely identifies each student participant and can be broken down into 4 parts. It looks something like: "TPub01F00003". The first part, "TPub", is the school's official acronym (i.e., Technical Public Institution). The second part, "01", is the cohort id. The third part, "F", refers to the gender, female. The fourth and final part, "00003", is a sequentially generated number identifier of the student at the indicated school.

For cohort-1, we have TPub, UPri, SPri, and LPub as the 4 possible school acronyms. When expanding the study in cohort-3, and cohort-4, most U.S. schools have unique acronyms. If we should encounter two or more schools with identical acronyms, we can append a lower case letter (a, b, c...) in sequence to differentiate these schools. Internal to the APS database, there is a table that connects this acronym (known as UnivID) to the full name of the school and its related descriptive data (e.g., university's full name, semester/quarter system, etc.).

With this StudentID code displayed in the filename, a researcher can quickly tell at a glance that the data file is associated with a specific student who attends a given school, is of a given gender, and participates as a member of a specific cohort.

If student data were aggregated into container documents by school, the containers' filenames would only include the school acronym and the cohort id (e.g., "TPub01"). No gender and student identifying sequence number would be included.

MethodType

The MethodType component in the filename identifies the data instrument or method being used to collect the data contained in the file. This portion of the filename is typically 3-4 letters long. For our research as planned, the following MethodTypes would be used:

SURV survey data

INTS structured interview data,

INTE ethnographic interview data

INTX exit interview data

INSP problem scoping exercise data within structured/ethno interview session

ETD? engineering thinking and doing data

ACTX academic transcript data

ETH? ethnography data

EventID

The EventID is used to identify the particular instance of the data collection event. The EventID, taken together with MethodType, allow us to refer to a specific data set in a sequence, such as Survey 2, or Structured Interview 1. We will use numeric digits such as {1, 2, 3} to specify the EventID.

Ethnographers will typically contribute new files on a regular basis throughout the year. It may be more appropriate for such research methods to use date in lieu of a sequence number to represent the data gathering event. When applied, the date would be formatted as "YYMMDD", so as to facilitate chronological sorting. This date information should not substitute for the inclusion of more detailed date information inside the file document itself.

ItemID

The ItemID is used to identify one or more data items collected together within the context of a single data collection event. It is composed of three parts, in order:

1. DataType,
2. ItemNumber, and
3. RevisionNumber.

For example, in the course of structured interview #1, we may produce one audio recording file, one interview notes document, and 2 PDF scan files. In this scenario, we would have 4 files with

MethodType = INTS
EventID=1

and the following distinguishing ItemIDs

ItemID=A1_1 (Audio File)
ItemID=N1_1 (Notes File)
ItemID=S1_1 (Scan File #1)
ItemID=S2_1 (Scan File #2)

If after review, the notes file with ItemID=N1_1was revised and resubmitted to the database, the revised file would take on ItemID=N1_2.

At the current time, the following DataType codes are proposed:
A audio recordings
V video recordings
N notes (field notes, interview notes)
T text transcriptions
R transcript revision requests
E MS Excel data
X tab delimited columnar data
C comma delimited data
H Survey rendered from HTML
S SPSS data analysis
P digital photos
Z scanned paper documents

ResearcherID

The ResearcherID identifies the researcher who is primarily responsible for collecting the data in the file. The researcher's initials (in all capital letters) will be used. If we should encounter a situation in which a new researcher has initials identical to an existing researcher, we would append a number to the new researcher's initials for the ResearcherID. For example, if we have a researcher Gwendelyn Talbot and we add a new researcher Greg Taylor, Gwendelyn Talbot would have ResearcherID "GT" and Greg Taylor would be assigned "GT1".

Pseudonym

Ethnographers will typically contribute new files on a regular basis throughout the year. In such cases, the CAEE student ID may be hard to write and refer to in discussion. The student pseudonym, appended to the root part of the document name and also recorded in the APS database, would be the identifier that ethnography researchers would use to refer to the student subject.

Student pseudonyms would be created by the research teams at each university, and may be something like "Lego1". Each pseudonym is unique within the subject group at each school; it is not permitted to have another "Lego1" within that school's subject group. However, it is entirely acceptable to have "Lego1" at another school. This way, researchers have full autonomy and flexibility to choose pseudonyms without fear of conflicts with those chosen by researchers at other universities.

Pseudonym, this filename component, is optional and is not likely used outside of ethnography documents.

FilenameExtension

We use familiar filename extensions to identify their respective applications and data types. The following example filename extensions would be used with associated applications:

.rtf Microsoft Word, Mac TextEdit

.doc Microsoft Word

.dot Microsoft Word (Template)

.xls Microsoft Excel (spreadsheet)

.csv Microsoft Excel (comma separated values)

.sav SPSS data file

.sps SPSS variable definitions/label file

.dss Olympus Audio Recorder/Player

.pdf Adobe Acrobat Reader, Mac Preview

.txt Microsoft Notepad, Mac TextEdit

.zip WinZip, Windows Explorer (XP), Stuffit Expander

.jpg Internet Explorer, Netscape, Mozilla, Safari

.tif (tagged image format)

Appendix 1-B
APS Data Access Guidelines

Researchers will be able to access data needed for their research through the APS database. However, it is important that we, as APS researchers–individually and as a community, handle APS data responsibly.

This data access guideline is intended to facilitate adherence to IRB research procedures and obligations. **The goal is to minimize the likelihood for accidental data sharing with those for whom such data access may violate conflicts of interests, IRB approved research protocols, and privacy laws.** Toward this end, the procedures presented here are designed to help researchers identify the data type, recognize data handling risks, and acknowledge responsibilities.

1 Data Types

Some APS data sets are more sensitive than others. To help us differentiate, we can classify our APS data sets as 3 different types: raw, anonymized, or aggregated.

> **Raw** data describes individual student attributes or performance in a way that allows a researcher to identify individual students -- by voice, by appearance (picture), by name, by a standardized identifier used in the study (CAEE_ID), or any other similar means. Thus, data files that include the student's CAEE_ID in its filename must also be considered raw. *Raw data is highly sensitive.* It must be carefully secured at all times, and should not be shared with anyone unnecessarily. Typically, only those researchers involved in the specific data collection process would need access to the respective raw data set.
>
> **Anonymized** data can be prepared from raw data by either stripping all student identifiers, or replacing identifiers with newly created codes which would be unknown to any other researcher. Using a private set of pseudonyms is one way of anonymizing student data. While real student identities cannot be traced, data of individual students can be collected and tracked. Thus, *anonymized data is moderately sensitive.*
>
> **Aggregated** data is prepared by grouping, processing, categorizing data of multiple students statistically, numerically, or descriptively. In such case, no individual students are distinguishable or identifiable. With any reasonably large grouping, aggregated data is descriptive of its constituent population. No individual student information can be extracted. Thus, *aggregated data is the least sensitive*.

2 Risks and Responsibilities

Prerequisite: all researchers that have (or are expected to have) contact with the study's subjects and/or their data must first complete human subjects research (IRB) training.

Researchers are individually responsible for continuously reviewing their own risks and concerns, when accessing and handling APS data. To avoid accidentally exposing information to an inappropriate recipient, individual researchers should make their own sets of recognized risks known to others. For example, if researcher_X should not receive information_Y because of a particular conflict of interest risk, researcher_Z who has information_Y should be alerted. In this way, APS researchers share responsibility to alert one another.

3 Research Data Access Requests by Category of Researcher:

A data sharing arrangement for the duration of the active grant was developed near the start of the project and is described in general for the three researcher categories below. Any deviation from these data sharing arrangements could occur with permission from the project leads and subsequent final approval from APS lead, Sheri Sheppard. Data sharing following the end of the grant period is outlined in section 5 Data Academic Pathways Study Data Sharing Agreement below.

Category 1. APS School Researcher: School PI approved
Each school PI would enable access to APS researchers at their own campus to their school's data. It would be up to this PI to decide what types (e.g., method, and raw/anonymized, aggregated) each of his/her researchers should have access to, and to ensure that each researcher has completed human subjects training and has been apprised in the APS risks and responsibility statement. New campus researchers would be added by the PI, as needed.

• LONGTERM APPROACH: PIs would enable access for each researcher via a web form. This form would automatically enable access and would post the status of the researcher's access privileges on the database (so that everyone knows of everyone else's access).

• SHORTTERM APPROACH: until the web form is up and active, PIs should send a list of their campus researchers to the database manager.

Category 2. APS Method Researcher: Method lead compiled, Cognizant APS Lead Reviewed.
Each method lead (ethnography, surveys, structured interviews, performance task, academic transcripts, and Cohort 2) would provide cognizant APS Lead PI with a list of researchers who should have access to data associated with a particular method across ALL schools for the purpose of cross-campus analysis on a single method. In general these will be a list of researchers who have responsibility for single-method analysis at all institutions and who are working closely with the method lead. Cognizant APS Lead PI would then enable access to APS researchers to that data type. It would be up to this PI to decide what types (e.g., method, and raw/anonymized, aggregated) each of his/her researchers should have access to, and to ensure that each researcher has completed human subjects training and has been apprised in the APS risks and responsibility statement. New cross-campus researchers would be added by the cognizant APS Lead PI, as needed.

• LONGTERM APPROACH: Cognizant APS Lead PIs would enable access for each researcher via a web form. This form would automatically enable access and would post the status researcher's access privileges on the database (so that everyone knows of everyone else's access).

• SHORTTERM APPROACH: until the web form is up and active, PIs should send a list of their campus researchers to the database manager.

Category 3. APS Researcher.
APS researcher who wants data across all four campuses for the purposes of multi-method and/or multi-institution APS analysis, submits a web form to the APS Lead team. The form would ask that the researcher briefly describe the research question that they are pursuing, how it relates to core APS research questions, and what type of analysis they are undertaking. This form is reviewed on one of the monthly/bi-monthly APS Lead calls. If urgent, the review could happen via email (championed by the campus APS lead). Each school has the right to veto access to his/her school's data. Approved Category 3 web form is then forwarded to database manager who enables access (if there is way to automate this enabling, we will).

4 Recommended Data Handling Guidelines

1. Whenever possible, data should be transferred via the APS database.
2. Unencrypted data should NOT be transferred via unsecured mail or email.
   Sending data via secure mail or email guarantees that only the intended recipient is able to receive and read the contents of the delivered package. For email, this typically means applying digital key encryption and digital signatures on the data package before sending. For mail, this may mean physically locking the package in such a way so that an unintended recipient would be prevented from opening it.
3. All computers and media containing APS data must be carefully secured and protected from compromise by hackers/virus/spyware/Trojan horse programs/network attacks.
4. Here are a few things to review:
   - is your computer secured from theft?
   - is your computer used or accessible by other people?
   - is your computer data files accessible by other users?
   - is your computer ever connected to a network?
   - is your computer protected by a hardware or software network firewall?
   - does your computer run a virus checker with daily or weekly updates?
   - is your computer running a “malware” checker with daily or weekly updates?
   - are your data files being backed up?
   - are your backups protected from theft?
   - are your backups accessible by other people?
5. In general, researchers should avoid sharing any raw APS data, student contact information and even names of students’ participation in the study. For example, in cases with faculty researchers, knowledge of study participant’s identities may pose a conflict of interest, or a potential conflict of interest in future years of the study. These represent undesirable outcomes. Therefore, assume APS raw data, student participation or contact information is not sharable. Such information should not be shared publicly, or shared in an insecure forum.

5 Academic Pathways Study Data Sharing Agreement

This agreement establishes the policy to address data sharing among the Academic Pathways Study leads during the concluding phase of the grant (beginning with the initial distribution of CD#1 in early 2009) and continuing after the grant ends (September 30, 2009).

1) The APS Core Data set consists of a 4-box CD set:
    CD#1 (Cohort 1) (late 2008/early 2009)
    CD#2 (Cohort 2) (3rd quarter 2009)
    CD#3 (Cohort 3) (first quarter 2009)
    CD#4 (Cohort 4) (2nd quarter 2009)

Each APS co-PI from the four primary schools receives a 4-box CD set of Core APS data. In addition, the APS co-PI from the remaining school receives CD#2 and CD#4.

2) When a new topic/question is being explored with the Core APS data that involves cross-school data, email notification to the APS co-PI team is required. If the topic/question is to be explored using only data from the cognizant APS Lead's school, notification is recommended.

3) Any publications coming out of said research to have an APS co-PI as a co-author. In addition, any and all references to schools should be via the established pseudonyms.

4) Any research using this core data needs to be under the supervision of one of the APS co-PIs. The supervising APS co-PI is responsible for ensuring that proper IRB approval and training have been obtained for all associated researchers.

5) Secondary data (e.g., Cohort 1', NSSE) to be held by cognizant APS co-PI, and requests to use that data to be sent to that APS co-PI.

6) Any publications coming out of said research should include a statement acknowledging NSF Grant No. ESI-0227558.

Supplement A:
Research Data Access (RDA) Request Form (Category 3)

What:

Data Set ID: (see Appendix B) (data_type + school(s) + collection_event_date) [highlight in table]	[*Survey* | *Structured_Interview* | *Performance_Task* | *Exit_Interview* | *Ethnographic_Interview* | *Academic_Record* | [Cohort 2 Interviews…] [*school identifier*] [*Event_ID*] NOTE: Data Set ID would have format similar to APS data filenaming convention.
Data Classification:	[*Raw* | *Anonymized* | *Aggregated*]

Who:

Researcher Name:	

Researcher Institution:	
Researcher Role(s) (relative to data set):	[*APS Data Owner* | *Campus Data Owner* | *APS_ Researcher* | *CAEE_Researcher*]
Affiliated CAEE PI (if different than researcher)	
Has researcher completed IRB training?	(circle one) YES NO

Duration:

Date when data set access will end:	

Benefits:

Briefly describe analysis plan for use of data set:
Briefly explain expected outcome of analysis, why data access is beneficial or required:

Risks:

Identify potential risks associated with researcher's data access and describe how these are (or will be addressed):
Identify persons who should not see data set(s), and why, if any:

Expected Outcomes:

What type of analysis results can or will be made available to others? Analysis results data file format (i.e. software applications used)? Data type of results: raw, anonymized, or aggregated?

Appendix 1-C
APS Persistence Definitions (Longitudinal Cohort /Cohort 1)

Date: 17 September 2007

ACADEMIC PERSISTENCE AND NON-PERSISTENCE

Persistence = Declared an engineering major
Non-persistence = Declared a non-engineering major after having intent to study engineering at admission to university

Guidelines for determining persistence from APS Longitudinal Cohort (Cohort 1) data

(1) Majors are determined to be engineering or non-engineering on a school-by-school basis. If the subject chooses a major within the school of engineering at his/her institution after having the intent to study engineering at admission, the student is considered a "persister". (Therefore some majors, such as computer science, may be considered an engineering major at some institutions and not others).
(2) A students persistence status is determined when s/he formally declares her/his major. (The major must be reflected in the academic record, i.e., stating an intent to declare a specific major in an APS interview will not change their persistence status.)
(3) For subjects who are not listed as persisters or non-persisters, we do not have enough information to classify them. (For example, the subject may have dropped out of the study and researchers are unable to track him/her down - or the subject has not yet formally declared a major.)
(4) Subjects with double (or more) majors of which (at least) one is an engineering major, are classified as persisters.
(5) Persistence status should be considered subject to change:
    a. Persistence status is periodically revisited (~twice a year). (I reanalyze previous classifications to update persistence status, for example, there are still subjects declaring non-engineering majors - and we've had one subject declare an engineering major after having declared a non-engineering major).
    b. Persistence status will be finalized once transcript analyses are completed.

Note: In the Longitudinal Cohort, we have one exception who is a CS major (CS is not considered engineering at one APS partner institution) - this student was recruited as a CS student and has remained a CS student. He was initially considered a persister, but as of August 2007 will be excluded from persistence analysis.

MIGRATOR

Student who initially did not intend to study engineering at admission to university, but later declared an engineering major. Please see: K.M. Donaldson, S.D. Sheppard (2007), Exploring the Not-So-Talked-About Undergraduate Pathway: Migrating Into Engineering. Paper presented at the 2007 International Conference on Research in Engineering Education, Honolulu, Hawaii, June 23-24, 2007.

DROPPED OUT

Longitudinal Cohort subject who left the university they were attending during the APS study

EXIT

When a Longitudinal Cohort subject declares a non-engineering major (same as non-persister). Not all “exited” students had exit interviews. (For people who are no longer a part of the study, please say they “left the study.”)

EXIT INTERVIEW

A special semi-structured interview given to Longitudinal Cohort subjects who formally declared a non-engineering major (or exited engineering).

FULL DATA

Full data refers to subject data sets that are complete for their contact grouping, e.g., the low contact group has a full data set for 24 subjects at Orchard University (24 Orchard subjects participated in all of the surveys and APS has all of their transcripts).

INCOMPLETE DATA

Incomplete data refers to a subject data set that is not complete, e.g., a Longitudinal Cohort subject took five (out of a total six) surveys.

LEFT THE STUDY

Used to describe Longitudinal Cohort subjects who left APS before the study ended – therefore they have an incomplete data set (e.g., they took three surveys and then no longer took part in the study). We do not characterize these students.

PROFESSIONAL PERSISTENCE

Subject intends to work in engineering for three years following graduation with their undergraduate degree.

RETURNED

Returned refers to a Longitudinal Cohort subject who exited engineering and then returned to engineering, i.e., declared a non-engineering major and then changed majors to an engineering major.

UNKNOWN

Refers to Longitudinal Cohort subjects whose persistence status(es) are unknown based on conversations with researchers at the associated Longitudinal Cohort institutions.

Appendix 1-D
APS Representative Examples of Informed Consent Forms

Technical Public Institution (administered by Urban Private University)

Urban Private University

Suburban Private University

Large Public University

Note: Informed Consent forms for Urban Private University and Technical Public Institution used the same text with the exception of the school name and other school-specific details.

TECHNICAL PUBLIC INSTITUTION[1] PARTICIPANT CONSENT FOR INVESTIGATIVE PROCEDURES URBAN PRIVATE UNIVERSITY

The following instruments, interviews, or procedures are needed for the research project entitled, "Scholarship on Learning Engineering Project."

Instruments, Interviews, or Procedures to be Employed

A. Surveys will be administered to participants in the observational group to ascertain information about students' perceptions, experiences and motivations as an undergraduate engineering student.
B. Individual interviews will be administered to participants in the observational group to obtain a deeper understanding of students' perceptions, expectations, motivations, practices, and experiences in engineering.
C. Ethnographies will be conducted on some participants in the observational group in order to obtain a general impression of undergraduate engineering student life.
D. Student academic and admission records will be obtained for participants in the observational group.
E. Student academic and admission records will be obtained for participants in the control group.

Explanation to Participants

You are invited to participate in a national research study funded by the National Science Foundation (NSF). The purpose of this study is to gain an in-depth understanding of how engineering students explore and utilize the educational opportunities available to them in college, plan and carry out their curriculums (successfully or unsuccessfully), and navigate the process of becoming engineers. The study will take place over a period of three years, between Fall 2003 and Spring 2006. You will not need to do any more or less work in your classes because you have agreed to participate in this study. Nor will you be asked to perform differently than you would if you did not participate in this study. As discussed in the information meeting, a combination of the following methods will be used in the study to capture different aspects of your experience as an engineering student. These methods and procedures are as follows:

You will be asked to:

1) Complete two 2-hour Internet-based questionnaires in which you will be requested to provide some information about your experiences and motivations as an undergraduate engineering student.
2) Participate in a 2-hour interview per year in which a trained observer will ask of you standardized questions regarding your experiences and motivations as an undergraduate

[1] Informed consent for Technical Public Institution (TPub) was administered by Urban Private University because TPub does not have its own IRB office.

engineering student. These interviews will be audio taped. The audiotapes will be destroyed five years after the study is completed.

3) Participate in a series of non-intrusive observations in which a trained observer will accompany you for no more than 2 hours a week in various academic (e.g., lectures, study groups) and as well as non-academic settings (e.g., dormitory, extracurricular activity settings) in order to obtain a general impression of undergraduate engineering student life. Observations will be recorded in field notes and through the occasional use of digital photography, audiotape, and videotape. Photos and videos taken of the activity being conducted will feature only the individual's body and not his or her face. The digital photography, audiotapes, and videotapes will be destroyed five years after the study is completed.
4) Authorize access to your academic information maintained by the university registrar, such as SAT scores, high school GPA, college transcripts, gender, and ethnicity. This information will be kept in strictest confidence and will only be used for research purposes.

There is some risk associated with all research. However, the risks to you are no greater than would be expected from participation in any educational research activity. The potential risks are the inappropriate use of the information that is collected and uneasiness from participation in the interview and observation processes. To protect against these potential risks, the research personnel have signed a confidentiality agreement that limits access and use of all study data. Moreover, the trained interviewers and observers will take extra precaution to ensure that you are as comfortable as possible.

There are a number of benefits for participating in this study. The study seeks to identify and characterize the pathways for making the choice of becoming an engineer. You will have an opportunity to contribute your experiences in this process. This understanding will enable the engineering community to pinpoint and clearly define areas in engineering education, where additional work is needed for improvement.

You will be compensated in cash for participating in this study. Legally, you are only eligible for compensation if you are a U.S. citizen, a legal resident alien (i.e., possess a "green" card), or have a work eligible visa sponsored by the paying institution. The amount of compensation will depend on your level of participation. There will be two groups of participants: an observational group and a control group. Observational group participants will be compensated $175.00 per year for participating in a combination of survey, interview, and observation methods. Observational group participants will also be given a scientific calculator during the spring semester of the first year. Control group participants will be compensated $25.00 per year for authorizing access to student admission and registrar records. Annual payments will be made at the end of spring semester upon continuous participation for that school year. There will be an equal number of participants in each group. However, if you chose to participate, it is not possible to know which group you will be assigned to before the researchers have obtained consent from all potential participants.

All information we gather on this project will remain strictly anonymous and will not identify you in any way. The interview sessions will be audio taped, and the ethnographic sessions will be audio taped, photographed, and videotaped so that we can review them later. However, all identifying information will be removed and replaced by code numbers. Participant codes will be kept in a logbook, which will be stored in a locked file cabinet separate from the actual data information. We will keep all materials in a secure place in our university office. Information will be reported based on group profiles and averages, and not on individual responses. At no time will information be reported or identified with the participant's name, guaranteeing that the privacy of all participants will be protected. All information that we gather will be destroyed by December 2012.

Your participation in this project is completely voluntary, so you can stop taking part at any time without jeopardizing your relationship with the university institution, engineering department, project researchers, or related staff.

Participant's Statement of Understanding

I may be asked to participate in several activities throughout the school year, such as surveys, interviews, and observations, as well as authorize access to my academic admission and registrar records for research purposes only.

Some of the tests or procedures described may be novel or experimental, but they do not involve any risk(s) other than those described above. In the event of physical or other injury resulting from the research tests or procedures, emergency medical treatment will be provided, but financial compensation will not be available.

With this knowledge and the above description of the project, I voluntarily agree to take part, accepting the risk(s) of my participation in this project. I further understand that all reasonable precautions have and will be taken to reduce the risks(s) and to provide for my care.

I am aware that I am free to withdraw this consent and discontinue participation in this project at any time without affecting either my ability to receive on-going care or my relationship with Technical Public Institution or Urban Private University.

The Principal Investigator or Project Researcher, at Technical Public Institution may be contacted at [phone #] in the event that I have any questions regarding my participation in this project. The Urban Private University Institutional Review Board will have access to the records of this project. If I have questions regarding my rights as a study participant that I would like to discuss with someone other than the investigators on this project, I am free to contact the Office of Executive Secretary, Urban Private University Institutional Review Board at [phone #].

The study described above has been explained to me. My willingness to participate is indicated below. (Please check appropriate box.)

☐ **I do not wish to participate in this activity. In order for us to ensure that you will not be contacted again, please provide your name here: ______________________**
(Please do not read any further. Thank you for your time and consideration.)

☐ **I voluntarily consent to participate in this activity. I have had an opportunity to ask questions. I give permission for the study team to use my responses in research. (Please proceed to the following sections).**

I give consent to be interviewed during this study. (Please initial):__ Yes____ _ No

I give consent for my interview to be audio taped. (Please initial):___ Yes_____ No

I give consent for the responses I provide during the interviews and surveys to be used for research purposes in this study. (Please initial): ______Yes ______ No

I give consent to be observed during this study. (Please initial): ____Yes____ No

I give consent for my observation to be audio taped, photographed, and videotaped. I understand that my face will not be shown in any photograph or videotape. (Please initial): ____Yes_____ No

I give consent for my photographed, and videotaped observation to be used during presentations concerning the research, such as at a professional conference. (Please initial): ____Yes_____ No

I give consent for my academic records to be used for research purposes in this study.

(Please initial): ___Yes _____ No

I have read the above description of the research project. A member of the research team has answered all of my questions to my satisfaction. I agree to participate in the above-referenced project. I acknowledge that I have received a personal copy of this consent form.

Participant's Signature ______________________________________ Date __________

I, the undersigned, have defined and fully explained the tests and procedures involved in this study to the above participant.
Researcher's Signature ______________________________________ Date __________

Witness' Signature ____ Date __________

URBAN PRIVATE UNIVERSITY PARTICIPANT CONSENT FOR INVESTIGATIVE PROCEDURES
URBAN PRIVATE UNIVERSITY

The following instruments, interviews, or procedures are needed for the research project entitled, “Scholarship on Learning Engineering Project.”

Instruments, Interviews, or Procedures to be Employed

A. Surveys will be administered to participants in the observational group to ascertain information about students’ perceptions, experiences and motivations as an undergraduate engineering student.
B. Individual interviews will be administered to participants in the observational group to obtain a deeper understanding of students’ perceptions, expectations, motivations, practices, and experiences in engineering.
C. Ethnographies will be conducted on some participants in the observational group in order to obtain a general impression of undergraduate engineering student life.
D. Student academic and admission records will be obtained for participants in the observational group.
E. Student academic and admission records will be obtained for participants in the control group.

Explanation to Participants

You are invited to participate in a national research study funded by the National Science Foundation (NSF). The purpose of this study is to gain an in-depth understanding of how engineering students explore and utilize the educational opportunities available to them in college, plan and carry out their curriculums (successfully or unsuccessfully), and navigate the process of becoming engineers. The study will take place over a period of three years, between Fall 2003 and Spring 2006. You will not need to do any more or less work in your classes because you have agreed to participate in this study. Nor will you be asked to perform differently than you would if you did not participate in this study. As discussed in the information meeting, a combination of the following methods will be used in the study to capture different aspects of your experience as an engineering student. These methods and procedures are as follows:

You will be asked to:

1) Complete two 2-hour Internet-based questionnaires in which you will be requested to provide some information about your experiences and motivations as an undergraduate engineering student.

2) Participate in a 2-hour interview per year in which a trained observer will ask of you standardized questions regarding your experiences and motivations as an undergraduate engineering student. These interviews will be audio taped.

3) Participate in a series of non-intrusive observations in which a trained observer will accompany you for no more than 2 hours a week in various academic (e.g., lectures, study groups) and as well as non-academic settings (e.g., dormitory, extracurricular activity settings) in order to obtain a general impression of undergraduate engineering student life. Observations will be recorded in field notes and through the occasional use of digital photography, audiotape, and videotape. Photos and videos taken of the activity being conducted will feature only the individual's body and not his or her face.

4) Authorize access to your academic information maintained by the university registrar, such as SAT scores, high school GPA, college transcripts, gender, and ethnicity. This information will be kept in strictest confidence and will only be used for research purposes.

There is some risk associated with all research. However, the risks to you are no greater than would be expected from participation in any educational research activity. The potential risks are the inappropriate use of the information that is collected and uneasiness from participation in the interview and observation processes. To protect against these potential risks, the research personnel have signed a confidentiality agreement that limits access and use of all study data. Moreover, the trained interviewers and observers will take extra precaution to ensure that you are as comfortable as possible.

There are a number of benefits for participating in this study. The study seeks to identify and characterize the pathways for making the choice of becoming an engineer. You will have an opportunity to contribute your experiences in this process. This understanding will enable the engineering community to pinpoint and clearly define areas in engineering education, where additional work is needed for improvement.

You will be compensated in check for participating in this study. Legally, you are only eligible for compensation if you are a U.S. citizen, a legal resident alien (i.e., possess a "green" card), or have a work eligible visa sponsored by the paying institution. There will be one group of participants: an observational group. Observational group participants will be compensated $175.00 per year for participating in a combination of survey, interview, observation methods, and review of academic information. Annual payments will be made at the end of spring semester upon continuous participation in surveys and interviews for that school year.

All information we gather on this project will remain strictly anonymous and will not identify you in any way. The interview sessions will be audio taped, and the ethnographic sessions will be audio taped, photographed, and videotaped so that we can review them later. However, all identifying information will be removed and replaced by code numbers. Participant codes will be kept in a logbook, which will be stored in a locked file cabinet separate from the actual data information. We will keep all materials in a secure place in our university office. (All encryption documents relating your randomly generated ID codes to your identity will be destroyed by December 2012. Data files will be archived until they are no longer needed.) At no time will information be reported or identified with the participant's name, guaranteeing that the privacy of all participants will be protected.

Your participation in this project is completely voluntary, so you can stop taking part at any time without jeopardizing your relationship with the university institution, engineering department, project researchers, or related staff.

Participant's Statement of Understanding

I may be asked to participate in several activities throughout the school year, such as surveys, interviews, and observations, as well as authorize access to my academic admission and registrar records for research purposes only.

Some of the tests or procedures described may be novel or experimental, but they do not involve any risk(s) other than those described above. In the event of physical or other injury resulting from the research tests or procedures, emergency medical treatment will be provided, but financial compensation will not be available.

With this knowledge and the above description of the project, I voluntarily agree to take part, accepting the risk(s) of my participation in this project. I further understand that all reasonable precautions have and will be taken to reduce the risks(s) and to provide for my care.

I am aware that I am free to withdraw this consent and discontinue participation in this project at any time without affecting either my ability to receive on-going care or my relationship with Urban Private University.

The Principal Investigator or Project Researcher, may be contacted at [phone #] in the event that I have any questions regarding my participation in this project. The Urban Private University Institutional Review Board will have access to the records of this project. If I have questions regarding my rights as a study participant that I would like to discuss with someone other than the investigators on this project, I am free to contact the Office of Executive Secretary, Urban Private University Institutional Review Board at [phone #].

The study described above has been explained to me. My willingness to participate is indicated below. (Please check appropriate box.)

☐ **I do not wish to participate in this activity. In order for us to ensure that you will not be contacted again, please provide your name here: ______________________ (Please do not read any further. Thank you for your time and consideration.)**

☐ **I voluntarily consent to participate in this activity. I have had an opportunity to ask questions. I give permission for the study team to use my responses in research. (Please proceed to the following sections).**

I give consent to be interviewed during this study. (Please initial):__ Yes____ _ No

I give consent for my interview to be audio taped. (Please initial):___ Yes_____ No

I give consent for the responses I provide during the interviews and surveys to be used for research purposes in this study. (Please initial): ______Yes ______ No
I give consent to be observed during this study. (Please initial): ____Yes____ No

I give consent for my observation to be audio taped, photographed, and videotaped. I understand that my face will not be shown in any photograph or videotape. (Please initial): ____Yes____No

I give consent for my photographed, and videotaped observation to be used during presentations concerning the research, such as at a professional conference. (Please initial): ____Yes_____No
I give consent for my academic records to be used for research purposes in this study.

(Please initial): ___Yes _____ No

I have read the above description of the research project. A member of the research team has answered all of my questions to my satisfaction. I agree to participate in the above-referenced project. I acknowledge that I have received a personal copy of this consent form.

Participant's Name (Print)________________________________

Participant's Signature ____________________________________ Date __________

I, the undersigned, have defined and fully explained the tests and procedures involved in this study to the above participant.

Researcher's Signature _____________________________________ Date __________

Witness' Signature ____ Date __________

NSF Center for the Advancement of Engineering Education

CONSENT FORM: Longitudinal Study

FOR QUESTIONS ABOUT THE STUDY, CONTACT: Project Researcher at Suburban Private University [contact information].

DESCRIPTION:

You are invited to participate in a national research study funded the National Science Foundation (NSF), which aims to gain an in-depth understanding of how engineering students explore the educational opportunities available to them in college, plan and carry out their curriculums (successfully or unsuccessfully), and become engineers. The study will take place between Fall 2003 and Spring 2006. You will not need to do any more or less work in your classes because you have agreed to participate in this study, nor will you be asked to perform differently than you would if you did not participate. As discussed in the information meeting, a combination of the following methods will be used in the study to capture different aspects of your experience as a student who is planning to major in engineering:

1) One 2 hour interview per year, in which a trained observer will ask of you standardized questions regarding your experiences and motivations as an undergraduate pre-engineering student. The interviews will be audiotaped.
2) Two 2 hour internet-based questionnaires, where you will be requested to provide some information about your experiences and motivations as an undergraduate pre-engineering student.
3) A series of non-intrusive observations in which a trained researcher will accompany you for no more than 2 hours a week in various academic (e.g., lectures, study groups) and as well as non-academic settings (e.g., dormitory, extracurricular activity settings) in order to obtain a general impression of undergraduate pre-engineering student life. The researcher will take notes and occasional photographs in order to document his/her observations, and might ask informal questions.
4) Access to your academic information maintained by the university registrar such as your SAT scores, high school GPA, college transcripts, gender, and ethnicity. This information will be kept in strictest confidence and will only be used for research purposes.

All information collected will be kept confidential, and accessed only by authorized researchers who have signed a confidentiality agreement. To better preserve your privacy, a random identification code will be used in place of your name during the study. This is the same code that will be used in the interviews and questionnaires you have been asked to participate in.

RISKS :

The potential risk is the inappropriate use of the information that is collected. To guard against this, the research personnel have signed a confidentiality agreement that limits access and use of data. (All encryption documents relating your randomly generated ID codes to your identity will be destroyed by December 2012. Data files will be archived until they are no longer needed.) Also, some people feel self-conscious when they are observed for the purposes of a study.

BENEFITS:

The study seeks to identify and characterize the pathways for making the choice of becoming an engineer. This understanding will enable the engineering community to pinpoint and clearly define areas in engineering education, where additional work is needed for improvement.

PAYMENTS:

You will be compensated in cash. Legally, you can be paid only if you are a US citizen, a legal resident alien (i.e, possess a "green" card), or have a work eligible visa sponsored by the paying institution. The amount of compensation will depend on your level of participation. There will be two groups of participants: a detailed study group, and a control group. Detailed study participants will be observed through a combination of any of the four methods described in the “description” section of this form, and compensated $175 per year. **Detailed group participants will also be given a scientific calculator during the winter quarter of the first year.** Control study participants will be observed through the fourth method only, and compensated $25 per year. Annual payments will be made at the end of spring quarter upon continuous participation for that school year. There will be an equal number of participants in each group. However, if you chose to participate, it is not possible to know which group you will be in before the researchers obtain consent from all interested students.

SUBJECT’S RIGHTS:

If you have read this form and have decided to participate in this project, please understand that your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. You have the right to refuse to participate in studies involving a particular method. You also have the right to refuse to answer particular questions. Your individual privacy will be maintained in all published and written information resulting from the study.

If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact - anonymously, if you wish - the Institutional Review Board, Suburban Private University [contact information].

The study described above has been explained to me. My willingness to participate is indicated below. (Please check appropriate box.)

☐ I do not wish to participate. I do not wish to participate in this activity. In order for us to ensure that you will not be contacted again, please provide your name here: ______________________ (Please do not read any further. Thank you for your time and consideration.)

☐ I wish to participate. I voluntarily consent to participate in this activity. I have had an opportunity to ask questions. I give permission for the study team to use my responses in research. (Please proceed to the following sections).

I give consent to be interviewed and audiotaped during this study.(Please initial): _____Yes _____ No

I give consent for the responses I provide during the interviews and surveys, and the photographs taken during the observations to be used for research purposes in this study. (Please initial): ____Yes ____ No

I give consent to be observed and photographed during this study. (Please initial): _____Yes _____ No

I give consent for my academic records to be used for research purposes in this study.

(Please initial): _____Yes _____ No

I have read the above and give my consent to participate in this study.

NAME ________________________________ STUDENT ID# ______________

SIGNATURE ________________________________ DATE ______________

The extra copy of this consent form is for you to keep.
Approval Date: 9/26/2003
Expiration Date: 5/29/2004

NSF Center for the Advancement of Engineering Education

CONSENT FORM: Longitudinal Study

FOR QUESTIONS ABOUT THE STUDY, CONTACT: Project Researcher at Suburban Private University [contact information].

DESCRIPTION:

You are invited to participate in a national research study funded the National Science Foundation (NSF), which aims to gain an in-depth understanding of how engineering students explore the educational opportunities available to them in college, plan and carry out their curriculums (successfully or unsuccessfully), and become engineers. The study will take place between Fall 2003 and Spring 2007. You will not need to do any more or less work in your classes because you have agreed to participate in this study, nor will you be asked to perform differently than you would if you did not participate. As discussed in the information meeting, a combination of the following methods will be used in the study to capture different aspects of your experience as a student who is planning to major in engineering:

1) Interviews in which a trained observer will ask you standardized questions regarding your experiences and motivations as an undergraduate pre-engineering student. The interviews will be audiotaped.

2) Internet-based questionnaires where you will be requested to provide some information about your experiences and motivations as an undergraduate pre-engineering student.

3) A series of non-intrusive observations in which a trained researcher will accompany you for no more than 2 hours a week in various academic (e.g., lectures, study groups) and as well as nonacademic settings (e.g., dormitory, extracurricular activity settings) in order to obtain a general impression of undergraduate pre-engineering student life. The researcher will take notes, and if you permit, occasional photographs, in order to document his/her observations. The researcher might ask informal questions, which will be audiotaped if you agree.

4) Access to your academic information maintained by the university registrar such as your SAT scores, high school GPA, college transcripts, gender, and ethnicity. This information will be kept in strictest confidence and will only be used for research purposes.

All information collected will be kept confidential, and accessed only by authorized researchers who have signed a confidentiality agreement. To better preserve your privacy, a random identification code will be used in place of your name during the study. This is the same code that will be used in the interviews and questionnaires you have been asked to participate in. All documents that can be used to decrypt your identification code will be destroyed by 2012. The original data files (any audiotapes, survey responses, photographs) will be archived until the Faculty Investigator decides that they are no longer needed.

RISKS :

The potential risk is the inappropriate use of the information that is collected. To guard against this, the research personnel have signed a confidentiality agreement that limits access and use of data. (All encryption documents relating your randomly generated ID codes to your identity will be destroyed by December 2012. Data files will be archived until they are no longer needed.) Also, some people feel self-conscious when they are observed for the purposes of a study.

BENEFITS:

The study seeks to identify and characterize the pathways for making the choice of becoming an engineer. This understanding will enable the engineering community to pinpoint and clearly define areas in engineering education, where additional work is needed for improvement.

PAYMENTS:

You will be compensated by check. Legally, you can be paid only if you are a US citizen, a legal resident alien (i.e., possess a "green" card), or have a work eligible visa sponsored by the paying institution. The amount of compensation will depend on your level of participation. Participants will be observed through a combination of any of the four methods described in the "description" section of this form, and compensated $175 per year. Annual payments will be made at the end of spring quarter upon continuous participation for that school year. There will be an equal number of participants in each group. However, if you chose to participate, it is not possible to know which group you will be in before the researchers obtain consent from all interested students.

SUBJECT'S RIGHTS:
If you have read this form and have decided to participate in this project, please understand that your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. You have the right to refuse to participate in studies involving a particular method. You also have the right to refuse to answer particular questions. Your individual privacy will be maintained in all published and written information resulting from the study.
If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact - anonymously, if you wish - the Institutional Review Board, Suburban Private University [contact information].

The study described above has been explained to me. My willingness to participate is indicated below. (Please check appropriate box.)
I do not wish to participate. I do not wish to participate in this activity. In order for us to ensure that you will not be contacted again, please provide your name here: ______________________
(Please do not read any further. Thank you for your time and consideration.)
I wish to participate. I voluntarily consent to participate in this activity. I have had an opportunity to ask questions. I give permission for the study team to use my responses in research. (Please proceed to the following sections).
I give consent to be interviewed during this study.(Please initial): _____Yes _____ No
I give consent to be audiotaped during this study.(Please initial): _____Yes _____ No
I give consent to be observed during this study. (Please initial): _____Yes _____ No
I give consent to be photographed during this study. (Please initial): _____Yes _____ No
I give consent for my academic records to be used for research purposes in this study.
(Please initial): _____Yes _____ No
I give consent for the responses I provide during the interviews and surveys, and the photographs taken during the observations to be used for research purposes in this study. (Please initial): ____Yes ____ No
I have read the above and give my consent to participate in this study.
NAME _______________________________ STUDENT ID# _____________
SIGNATURE _______________________________ DATE _____________
The extra copy of this consent form is for you to keep.
Approval Date: 4/28/2006

Expiration Date: 4/28/2007

LARGE PUBLIC UNIVERSITY
GENERAL CONSENT FORM
ACADEMIC PATHWAYS STUDY

[list of investigators with contact information]

INVESTIGATORS' STATEMENT

Purpose and Benefits

We are engaged in an ongoing study to learn more about how engineering students explore the educational opportunities available to them in college, plan and carry out their curricula, and become engineers. We hope that the results of this study will help the engineering education community to improve the design of curriculum and teaching methods in order to help students to succeed in becoming engineers. You might not benefit directly from this study.

Procedures

This research is being conducted by researchers at Large Public University. Part of the data collection for the study involves observation and videotaping of the academic work of undergraduate engineering students. You will not need to do any more or less work in your classes because you have agreed to participate in this study, nor will you be asked to perform differently than you would if you did not participate. We are asking for your consent to collect the following forms of data:

1. Videotape of your participation in today's observational session. These videotapes will be kept by the researchers until December of 2012, to be used for research purposes only.
2. Copies of written work, such as sketches and equations, that you produce or use during this observational session.

All data collected will be kept confidential, and accessed only by authorized researchers who have signed a confidentiality agreement. Your name will not appear in transcriptions of the videotapes. If we publish the results of this study we will not use your name.

You can request that we terminate the recording at any time and for any reason. You also have the option of reviewing the recording, and deleting all or part of it.

We sometimes use recordings to make academic presentations. In the event that we plan to use a video recording of today's session in such a presentation, we will mask your identity by electronic means. These electronic means will eliminate all instances in which non-subjects are directly identifiable. This is possible because we are using digital media to make these recordings, and these media make this masking process relatively easy.

Risks, Stress, or Discomfort

Some people might feel stress or discomfort as a result of the invasive nature of the research procedures.

Some people might feel concerned that confidential information will be used inappropriately. To guard against this, all research personnel have signed a confidentiality agreement that limits access and use of data.

Some people might feel uncomfortable being observed and video recorded for the purposes of a study. We want to reiterate that you can request that we terminate the recording at any time and for any reason, and that you also have the option of reviewing the recording, and deleting all or part of it.

Other information

You must be at least 18 years of age to participate in this research.

Participation in this study is voluntary. At any time during the study you may choose to stop participating. You can ask us to stop videotaping at any time, for any reason. You can ask us to terminate the observation at any time, for any reason. If you decide to stop participating, this will have no adverse effect on your course grades or your standing in school.

If you have read this form and have decided to participate in this project, please understand that your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. You have the right to refuse to participate in studies involving a particular method. Your individual privacy will be maintained in all published and written information resulting from the study.

SUBJECT'S STATEMENT

The study described above has been explained to me. My willingness to participate is indicated below. (Please check appropriate box.)

- ☐ I do not wish to participate. I do not wish to participate in this study. In order for us to ensure that you will not be contacted again, please provide your name here: ______________________
- ☐ I wish to participate. I voluntarily consent to participate in this study. I have had an opportunity to ask questions. I give permission for the study team to use my responses in research. I understand that future questions I may have about the research or about my rights as a subject will be answered by one of the investigators listed above. (Please proceed to the following items 1-3.)

1. I give consent to be observed during this study. I understand that some of my activity will be videotaped, and I consent to this. I understand that I will have the opportunity to review and edit the recording. I also understand that these tapes and photographs will be retained by the researchers until December, 2012, to be used for research purposes only.

   Please initial: ______Yes ______ No

2. I give consent for videotapes resulting from my participation in this study to be used in academic publications and presentations.

   Please initial: ______Yes ______ No

3. I give consent for samples of my written work to be used for research purposes in this study.

   Please initial: ______Yes ______ No

I have read the above and give my consent to participate in this study.

NAME ________________________________

SIGNATURE ________________________________

DATE ______________

The extra copy of this consent form is for you to keep.

cc: Participant
Investigator's file

LARGE PUBLIC UNIVERSITY
CONSENT FORM
ACADEMIC PATHWAYS STUDY, ETHNOGRAPHIC GROUP

[list of investigators and contact information]

INVESTIGATORS' STATEMENT

We are asking you to take part in a research study. The purpose of this consent form is to give you the information you will need before you decide whether or not to take part in this study. Please read this form carefully. You may ask questions about what we will ask you to do, the risks, the benefits, your rights as a volunteer, or anything else about the research or this form that is not clear. When all your questions have been answered, you can decide if you want to take part or not. This process is called "informed consent." We will give you a copy of this form for your records.

Purpose of the Study

We want to know more about how engineering students explore the educational opportunities available to them in college, plan and carry out their curricula, and become engineers.

Procedures

You have been selected as a participant in the Ethnographic group of the study. Data collection for the study will take place between Fall 2003 and Spring 2009, and will be conducted by researchers at Large Public University, Technical Public Institution, Urban Private University, and Suburban Private University.

General Procedures:

You will not need to do any more or less work in your classes because you have agreed to participate in this study, nor will you be asked to perform differently than you would if you did not participate. The following forms of data will be used to study different aspects of your experience as a student who is planning to major in engineering:

1) Academic information maintained by the university registrar, including your college transcripts, SAT scores, high school GPA, gender, and ethnicity. This information will be kept in strictest confidence and will only be used for research purposes.
2) Two 2-hour internet-based questionnaires, in which you will be asked to provide some information about your experiences and motivations as an undergraduate engineering student. Some questions on these questionnaires will be of a personal and potentially sensitive nature, including questions about your ethnicity, about your parents' education and income levels, and about how much time you spend studying. You do not have to answer any questions you do not wish to answer.
3) One formal audio taped interview per year for each of the three years of the study, each of which will take approximately 2 hours, in which a trained interviewer will ask a series of questions regarding your experiences and motivations as an undergraduate engineering student. Audio tapes of these interviews will be kept by the researchers for 10 years, until December of 2012, to be used for research purposes only. Some questions in these questionnaires will be of a personal

and potentially sensitive nature, including questions about your family background and its relationship to decisions you make about your education and career, about difficulties you might have in your coursework, and about how your relationships with friends, family, peers at school, and faculty relate to your performance in school and your career choices. You do not have to answer any questions you do not wish to answer.

4) A series of observations in which a trained observer will accompany you for an average of approximately 2 hours per week in various academic settings (e.g., lectures, study groups) and academically-oriented extracurricular settings (e.g., College of Engineering Sponsored workshops, engineering student society meetings) in order to obtain a general impression of undergraduate engineering student life. Some of these observations may be audio taped, video taped, and/or photographed. Audio tapes, video tapes, and photographs resulting from your participation will be kept by the researchers for 10 years, until December of 2012, to be used for research purposes only.
5) Periodic brief interviews in which a trained observer, based on the observations made in 4) above, which will explore in more detail your experiences and motivations as an undergraduate engineering student. These interviews may be audio taped, video taped, and/or photographed. Audio tapes, video tapes, and photographs of these interviews will be kept by the researchers for 10 years, until December of 2012, to be used for research purposes only.
6) Samples of your written coursework, such as homework, project reports, and examinations.
7) In some cases when research participants are no longer in the immediate area, or are unavailable to be present for a face-to-face interview, we will conduct interviews over the phone. These interviews will be recorded.

<u>Procedures for observing and recording activities:</u>

We will conduct observations only on campus and only of academically oriented activities. These can include both curricular (e.g., lectures, project meetings) and extracurricular (e.g., undergraduate engineering societies, College of Engineering sponsored workshops) activities. We anticipate video recording a small percentage of the activities that we observe – probably less than ten percent of the total observation time will be video recorded.

You will have an important role in determining the time, place, and nature of the observation settings. We will consult with you each week on where and when that week's observation will take place. We will solicit your opinion on what settings and what activities might be interesting and appropriate for us to observe.

You will always know in advance that an observation will be taking place – we will not show up unannounced. A day before a scheduled observation, we will remind you via your preferred means of communication (e.g., phone or email) that the observation will take place.

You will always know in advance whether or not we plan to tape during a given observation – we will not tape without having arranged this with you in advance.

You will always have the option to ask us not to observe and/or to record a given activity. You may decline our suggestion to be observed and/or taped at a particular time or place, and you may cancel a scheduled observation for any reason and at any time, including after the observation has begun. In addition, you may ask us to discontinue taping for any reason and at any time. We will always comply with such requests immediately.

Procedures for storing and accessing data:

All data collected, with the exception of video recordings, will be stored in a secure, password-protected database at Suburban Private University and will be shared with the researchers at the other 3 institutions.

All data will be kept confidential, and accessed only by authorized researchers at the four participating schools who have signed a confidentiality agreement. To better protect your privacy, we will generate a unique identification code that will be used in place of your name during the study. If we publish the results of this study we will not use your name. We will destroy the link between the data for this study and your name by December 2012.

Whenever possible, we will remove identifying information from data collected from you. Your name and other identifying information will be removed from student records, surveys, transcripts of interviews, fieldnotes, and work samples. Removal of identifying information from these forms of data will take place as soon as possible after collection, and always before storage in the database.

You will remain identifiable in some of the data that we will collect during this study. This includes audio and video recordings, and photographs. Information relevant to our procedures for identifiable data follows.

Audio recordings and photographs will be stored in the database at SPri, and will be accessible to faculty and student researchers involved in the Academic Pathways Study. This includes researchers from Large Public University, Technical Public Institution, Urban Private University, and Suburban Private University.

Video recordings will be stored in a locked cabinet in a private office in the LPub College of Education. Researchers at the other participating institutions will not have access to video recordings in which you are identifiable.

You will have the option of reviewing all recordings in which you are identifiable (i.e., audio and video recordings, and photographs). You can request that we delete any such recording, or any part of it, and we will comply with this request.

We sometimes use identifiable recordings in academic presentations. In such cases, we will offer you the option of reviewing recordings in which you are identifiable prior to making the presentation. This option will be in effect both during and after your participation in the study.

Two faculty members in the LPub College of Engineering will have access to audio and video recordings and photographs in which you are identifiable. These researchers are subject to the same confidentiality agreement as are all other researchers associated with the Academic Pathways Study.

Risks, Stress, or Discomfort

Some people might feel discomfort or stress from the intensive nature of this research. Some people might feel that the research procedures are invasive.

Some people might feel concerned that confidential information will be used inappropriately. To guard against this, the research personnel at each of the four participating institutions will sign a confidentiality agreement that limits access to and use of data.

Some people might feel concerned that their academic and professional careers might be negatively impacted as a result of the fact that some faculty in the College of Engineering have access to identifiable data. We want to stress that you have the option of reviewing all recordings in which you are identifiable, and that you have the option to ask that all or part of any recordings be deleted. We also want to stress that you have the option of terminating any observation and/or recording at any time and for any reason.

Some people might feel uncomfortable when their responses to interviews are analyzed for the purposes of a study.

Some people might feel uncomfortable being observed for the purposes of a study.

Payments

You will be compensated in cash. Legally, you can be paid only if you are a US citizen, a legal resident alien (i.e., possess a “green” card), or have a work eligible visa sponsored by the paying institution. You will be compensated at the rate of $175 per year, to be paid at the end of the Spring quarter. If you end your participation in the study early, you will be paid a pro-rated amount based on the duration of your participation.

Benefits of the Study

We hope that the results of this study will help the engineering education community to improve the design of curriculum and teaching methods in order to help students to succeed in becoming engineers. You might not benefit directly from this study.

Other information

Participation in this study is voluntary. At any time during the study you may choose to stop participating. A decision to stop participating will have no adverse effect on your course grades or your standing in school.

This is a three-year study. We will contact you at the beginning of the Fall quarter each year to review with you the objectives and procedures of the study and to obtain signed consent for your continuing participation.

If in the course of our observations we see evidence of suicidal tendencies or physical abuse, we are required to report this to appropriate authorities. All other identifiable information about you will be kept confidential.

If in the course of our observations we recognize signs of unhealthy or dangerous behavior or psychological states, we will offer you information on where you can go to receive treatment.

The following groups may need to review study records about you: Institutional oversight review offices at the research site, LPub, or state; and federal regulators.

<u>Termination of participation:</u>

As stated above, you are free to terminate your participation in this study for any reason and at any time. Under certain circumstances, it might be necessary for the research team to terminate your participation. Below are the conditions under and procedures by which this might occur:

If you leave Large Public University for any reason, including illness, transfer to another institution, etc., your participation in the study will be terminated.

Our study is focused on engineering education, and we are accordingly recruiting subjects who display intent to major in engineering. We expect that some subjects might decide to major in a subject other than engineering. Such cases are quite relevant to the goals of our research, and we will as a result continue to include such subjects in our research for a period sufficient to capture the subject's initial transition out of engineering. We expect this period to be at least one quarter and for up to a full academic year. We will terminate the subject's participation in the study after this point.

It is possible that you might, for a variety of reasons, become unwilling or unable to participate consistently in study activities, such as interviews and observations. In cases in which we have been unable to you consistently in study activities for a reasonable period of time, which we take to be approximately one month, we will approach you to inquire whether you wish to continue your participation. If you wish to continue, we will attempt to work out a satisfactory participation schedule. If after this point we continue to be unable to consistently engage you in study activities, we reserve the right to terminate your participation. Please note that termination of subjects for these reasons is an undesirable outcome for the study, and will be done only as a last resort.

If you have read this form and have decided to participate in this project, please understand that your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. You have the right to refuse to participate in studies involving a particular method. You also have the right to refuse to answer particular questions. Your individual privacy will be maintained in all published and written information resulting from the study.

At the conclusion of your participation in the study, we will ask for permission to re-contact you should we wish to use identifiable recordings of you in public presentations.

SUBJECT'S STATEMENT

The study described above has been explained to me. My willingness to participate is indicated below. (Please check appropriate box.)

☐ I do not wish to participate. I do not wish to participate in this study. In order for us to ensure that you will not be contacted again, please provide your name here: ______________________
(Please do not read any further. Thank you for your time and consideration.)

☐ I wish to participate. I voluntarily consent to participate in this study. I have had an opportunity to ask questions. I give permission for the study team to use my responses in research. I understand that future questions I may have about the research or about my rights as a subject will be answered by one of the investigators listed above. (Please proceed to the following items 1-6.)

1) I give consent for my academic records to be used for research purposes in this study.

   Please initial: ______Yes ______ No

2) I give consent to be interviewed during this study. I understand that these interviews will be audiotaped, and I consent to this. I understand that I will have the opportunity to review and edit these audiotapes. I also understand that these audiotapes will be retained by the researchers until December, 2012.

   Please initial: ______Yes ______ No

3) I give consent for the responses I provide during interviews and surveys to be used for research purposes in this study.

   Please initial: ______Yes ______ No

4) I give consent to be observed during this study. I understand that I can decline to be observed at any time and for any reason, including after an observation has begun. I understand that some of my activities will be audio taped, video taped, and/or photographed, and I consent to this. I understand that I can, at any time and for any reason, request that audio and video recordings be terminated. I understand that I will have the opportunity to review and edit these tapes and photographs. I also understand that recordings and photographs will be retained by the researchers until December, 2012.

   Please initial: ______Yes ______ No

5) I give consent for audiotapes, videotapes, and photographs resulting from my participation in this study to be used in academic publications and presentations. I understand that I will have the option of reviewing such materials before they are presented publicly.

   Please initial: ______Yes ______ No

6) I give consent for samples of my written coursework to be used for research purposes in this study.

   Please initial: ______Yes ______ No

7) I give consent for an interview to be conducted over the phone. I understand that this interview will be audio-recorded.

   Please initial: ______Yes ______ No

I have read the above and give my consent to participate in this study.

NAME___________________________ SIGNATURE____________________________

DATE ________________

The extra copy of this consent form is for you to keep.

cc: Participant
Investigator's file

Ethnographic Consent Form (rev. 5/20/2008)

LARGE PUBLIC UNIVERSITY
CONSENT FORM
ACADEMIC PATHWAYS STUDY, OBSERVED GROUP

[list of investigators and contact information]

INVESTIGATORS' STATEMENT

We are asking you to take part in a research study. The purpose of this consent form is to give you the information you will need before you decide whether or not to take part in this study. Please read this form carefully. You may ask questions about what we will ask you to do, the risks, the benefits, your rights as a volunteer, or anything else about the research or this form that is not clear. When all your questions have been answered, you can decide if you want to take part or not. This process is called "informed consent." We will give you a copy of this form for your records.

Purpose of the Study

We want to know more about how engineering students explore the educational opportunities available to them in college, plan and carry out their curricula, and become engineers.

Procedures

You have been selected as a participant in the Ethnographic group of the study. Data collection for the study will take place between Fall 2003 and Spring 2009, and will be conducted by researchers at Large Public University, Technical Public Institution, Urban Private University, and Suburban Private University.

General Procedures:

You will not need to do any more or less work in your classes because you have agreed to participate in this study, nor will you be asked to perform differently than you would if you did not participate. The following forms of data will be used to study different aspects of your experience as a student who is planning to major in engineering:

1) Academic information maintained by the university registrar, including your college transcripts, SAT scores, high school GPA, gender, and ethnicity. This information will be kept in strictest confidence and will only be used for research purposes.
2) Two 2-hour internet-based questionnaires, in which you will be asked to provide some information about your experiences and motivations as an undergraduate engineering student. Some questions on these questionnaires will be of a personal and potentially sensitive nature, including questions about your ethnicity, about your parents' education and income levels, and about how much time you spend studying. You do not have to answer any questions you do not wish to answer.
3) One formal audio taped interview per year for each of the three years of the study, each of which will take approximately 2 hours, in which a trained interviewer will ask a series of questions regarding your experiences and motivations as an undergraduate engineering student. Audio tapes of these interviews will be kept by the researchers for 10 years, until December of 2012, to be used for research purposes only. Some questions in these questionnaires will be of a personal

and potentially sensitive nature, including questions about your family background and its relationship to decisions you make about your education and career, about difficulties you might have in your coursework, and about how your relationships with friends, family, peers at school, and faculty relate to your performance in school and your career choices. You do not have to answer any questions you do not wish to answer.

4) In some cases when research participants are no longer in the immediate area, or are unavailable to be present for a face-to-face interview, we will conduct interviews over the phone. These interviews will be audio-recorded.

Procedures for storing and accessing data:

All data collected, with the exception of video recordings, will be stored in a secure, password-protected database at Suburban Private University and will be shared with the researchers at the other 3 institutions.

All data will be kept confidential, and accessed only by authorized researchers at the four participating schools who have signed a confidentiality agreement. To better protect your privacy, we will generate a unique identification code that will be used in place of your name during the study. If we publish the results of this study we will not use your name. We will destroy the link between the data for this study and your name by December 2012.

Whenever possible, we will remove identifying information from data collected from you. Your name and other identifying information will be removed from student records, surveys, and transcripts of interviews. Removal of identifying information from these forms of data will take place as soon as possible after collection, and always before storage in the database.

You will remain identifiable in some of the data that we will collect during this study. Information relevant to our procedures for identifiable data follows.

Audio recordings and photographs will be stored in the database at SPri, and will be accessible to faculty and student researchers involved in the Academic Pathways Study. This includes researchers from Large Public University, Technical Public Institution, Urban Private University, and Suburban Private University.

You will have the option of reviewing all audio recordings in which you are identifiable. You can request that we delete any such recording, or any part of it, and we will comply with this request.

Two faculty members in the LPub College of Engineering will have access to audio recordings in which you are identifiable. These researchers are subject to the same confidentiality agreement as are all other researchers associated with the Academic Pathways Study.

Risks, Stress, or Discomfort

Some people might feel discomfort or stress from the intensive nature of this research. Some people might feel that the research procedures are invasive.

Some people might feel concerned that confidential information will be used inappropriately. To guard against this, the research personnel at each of the four participating institutions will sign a confidentiality agreement that limits access to and use of data.

Some people might feel concerned that their academic and professional careers might be negatively impacted as a result of the fact that some faculty in the College of Engineering have access to identifiable data. We want to stress that you have the option of reviewing all recordings in which you are identifiable, and that you have the option to ask that all or part of any recordings be deleted. We also want to stress that you have the option of terminating any observation and/or recording at any time and for any reason.

Some people might feel uncomfortable when their responses to interviews are analyzed for the purposes of a study.

Payments

You will be compensated in cash. Legally, you can be paid only if you are a US citizen, a legal resident alien (i.e., possess a "green" card), or have a work eligible visa sponsored by the paying institution. You will be compensated at the rate of $175 per year, to be paid at the end of the Spring quarter. If you end your participation in the study early, you will be paid a pro-rated amount based on the duration of your participation.

Benefits of the Study

We hope that the results of this study will help the engineering education community to improve the design of curriculum and teaching methods in order to help students to succeed in becoming engineers. You might not benefit directly from this study.

Other information

Participation in this study is voluntary. At any time during the study you may choose to stop participating. A decision to stop participating will have no adverse effect on your course grades or your standing in school.

This is a three-year study. We will contact you at the beginning of the Fall quarter each year to review with you the objectives and procedures of the study and to obtain signed consent for your continuing participation.

If in the course of our interviews we see evidence of suicidal tendencies or physical abuse, we are required to report this to appropriate authorities. All other identifiable information about you will be kept confidential.

If in the course of our interviews we recognize signs of unhealthy or dangerous behavior or psychological states, we will offer you information on where you can go to receive treatment.

The following groups may need to review study records about you: Institutional oversight review offices at the research site, LPub, or state; and federal regulators.

<u>Termination of participation:</u>

As stated above, you are free to terminate your participation in this study for any reason and at any time. Under certain circumstances, it might be necessary for the research team to terminate your participation. Below are the conditions under and procedures by which this might occur:

If you leave Large Public University for any reason, including illness, transfer to another institution, etc., your participation in the study will be terminated.

Our study is focused on engineering education, and we are accordingly recruiting subjects who display intent to major in engineering. We expect that some subjects might decide to major in a subject other than engineering. Such cases are quite relevant to the goals of our research, and we will as a result continue to include such subjects in our research for a period sufficient to capture the subject's initial transition out of engineering. We expect this period to be at least one quarter and for up to a full academic year. We will terminate the subject's participation in the study after this point.

It is possible that you might, for a variety of reasons, become unwilling or unable to participate consistently in study activities, such as interviews and observations. In cases in which we have been unable to you consistently in study activities for a reasonable period of time, which we take to be approximately one month, we will approach you to inquire whether you wish to continue your participation. If you wish to continue, we will attempt to work out a satisfactory participation schedule. If after this point we continue to be unable to consistently engage you in study activities, we reserve the right to terminate your participation. Please note that termination of subjects for these reasons is an undesirable outcome for the study, and will be done only as a last resort.

If you have read this form and have decided to participate in this project, please understand that your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. You have the right to refuse to participate in studies involving a particular method. You also have the right to refuse to answer particular questions. Your individual privacy will be maintained in all published and written information resulting from the study.

At the conclusion of your participation in the study, we will ask for permission to re-contact you should we wish to use identifiable recordings of you in public presentations.

SUBJECT'S STATEMENT

The study described above has been explained to me. My willingness to participate is indicated below. (Please check appropriate box.)

☐ I do not wish to participate. I do not wish to participate in this study. In order for us to ensure that you will not be contacted again, please provide your name here: ______________________ (Please do not read any further. Thank you for your time and consideration.)

☐ I wish to participate. I voluntarily consent to participate in this study. I have had an opportunity to ask questions. I give permission for the study team to use my responses in research. I understand that future questions I may have about the research or about my rights as a subject will be answered by one of the investigators listed above. (Please proceed to the following items 1-6.)

1) I give consent for my academic records to be used for research purposes in this study.

   Please initial: ______Yes ______ No

2) I give consent to be interviewed during this study. I understand that these interviews will be audio-recorded, and I consent to this. I understand that I will have the opportunity to review and edit these audio files. I also understand that these audiotapes will be retained by the researchers until December, 2012.

   Please initial: ______Yes ______ No

3) I give consent for the responses I provide during interviews and surveys to be used for research purposes in this study.

   Please initial: ______Yes ______ No

4) I give consent for audiotapes resulting from my participation in this study to be used in academic publications and presentations.

   Please initial: ______Yes ______ No

5. I give consent for an interview to be conducted over the phone. I understand that this interview will be audio-recorded.

   Please initial: ______Yes ______ No

I have read the above and give my consent to participate in this study.

NAME__________________________ SIGNATURE___________________________

DATE _______________

The extra copy of this consent form is for you to keep.

cc: Participant
Investigator's file

Observed Group Consent Form (rev. 5/20/2008)

Appendix 1-E
APS Longitudinal Cohort Demographics Table

This table presents status and demographic details for each ID number issued in the APS Longitudinal Cohort. Data in the table was obtained from the following sources:

- Citizenship status was determined from PIE survey responses. In two cases, different responses were recorded at different time points, and these are explained in the far right column. Citizenship was asked on surveys #1, #4 and #7.

- Ethnicity was determined from PIE responses. In cases where different responses were recorded at different time points, the earliest response was used. Ethnicity was asked on surveys #1, #4 and #7.
    - Survey 1 response was used if subject started the study in Year 1.
    - Survey 4 response was used if subject started the study in Year 2, or did not respond to the ethnicity question on survey 1.

- The year in which students left the study was determined from the date of the last piece of data we collected for that student.

- Engineering Persistence was determined from the major listed on the last academic transcript supplied to APS, or from records supplied by the department or institution if transcripts were not available or complete.
    - Persister = documented engineering major
    - Non-persister = documented non-engineering major OR interview data (exit interview or regular APS interview) where subject states he/she will not pursue engineering. Non-persisters had an interest in an engineering major upon enrolling in University.
    - Lost to follow-up = did not complete APS and major status not known

- Year 4 Transcripts were supplied by the institutions.

- Last Recorded Major was determined from transcripts, if available, or from official department or school records

A key to notations in the table is included on the last page.

	Study Group	Citizen	Initial Ethnicity (Year 1-2)	Left study after…	Exit Inter-view	Eng. Persis. Status	Year 4 Trans-cript	Last recorded major	
SCH1STU01	M	1	W	Y3		LTF		ME	
SCH1STU02	L	1	Asian			P	1	ChemE	
SCH1STU03	L	1	W			P	1	ChemE	
SCH1STU04	H	1	Mex			P	1	Metal-MatE	
SCH1STU05	H	1	W			P	1	ChemE	
SCH1STU06	L	1	W			P	1	ChemE	
SCH1STU07	M	1	Multi			P	1	EnvironE	
SCH1STU08	H	1	W			P	1	EPhysics	
SCH1STU09	L	1	W			P	1	GeophysE	
SCH1STU10	L	1	W			P	1	ME	
SCH1STU11	L	1	W			P	1	ChemE	
SCH1STU12	M	1	Asian	Y3	1	NP		EE	transcript in DB altho student dropped out of stu
SCH1STU13	L	1	W			P	1	ME	
SCH1STU14	L	1	W	Y1		NP		n/a	
SCH1STU15	H	1	W			P	1	CivilE	
SCH1STU16	L	1	W			P	1	ChemE	
SCH1STU17	L	1	W			P	1	CivilE	
SCH1STU18	L	1	W			P	1	ME	
SCH1STU19*	L	1	Mex			P	1	ChemE	
SCH1STU20	M	1	W		1	P	0	Metal-MatE	sabbatical during Y4; not exiting eng. despite ex
SCH1STU21*	L	1	W			P	1	ME	
SCH1STU22	H	1	W			P	1	PetrE	
SCH1STU23	M	1	W	Y1	1	NP		n/a	
SCH1STU24	L	1	W			P	1	PetrE	
SCH1STU25	L	1	W			O	1	Math-CS	
SCH1STU26	M	1	Multi			P	1	ME	
SCH1STU27*	L	1	Other			P	1	PetrE	
SCH1STU28	L	1	W			P	1	PetrE	
SCH1STU29	L	1	Asian			P	1	ChemE	
SCH1STU30	M	1	Multi			P	1	EPhysics	
SCH1STU31*	L	1	W			P	1	PetrE	

SCH1STU32	L	1	W			P	1	PetrE	
SCH1STU33	L	1	W			P	1	ME	
SCH1STU34	L	1	W			P	1	CivilE	
SCH1STU35	L	1	Multi	Y3		LTF		EPhysics	
SCH1STU36	L	1	Multi	Y1		NP		n/a	transcript in DB altho student dropped out of stu
SCH1STU37*	L	1	Mex			O	1	Math-CS	
SCH1STU38	H	1	Asian			P	1	ME	
SCH1STU39	H	1	W	Y2	1	NP		EE	
SCH1STU40	L	1	Multi	Y2		NP		Math+CS	
SCH1STU41	H	1	W			P	1	Metal-MatE	
SCH1STU42	L	1	W	Y1		NP		n/a	transcript in DB altho student dropped out of stu
SCH1STU43	L	1	W			P	1	Metal-MatE	
SCH1STU44	M	1	W			P	1	PetrE	
SCH1STU45	L	1	Mex	Y1		NP		n/a	transcript in DB altho student dropped out of stu
SCH2STU01	M	0	AA	Y1		LTF		ME	
SCH2STU02*	L	0	AA			P	1	EE	
SCH2STU03	M	0	AA			P	1	EE	
SCH2STU04*	L	1	AA			P	1	EE	
SCH2STU05	L	1	AA	Y1	1	NP		Accounting	
SCH2STU06*	L	1	AA	Y3	1	NP		ME	
SCH2STU07*	L	1	Other	Y3		LTF		Sys-CS	
SCH2STU08	L	1	AA			P		ChemE	
SCH2STU09*	L	0	AA			P	1	ME	
SCH2STU10	H	1	AA			P	1	ChemE	
SCH2STU11	H	0	AA			P		EE	
SCH2STU12	H	0	AA			P	1	Sys-CS	
SCH2STU13	H	1	AA	Y2		LTF		CompE	
SCH2STU14	L	0	Other			P		Sys-CS	graduated early (May 2006)
SCH2STU15	M	1	AA	Y1		NP		Hlth Mgt	
SCH2STU16									Did not complete survey #1
SCH2STU17	L	1	AA	Y1		LTF		CompE	
SCH2STU18	M	1	AA			P	1	CompE	
SCH2STU19									Did not complete survey #1
SCH2STU20									Did not complete survey #1
SCH2STU21	L	1	AA	Y2		LTF		ME	
SCH2STU22*	L	0	Other			P	1	EE	

SCH2STU23	L	0	Multi			P	1	EE	
SCH2STU24*	L	0	AA			P	1	EE	
SCH2STU25*	L	0	Other			P	1	EE	
SCH2STU26*	L	0	Multi			P	1	EE	
SCH2STU27	L	0	AA	Y1		NP		Accounting	
SCH2STU28*	L	1	AA			P	1	EE	
SCH2STU29	L	1	AA	Y1		LTF		n/a	
SCH2STU30*	L	1	AA			LTF		EE	
SCH2STU31*	L	1	AA			P	1	Sys-CS	no major on final transcript; all prior were Comp
SCH2STU32	L	1	AA			P		ME	
SCH2STU33	H	1	AA	Y2		LTF		CompE	
SCH2STU34	H	0	AA			P	1	EE	
SCH2STU35	H	0	AA			P	1	Sys-CS	
SCH2STU36	H	1	Multi			P	1	CivilE	
SCH2STU37	M	1	AA	Y2	1	NP		AfrAmStudies	
SCH2STU38	M	0	AA			P	1	ME	
SCH2STU39	M	0	Other			P	1	ME	
SCH2STU40	L	0	Other	Y1	1	NP		Accounting	
SCH2STU41	L	0	AA	Y2		LTF		ME	
SCH2STU42	L	0	Other	Y3		LTF		ChemE	
SCH2STU43	L	0	AA	Y2		LTF		ChemE	
SCH2STU44	M	1	AA			P	1	EE	
SCH2STU45	L	1	AA	Y1	1	NP		Radio,TV,Film	
SCH2STU46	L	1	AA			P	1	CompE	
SCH2STU47	L	1	AA			P	1	CivilE	
SCH2STU48	L	1	AA	Y3		P		Sys-CS	Not enrolled Spring 06-Winter 08; returned Spri
SCH2STU49	L	1	AA	Y3		P		Sys-CS	
SCH2STU50									Did not complete survey #1
SCH2STU51	L	1	AA	Y3		P		Sys-CS	
SCH2STU52	L	1	AA	Y2	1	NP		InfoSys+Anal	
SCH3STU01	H	0	Asian			P	1	CivilE	
SCH3STU02	H	1	Mex			P	1	Eng	
SCH3STU03	H	0	W		1	NP	1	Math-CmptnlSc	
SCH3STU04	H	1	W			NP	1	HumBio	
SCH3STU05	M	1	AA			NP	1	Ling	

SCH3STU06	L	1	Asian			P	1	Eng	
SCH3STU07	M	0	Other			P	1	CivilE	
SCH3STU08	L	1	Other			P	1	MgtSciE	
SCH3STU09	M	1	W			P	1	ChemE	
SCH3STU10	M	1	W			P	1	EE	
SCH3STU11	L	1	W			P	1	ChemE	
SCH3STU12	L	1	Multi			P	1	EE	
SCH3STU13	H	1	AA			P	1	ChemE+Span	
SCH3STU14	H	1	Asian			P	1	EE	
SCH3STU15	H	1	W		1	NP	1	Physics	
SCH3STU16	H	1	W			O		n/a	left school to work at a start-up; remained in stu
SCH3STU17*	L	1	Multi			P	1	CS	
SCH3STU18	L	1	AA			P	1	Eng	
SCH3STU19	L	1	AA			P	1	MgtSciE	
SCH3STU20	L	1	Multi		1	NP	1	SymbSys	
SCH3STU21	M	1	AA			P	1	CivilE	
SCH3STU22	L	1	Multi		1	NP	1	Int.Rel.	
SCH3STU23	M	1	Asian		1	NP	1	Phil.	
SCH3STU24	L	1	Multi			P	1	CS+Hist	
SCH3STU25	L	0	Other		1	NP	1	Math-CmptnlSc	
SCH3STU26	L	0	Other		1	NP	1	Econ	
SCH3STU27	L	0	Asian			P	1	EE	
SCH3STU28	L	1	Asian		1	NP	1	SymbSys	
SCH3STU29	M	1	Asian			P	1	EE	
SCH3STU30	L	1	Asian			P	1	Eng	
SCH3STU31	L	1	W			P	1	EE	
SCH3STU32	L	1	W			P	1	CS	
SCH3STU33	L	1	W		1	NP	1	SymbSys	
SCH3STU34	L	1	W			P	1	CS	
SCH3STU35	M	1	W			P	1	ME	
SCH3STU36	L	1	W			P	1	CS	
SCH3STU37	L	1	W			P	1	ME	
SCH3STU38	L	1	W			P	1	ME	
SCH3STU39	L	1	W			P	1	Eng	
SCH3STU40	L	1	W	Y2	1	NP		SymbSys	

SCH3STU41	L	1	W		1	NP		Physics	
SCH4STU01	H	1	Multi			P	1	ChemE	
SCH4STU02	H	1	Asian	Y2	1	NP		Mktg	
SCH4STU03	H	1	Mex			P	1	TechCom	Technical Communications
SCH4STU04	M	0	Asian			P	1	CS	
SCH4STU05	L	1	Asian			P	1	ChemE	
SCH4STU06	M	1	W			P	1	CivilE	
SCH4STU07	L	0	Asian			P	1	ComputerE	
SCH4STU08	H	1	W	Y3		NP		Micro	transcript in DB altho student left study
SCH4STU09	L	1	W			P	1	ChemE	
SCH4STU10	M	1	W			P	1	ChemE	
SCH4STU11	M	1	Multi			P	1	MSE	
SCH4STU12	L	1	W			P	1	ME	
SCH4STU13	L	1	W			P	1	CivilE	
SCH4STU14	L	1	Multi			P	0	MSE	no transcript but complete data set; graduat'n confirmed from school records
SCH4STU15	L	1	Asian	Y1		LTF		PreE	
SCH4STU16	L	1	Asian	Y2	1	NP		PoliSci	
SCH4STU17	L	1	Asian			P	1	CE	Citizen in 07, resident in 05, grn card in 04
SCH4STU18	H	1	Asian			P	1	IE	
SCH4STU19	H	1	W	Y2		LTF		PreE	
SCH4STU20	H	1	W			P	1	ME	
SCH4STU21	H	1	W			P	1	EE	
SCH4STU22	M	0	Lat			P	1	IE	
SCH4STU23	M	1	Asian			P	1	ComputerE	
SCH4STU24	M	1	W			P	1	ComputerE	
SCH4STU25	L	1	W			P	1	ComputerE	
SCH4STU26	L	1	W			P	1	AAE	
SCH4STU27	L	1	W			P	1	ME	
SCH4STU28	M	1	W			P	1	AAE	
SCH4STU29	L	1	W			P	1	EE	left ethnicity blank in Y1 but not Y2
SCH4STU30	L	1	W			P	1	ChemE	
SCH4STU31	L	1	W			P	1	ME	
SCH4STU32	L	1	W			P	1	ME	
SCH4STU33	L	1	Asian			P	0	AAE	no transcript but complete data; '07 graduat'n in confirmed from school records
SCH4STU34	L	0	Asian			P	1	IE	Resident in 05, green card in 04, 07

SCH4STU35	L	1	Asian	Y3	1	NP		Econ+Bio	transcript in DB altho student left study
SCH4STU36	L	1	Asian			P	1	AAE	
SCH4STU37	L	1	W	Y3	1	NP		Info	
SCH4STU38	L	1	Asian	Y3	1	NP		Entre	
SCH4STU39	L	1	W			P	1	ME	
SCH4STU40	L	1	Asian			P	1	ComputerE	

KEY

* added late (Y2)
1=Yes, 0=No
L=Low Contact
M=Med Contact
H=High Contact

Race/ethnicity

AA= African American
Nat = Native American including Native Alaskan
Asian
Pac = Pacific Islander or Native Hawaiaan
Puerto Rican
Mex = Mexican
Lat = Other Latino
W = White
Other = other race/ethnicity
Multi = multiple races/ethnicities

Initial ethnicity response is used when different response was given later.

P (Persister) = subjects with documented engineering major at end of Y4 (from academic transcript or from department) regardless of whether or not they supplied Y4 data

N (Non-persister) = subjects with documented non-engineering major OR who completed an exit interview or reported during a regular interview that they would not pursue an engineering major

O (other) = subjects meeting neither persister nor non-persister criteria

L (Lost to follow-up) = did not complete APS; reason unknown; may have left the insititution

Appendix 2-A
Original APS Longitudinal Cohort (Cohort 1) Sampling Plan

Introduction

The goal of the Longitudinal Cohort is to identify and characterize the pathways for making the *choice* of becoming an engineer. Incoming freshman will be studied through ethnographic, interview and survey techniques up until the end of their junior year. There will be 160 participants total, 40 participants each from TPub, UPri, SPri, and LPub. In each institution, 8 of the 40 will be studied in depth though ethnographies as well interviews and surveys. Since ethnographic studies are much more resource intensive, the other 32 will be studied though interviews and surveys only. In addition, there will be a control group at each institution consisting of 40 participants, who will not be subjected to any form of direct observation. Key statistics such as SAT scores, transcripts, major status, and other material institutional statistics their institutions tracks and keeps on file in the registrar's office will be monitored for both groups.

Institutional Background Information

Technical Public Institution (TPub)

Approximately 600 – 650 engineering freshmen enroll at TPub each year. The students are essentially identified as engineering students since TPub is an engineering institution, however students do not necessarily have to declare their major during their freshman year. Some students declare when they arrive, others declare later during their matriculation. All freshmen must enroll in "freshmen success" and their instructor for the course is also their advisor. Each instructor/advisor has 10-15 advisees. Engineering majors offered at TPub included in this study are Chemical Engineering, (General) Engineering, Geology and Geological Engineering, Geophysics, Metallurgical and Materials Engineering, Mining Engineering, Petroleum Engineering, Engineering Physics. For the purposes of this study the following majors will be excluded from the study: Economics, Mathematical and Computer Science, and Chemistry. In 2002, over 500 students graduated from the undergraduate engineering programs at TPub with over 400 students receiving degrees in the majors not excluded from this study.

Urban Private University (UPri)

Approximately 180 freshmen enter the UPri engineering program each year. Freshmen are accepted into the engineering program upon enrolling at UPri, and all freshmen across the University are required to stay on campus. Engineering majors offered at UPri include Chemical, Civil, Systems and Computer Science, Mechanical, and Electrical Engineering. In 2002, over 100 students graduated from undergraduate engineering programs at UPri.

Suburban Private University (SPri)

Approximately 320-350 freshmen self-identify as interested in engineering at SPri each year. Freshmen designate a preliminary academic interest (PAI) in Engineering, including Computer Science, during the summer and are assigned Academic Advisors that will advise them until they declare a major. Their selection of PAI does not guarantee or bind students to declare engineering. Students at SPri do not usually declare their major until the end of their sophomore year or during their junior year. The University does not offer a traditional introduction to engineering course, but does offer a few engineering related seminars for freshman with limited enrollment, approximately 15 students. Freshmen have to take a yearlong sequence in the humanities and a two-quarter course in writing and rhetoric. During the remainder of the freshmen year, students interested in engineering usually opt to enroll in math courses (either single or multi-variable calculus), start the physics sequence, and take a freshman seminar. The School of Engineering offers the following undergraduate engineering majors: Chemical Engineering, Civil and Environmental Engineering, Electrical Engineering, Material Science & Engineering, Management Science and Engineering (Industrial Engineering), Mechanical Engineering, Computer Science, Engineering/General Engineering- Aeronautics/Astronautics, Computer Systems Engineering, Individually Designed Majors, Product Design, BioMedical Computation, and Bio Mechanical. For the purposes of this study, Computer Science will be excluded. In 2002, over 300 students graduated from undergraduate engineering programs at SPri, including 154 students in Computer Science.

Large Public University (LPub)

Approximately 650 freshmen are coded as pre-engineering prior to their arrival at LPub. Students can change this coding at any time and it does not bind the student to apply to the engineering program. Either the student or the University may assign students with the "pre-engineering" code. An additional small group of students, approximately 20, are admitted into an engineering major as incoming freshmen. Pre-engineering students may apply to multiple engineering majors granted they have completed the requisite pre-engineering coursework. Students usually begin applying at the end of their sophomore year and are admitted into the engineering major beginning with their junior year. Admission into the undergraduate engineering program is extremely competitive and not all applicants are admitted into the engineering program. LPub offers an Introduction to Engineering Design course (Engr 100) as a recommended course for pre-engineering students. The typical first quarter course load for a pre-engineering student is calculus, inorganic chemistry, and either English Composition or Engr 100. The College of Engineering offers the following undergraduate engineering majors: Aeronautics and Astronautics Engineering, Bioengineering, Chemical Engineering, Civil and Environmental Engineering, Computer Engineering, Electrical Engineering, Materials Science and Engineering, Mechanical Engineering, Technical Communication and Interdisciplinary Engineering Studies. In 2002, over 600 students graduated from undergraduate engineering programs at LPub.

Identifying Students for the Study

There will be 160 observed participants total in the Longitudinal Cohort: 40 participants each from TPub, UPri, SPri, and LPub. An additional 160 participants, 40 at each institution, will be identified to comprise a control group at each school. The observed and control students will simultaneously be identified based on the criterion at each school and will randomly be assigned to either the observed or control group. Each institution will also oversample from its respective underrepresented populations of engineering students. The percent ratio of participants identified below will be representative of both the observed and control group.

Technical Public Institution

Students will be selected to participate in the study based on the following criteria:

- Gender: only 23% of TPub undergraduates are women so this population will be oversampled to obtain a 50/50 percent ratio of women to men in the study.

- Underrepresented Ethnic Populations: only 11% of TPub undergraduates are minority students, including African-American, Asian American, Hispanic American, and Native-American populations. For the purposes of this study, African-American, Hispanic American, and Native American populations will be oversampled. Another sub-group of underrepresented populations will include participants in the *TPub MEP summer program*. The *TPub MEP summer program* is a remedial program some students must attend and pass in order to gain admission into TPub. (Targeted percent ratio to be around 25/75 underrepresented populations to majority populations.)
- Keen Interest in Engineering – interviews will be conducted with students to assess their interest in engineering (targeted percent ratio to be determined).
- Social Integration with Campus – based on focus groups of upper-class students, social support groups are important to a successful matriculation through TPub. The study will include students from a range of residences (on and off-campus), varsity athletes, and students involved in other TPub activities (targeted percent ratio to be determined).

Urban Private University

Students will be identified to participate in the study during the summer as soon as their acceptance into the engineering program has been confirmed by the payment of their enrollment fee. The freshman engineering class is relatively small, averaging 149 US and 35 Non-US students. Thus, the main criteria for participating in the study are:

- Gender – the School of Engineering has a small representation of men, so this population will be oversampled to obtain a 50/50 percent ratio of men to women in the study.
- Origin – the school of engineering has a large representation of international students and this population will be oversampled to obtain a 50/50 percent ratio of US to Non-US students.
- Participation in *freshman summer bridge program* – a select group of students is invited to participate in the Summer Bridge program based on their SAT scores. At the end of the program, it is expected that students will increase awareness of the requirements and rewards of the engineering professions; proficiency to earn above average grades during the freshmen year; and knowledge of campus resources. This population will be sampled to obtain a 50/50 percent ratio of participants in the Summer Bridge program to non-participants.

Suburban Private University

Students will be identified to participate in the study during mid-June – July. Freshmen are required to submit several information forms and questionnaires by mid-June. These forms include personal information, information about their academic interests, as well as housing preferences. Students will be selected to participate in the study based on the following criteria:

- Preliminary Academic Interest (PAI) in Engineering (target 100 percent of participants)
- Gender – the freshmen engineering class has a small representation of women (approximately 25%), so this population will be oversampled to obtain a 50/50 percent ratio of women to men in the study
- Underrepresented Ethnic Populations: African Americans, Native Americans, Mexican Americans, Puerto Ricans, and other Latino groups comprise approximately 25% of the freshmen engineering class. We will oversample from these populations to ensure at least a 25/75 percent ratio of underrepresented ethnic populations to majority populations.
- Participation in SPri *summer bridge program* – a selected group of around 40 students from underrepresented ethnic populations as well as women. SSEA enables students to explore various

engineering disciplines and science and engage with engineering faculty early in their academic career. We would like to have approximately 25/75 percent ratio of SSEA participants to non-participants expressed as an equal 25/75 percent ratio of women and men SSEA participants to women and men non-participants.

- Housing assignments (4 class dorms, all freshman dorms, Freshman Sophomore College, ethnic theme houses) and participation in varsity athletics are two additional factors we would like account for in both the observed and control group (targeted percent ratios to be determined).

Large Public University

LPub will seek to identify students who during their freshman year are participating in activities that (in retrospective studies) indicate an interest in being admitted to the engineering majors. Since our goal is to understand both the pathways into engineering and those that fail to flow into the field, our primary goal is to identify students whose activities display organized intent. In other words, we will *not* be selecting our sample from only those students that indicators suggest are very likely to succeed and be retained in engineering, on the basis of either academic or cultural factors.

The criteria therefore for identifying between 75%-100% of the Longitudinal Cohort will be the following:

- Students Coded as “Pre-Engineering”
- From those coded as pre-engineering, we will then select from among students enrolled during the first quarter in one or more prerequisite courses required for all engineering majors. Students enrolled in one of the prerequisite math courses (1 in a sequence of 3 calculus courses) and the chemistry course (inorganic chemistry) will be included in the possible sample. Students also enrolled in Engineering 100 will be preferred in the sample.
- Upon invitation to the study, students express an evident willingness to participate in the study for three years.

The criterion for identifying up to 25% of the Longitudinal Cohort will be students who are among a small number admitted to an engineering major at LPub as incoming freshman. Approximately 2% of the overall engineering undergraduate population (20 students) enters the engineering majors through this route. Demographically, most of these students are male and are either of Caucasian or Asian-American descent. We will select up to 25% of the cohort (10 students) from this group, with the determining factor being the number of female students from this group that we can enlist into the study. For example, if there are three women who enter the major this way and are willing to participate, we will recruit three men from this group. The purposes of studying this more “elite” sub-population are two-fold. First, we want to see if their pathways differ significantly from those in the more typical track. Second, we want to be able to understand how women and men in this more elite track navigate their education in comparison to those in the typical track.

Since only about 20% of the freshmen meet the above criteria 1 and 2, we will be oversampling from this population.

Additional factors considered in the design of the observed and sample groups include:
- Gender – in 2002, around 26% of graduates of the engineering program were women so this population will be oversampled to obtain a 50/50 percent ratio of women to men in the study.
- Underrepresented Ethnic Populations – in 2002, around 6% of graduates of the engineering program were minority students, including African-American, Hispanic American, and Native-American populations. These populations will be oversampled to obtain a 25/75 percent ratio of

underrepresented to majority populations. Some of these students may be identified from participation in MESA activities during their high school years and who meet the above described criteria (MESA stands for Math, Engineering, and Science Academy, a program designed to recruit underrepresented populations).

Inviting Students to Participate in the Study

Technical Public Institution

The details for inviting students to participate in the study at TPub are being finalized. Some strategies for recruiting students to participate in the study include reviewing information garnered from a survey or questionnaire, conducting interviews with students, and contacts in their Freshmen Success course.

Urban Private University

A personalized letter will be sent to identified students in July to their permanent address. The letter will attempt to persuade students to participate in the study, and give descriptive information about the nature of the study. The letter will also include a consent form for the students to complete with a stamped-returned envelope. A follow-up phone call will be placed to further explain the study and answer any questions the students might have about the study.

Suburban Private University

A personalized letter sent to identified students in July - August to their permanent address. The letter will include enough information to garner interest in the study but not persuade students to study engineering, and a consent agreement with a stamped-returned envelope. Subsequent communications before interested students arrive on campus will establish a short meeting with a member of the longitudinal team once on campus to secure their participation in the study. Other venues for advertising the study include introductory mathematics courses, engineering programming during the New Student Orientation, their academic advisors, the Engineering Diversity Programs office, residential staff, and engineering societies.

Large Public University

A personalized letter sent in October to their university address inviting them to participate in the study. Members of the longitudinal research team will also make short presentations in the calculus sequence courses. The in–class solicitation and letter will include enough information to garner interest in the study but not to persuade students to study engineering. Subsequent communications with students will include a short individual meeting with a member of the research team to secure their participation and explain the commitment. Other venues for advertising the study include introductory mathematics courses, the chemistry course, the engineering presentations during the New Student Orientation, their academic advisors, Engineering 100 course, and a list-serv accessible to students coded as pre-engineering majors.

Replacement Strategy

We will choose a cohort of 40 freshmen to follow through their first three years at their respective institutions. At TPub and UPri, this represents following students through 2 – 3 years in their engineering major, while at SPri and LPub, students will be followed into the end of their first year in an engineering major. There are multiple pathways into engineering other than clear and linear progress from first quarter freshman year. If however all 160 observed students remain in engineering through the junior year, we will likely have chosen our initial sample in a way that is somewhat unrepresentative of the overall populations of engineering students. Also there are attrition rates at each school, for instance at LPub, on average only about 75% of applicants are admitted into the engineering program each year. Because we are seeking relative representation of pathways, we will therefore employ an ethnographically informed strategy for bringing students into the sample as others drop out. As students drop out and as we learn more about the other pathways into the disciplines (e.g., community college transfers, switching from a more basic science major or mathematics), we will solicit participation from students who have these basic profiles. At the end of the 3 years, we should therefore have a solid and closely observed image of what the first three years are like for a large number of students, but we will also have some solid understandings of other pathways based on replacement participants.

Appendix 2-B
Sample APPLES Institution Overview and Recruitment Plan

APPLES Institution Overview Checklist

The APPLES Institution Overview Checklist serves three central purposes, it assists us in: (1) ensuring that the relevant populations of students will be sampled at your institution, (2) establishing the target sample size for your institution – including the best ways to meet the strata (or sub-group) targets and finally (3) accurately interpreting data from your institution.

Date due: 15 September 2007 – Please return this form to us by then!
If you have any questions, please email your APPLES liaison or info@applesurvey.org

☐ 1. **Coordinator information**: Please provide your institution's APPLES coordinator's name, contact information and best means to contact him/her. Example:

> Coordinator: *Dr. Alexandria Smith, Director of Institutional Research*
> Email: *asmith@orchard.edu*
> Phone: *333-222-5555*
> Fax: *333-222-5554*
> Best way to contact: *Email*

☐ 2. **Overview description**: Please provide a short description (1 brief paragraph) of your university.

> *Orchard is a private research university in a suburban setting located in the eastern United States, with an enrollment of about 14,000 students, divided equally between graduate and undergraduate students. Orchard's School of Engineering is one of three schools at Orchard that offers an undergraduate degree. The University attracts students from around the nation and the world, with fifty percent of students classified as non-Caucasian. Of the approximately 1600 freshmen entering each year, 550 to 620 tend to self-identify as being interested in engineering. (Entering freshmen do not formally declare majors.)*

☐ 3. **List of engineering majors**: Please provide a list of your institution's engineering majors (as defined by your institution).

> *Orchard's: chemical engineering, civil engineering, computer science, electrical engineering, mechanical engineering, management engineering, materials science, industrial design, and environmental engineering. (In the enrollment chart, industrial design and environmental engineering are counted as "Engineering")*

This material is based upon work supported by the United States National Science Foundation under Grant No. ESI-0227558.

4. **List of technical non-engineering majors**: Please provide a list of technical non-engineering majors at your institution. We define technical non-engineering majors as non-engineering majors that share some of the mathematical, scientific and/or technological aspects of an engineering major, e.g. majors that:
   - share engineering prerequisites
   - many students who started off in engineering later migrated to
   - produce graduates who may take jobs similar to engineering graduates.

   At Orchard: Applied Mathematics, Economics, Physics, Management Sciences. (Economics at Orchard is highly analytical)

5. **Overview of major declaration process**: Please provide a brief description of how and when students declare an engineering major at your institution.

   Students apply to Orchard without specifying an intended major. They must declare their major by the first quarter of their junior year or by the time they have completed 85 units. At Orchard we are able to get an estimate of the number of incoming potential Freshmen engineering students from a form they fill out (after being admitted) where we ask their preliminary area of academic interests for the purpose of assigning them an academic advisor.

6. ***Engineering* enrollment and graduation figures**: Please provide the most recent enrollment and graduation numbers for your School of Engineering. (Your institution's current figures are preferable to existing ASEE figures).

ORCHARD's* ENGINEERING ENROLLMENT – *Fall 2007	***Frosh 1st Year***	***Soph 2nd Year***	***Junior 3rd Year***	***Senior 4th Year***	***Part Time Total***	***Full Time Total***
Chemical Engineering (B.S.)	*0*	*5*	*16*	*24*	*0*	*45*
Civil Engineering (B.S.)	*0*	*3*	*17*	*29*	*0*	*49*
Undeclared	*605*	*547*	*100*	*10*	*0*	*1262*
Computer Science (B.S.)	*0*	*17*	*44*	*84*	*0*	*145*
Electrical Engineering (B.S.)	*0*	*9*	*38*	*71*	*0*	*118*
Engineering (B.S.)	*0*	*2*	*46*	*58*	*0*	*106*
Management Engineering (B.S.)	*0*	*6*	*31*	*74*	*0*	*111*
Materials Science (B.S.)	*0*	*0*	*1*	*2*	*0*	*3*
Mechanical Engineering (B.S.)	*0*	*4*	*37*	*63*	*0*	*104*
TOTAL	*605**	*593**	*330*	*415*	*0*	*1943*
* *Frosh and Soph engineering majors largely estimated from students' preliminary areas of academic interest at acceptance to Orchard.*						

GRADUATION FIGURES: In 2007, 89% of Orchard's declared engineering students graduate within four years of enrolling at Orchard.

Source: *Orchard's Registrar's Office*

This material is based upon work supported by the United States National Science Foundation under Grant No. ESI-0227558.

☐ 7. ***University* enrollment and graduation figures**: Please provide the most recent undergraduate enrollment and graduation numbers for your institution.

ORCHARD UNDERGRADUATE ENROLLMENT – Fall 2007	***Frosh***	***Soph***	***Junior***	***Senior***	***Total***
All Undergraduates	*1623*	*1689*	*1598*	*1678*	*6588*

Source: Orchard's Registrar's Office

☐ 8. **Unique sub-populations**: Does your institution have a (or several) unique sub-population of students? APPLES tracks gender, ethnicity, enrollment status (part-time versus full-time), and international students. Examples of other unique sub-populations might be a high commuter population or a large number of "non-traditional" students.

At Orchard, we have a large number of international students. Almost all of our undergraduates are 18-22 years old and live on campus.

☐ 9. **Choose a deployment week:** From the list below please rank your preferences for the week APPLES will be deployed at your institution (and note if any of the dates would not work at all.)

- 28 January-1 February
- 11-15 February
- 25-29 February

Things to consider: (1) *Your schedule* as additional recruitment during the week of deployment may require extra time from you. (2) *Your institution's schedule*, e.g. other surveys that your institution may be taking part in, holidays or special events. In our experience, the end of the term is not a good time to deploy a survey – the beginning seems to be fine.

(1) 28 January-1 February, (2) 25-29 February, (3) 11-15 February. Option 3 is highly undesirable for us because we have "Engineering Week" that week – most of our engineering students will be off campus doing different projects and may not be as likely to participate in an online survey.

☐ 10. **Significant structure changes?** In the last year, have there been any significant structural, curricular, or institutional changes at your university that would impact the profile of your student body?

We are in the process of reorganizing our engineering curriculum to better meet specific ABET criteria – we do not however, expect this to noticeably impact our students.

This material is based upon work supported by the United States National Science Foundation under Grant No. ESI-0227558.

ORCHARD - APPLES Recruitment Plan

This is the last assignment we will ask you to do for us before the APPLES deployment on your campus in early 2008. We estimate it will take no more than one hour to complete. The information below will assist us and you in recruiting the needed subject participation in APPLES to achieve meaningful results. If you have any questions, please email your APPLES liaison. This is due: 15 November 2007. Thanks!

Coordinator: **Dr. Robert Jones**, Associate Dean, School of Engineering
Contact*:* **robert.jones@orchard.edu**

Recruitment classification: **SMALL** (> 500 undergraduate engineering students)
Deployment week: **28 January - 1 February** (Your 1st choice)
Your campus survey URL: **http://orchard.applesurvey.org**

(1) How many APPLES posters would you like us to send you?
See attached – they are 11" x 17" and will be tailored to your institution. We are able to send you up to 20 posters.

(2) Choose one of the suggested pseudonyms below for your institution.
In all external publications discussing APPLES data or findings (except your institution's final APPLES report), pseudonyms will be used to refer to participating institutions.

- ☐ Connerman University
- ☐ State Tech University
- ☐ Midland University

(3) Complete the shaded Orchard columns for Recruitment Plans A and B.
Please see "Notes on Recruitment Plans and APPLES Deployment" (page 3) for instructions and additional information. The "Orchard" column of the Recruitment Plan provides sample recruitment methods for each of the stratum.

Plan A – Planned Recruitment for APPLES Subjects

Strata (min target)	**Response rate needed at Orch**	**Orchard**	**Grove (*sample*)**
All (50)	16^{+}%		Email to entire undergraduate engineering list Posters – around campus
Engineering students (40)	16%		Same as above.
Non-persisters (10) [students who initially intended to study engineering but opted for a non-engineering major]			Targeted email to students majoring in non-engineering fields (i.e., chemistry, math, economics departmental email lists)

Plan B (Targeted recruitment if minimum responses are not achieved)

Strata (min target)	**Response rate needed at Orch**	**Orchard**	**Grove (*sample*)**
Female students (10)	?		Email to SWE members
Male students (10)	4%		(won't be a problem)
Minority students (0)	n/a		Email to Minority Engineering program
International students* (10)		Let's discuss the International students	Email to International Student Center distribution list
Transfer students (?)		Let's discuss	Email to transfer students
Freshmen (10)	9%		Email to freshmen
Sophomore (10)	16%		Email to sophomores
Juniors (10)	29%		Email to juniors
Seniors (10)	22%		Email to seniors
Non-persisters (still can't get enough...)			Follow-up email to students majoring in non-engineering fields (i.e., chemistry, math, economics)
Specific engineering major			Targeted email to students in underrepresented major(s)
Part-time students	n/a		NA

* Denotes special sub-populations at ORCH: International exchange students.

Notes on the Recruitment Plans and APPLES Deployment at Orchard

Orchard's strata targets for APPLES are listed in the recruitment plans. These numbers are based on your institution's overall and engineering undergraduate enrollments, and the requirements for statistical analysis given the other institutions taking part in APPLES. Based on the required response rates, we may need to put extra effort into recruiting juniors, seniors and women at Orchard. We need a minimum of ten International respondents in order to do statistical analysis on that stratum, which may not be realistic.

Plan A is the recruitment that your campus will undertake the week of the survey deployment. Based on previous deployments of APPLES, we recommend that the primary means of recruiting students be an email from an engineering dean or other senior engineering administrator at your institution to engineering students. (We will provide suggested text.) We also will be sending you posters tailored to your campus' APPLES participation (please specify how many posters you would like on your Recruitment Plan). We have found that posters increase general awareness of APPLES on campus among both students and faculty. We have also found that advertising in student newspapers does *not* significantly increase student participation.

The Survey and Daily Updates: The Orchard APPLE survey will turn "on" at 12:01 am on Monday, January 28, 2008, and will turn "off" at 11:59 pm on Friday, February 1, 2008 (Pacific Standard Time). During the APPLES deployment on your campus, a member of the APPLES team will send you a daily report of survey response rates from your campus by strata, noting those strata that have been fulfilled. You will receive the report between 3 and 6 pm (PST).

Plan B is the strategic recruitment you *may* need to undertake during the week of survey deployment if your campus' responses are falling short of strata targets. Based on the numbers in your daily reports, you (the campus coordinator) will determine if you need to implement parts of Plan B. For example, if by February 30 (Wed) only 6 women have filled out the survey (and 10 are needed from your campus) - you may decide to send an email to the SWE members first thing Thursday (January 31) morning. We urge you to be strategic in your Plan B recruitment – for example, we have found that targeting specific groups with low responses is *much* more effective than repeating mass emails to all students.

In rare cases, we and you may choose to extend the deployment period on your campus. Our experience with previous deployments indicates that most students take the survey immediately following the email announcement or reminder. (Thus, extending the survey doesn't buy us much.)

"Non-persisters" are students who initially intended to study engineering when they arrived at university, but later decided to pursue a non-engineering major. We have found the best way to recruit non-persister students is to send an email announcement of APPLES to non-engineering technical departments at your institution. From your Institutional Overview Checklist, these departments are:

At Orchard: information systems, mathematics, mathematics/computer science, chemistry, and biology

Incentives of $4 paid through PayPal will be offered to all APPLES subjects. The APPLES team will handle all aspects of administering incentives to subjects. We reserve the right to temporarily close your institution's survey if we detect widespread fraud (individuals repeatedly claiming the incentive). Should this happen, we will immediately notify you and have the survey offline only for the time required to address the problem.

What's next? After we receive your institution's recruitment plan, your APPLES liaison will seek to schedule a phone meeting with you (late November/early December). She will answer any questions you have and give you a more detailed rundown of what to expect during deployment week.

While this is the last "assignment" from us, there are still some "to do's" we recommend you consider:

- Determine who has access to the email distribution lists you will need to recruit the different strata, and contacting him/her in advance. This may be a bit more challenging, for example, with freshmen who intend to study engineering but have not yet declared the major.
- Decide who will hang the APPLES posters, and the most appropriate places given your strata targets (and various institutional rules about hanging posters).
- Come up with a schedule for the week of deployment to help you be sure you hit your target responses. In our experience, it is difficult to recruit more than 30% of any population (even with the incentive) – so coordinators at smaller schools may need to spend more time on strategic recruitment (Plan B) during deployment. We estimate that coordinators spend 2-10 hours on APPLES related activities the week leading up to and the week of APPLES deployment.

If you have any questions at all, please don't hesitate to contact your APPLES liaison.

undergraduate

studying ^ engineering now?

-or- **ever been interested in engineering?**

dates online

http://www.applesurvey.org

✓ **take a 10-minute survey** earn $4 (through PayPal)

The APPLE (Academic Pathways of People Learning Engineering) survey is trying to learn about students' experience in engineering to improve the educational process. That is why it is important to hear from you! It is part of a study funded by the National Science Foundation and supported by your institution's School of Engineering.

NSF

SCHOOL EMBLEM

Appendix 2-D
Sample APPLES Recruitment Email (to students in the school of engineering)

Subject: Please take 10 minutes for "APPLES"

Dear Student,

[Orchard] is taking the lead in a large, national survey, APPLES, of undergraduate students who intended to study engineering when they entered university. We want to learn more about the experiences and motivations of students like you. APPLES stands for the Academic Pathways of People Learning Engineering Survey. I ask your assistance in taking part in this study by completing a **10-15 minute online survey from [February 11-15].**

Who we are interested in?

- Undergraduates (18 years of age and older) who are majoring, or ever considered majoring in engineering (declared or not)

Why is this important?

- Not enough information is available about the experiences of students who studied or considered studying engineering – and we want to change this. We hope the information we learn from you will lead to improvements in the way engineering is taught in the United States.

What is involved?

- A 10-15 minute survey online

Where do I find it?

- **orchard.applesurvey.org**

When should I take it?

- The survey is only open from Monday (Feb 11) through Friday (Feb 15).

And?

- You will receive $4 through PayPal for your participation, but more importantly you will have made a contribution to research and to the education of future generations.
- All the data we collect are confidential.

Please take part – and please encourage your friends to take part.

If you would like more information on the survey, please contact [Orchard's APPLES coordinator name and email].

Thank you,

[Dean/Senior Administrator]
[Title of Senior Administrator]
[Institution] School of Engineering

Appendix 2-E
APPLES Recruitment Email for Non-persisters (to students NOT in the school of engineering)

Subject: Interested in engineering before economics?

Dear Student,

Did you declare a major in economics after thinking you were going to study engineering?

Orchard is taking the lead in a large, national survey, APPLES, of undergraduate students who intended to study engineering when they entered university. We want to learn more about the experiences and motivations of students like you. APPLES stands for the Academic Pathways of People Learning Engineering Survey. I ask your assistance in taking part in this study by completing a **10-15 minute online survey from February 11 to February 15.**

Who we are interested in?

- Undergraduates (18 years of age and older) who ever considered majoring in engineering (declared or not)

Why is this important?

- Not enough information is available about the experiences of students who studied or considered studying engineering – and we want to change this.

What is involved?

- A 10-15 minute survey online

Where do I find it?

- **orchard.applesurvey.org**

When should I take it?

- The survey is only open from **February 11 (Monday)** through **February 15 (Friday)**.

And?

- You will receive $4 through PayPal for your participation, but more importantly you will have made a contribution to research and to the education of future generations.
- All the data we collect are confidential.

Please take part – and please encourage your friends to take part.

If you would like more information on the survey, please contact [Orchard's APPLES coordinator name and email].

Thank you,

[Dean/Senior Administrator]
[Title of Senior Administrator]
[Institution]

Appendix 3-A

APS Structured Interview Protocol Example

ACADEMIC PATHWAYS STUDY
INTERVIEW PROTOCOL (EXAMPLE)
TECHNICAL PUBLIC INSTITUTION/URBAN PRIVATE UNIVERSITY/ SUBURBAN PRIVATE UNIVERSITY/ LARGE PUBLIC UNIVERSITY

PART I.

INSTRUCTIONS

Good morning (afternoon). My name is ___. Thank you for coming. This interview involves two parts. The first part is a survey, in which I will ask you about your experiences as a student at this university. The purpose is to get your perceptions of your experiences inside and outside of the classroom. There are no right or wrong or desirable or undesirable answers. I would like you to feel comfortable with saying what you really think and how you really feel. The second part is a short pencil-and-paper task, and I will give you specific instructions for completing that task once we have finished with the survey.

TAPE RECORDER INSTRUCTIONS

If it is okay with you, I will be tape-recording our conversation. The purpose of this is so that I can get all the details but at the same time be able to carry on an attentive conversation with you. I assure you that all your comments will remain confidential. I will be compiling a report which will contain all students' comments without any reference to individuals.

PREAMBLE/CONSENT FORM INSTRUCTIONS

Before we get started, please take a few minutes to read this preamble (read and sign this consent form). (Hand R consent form/preamble.) (After R returns preamble/consent form, turn tape recorder on.)

Q1. What is your major?

Q2. What year did you graduate from high school?

Q3. Did you participate in a Freshman Summer Bridge Program the summer after you graduated from high school?

Yes

No → Skip to Q4

Q3a. What were the most helpful aspects of that program?

Q4. Are you a member of any engineering student organizations on campus?

Yes | No → Skip to Q5

Q4a. What are those organizations?

Q4b. What are the most helpful aspects of that/those organization(s)?

Q5. In your own words, would you please define engineering?

Q6. Are there particular skills that you would say are important for an engineer to have?

Yes | No → Skip to Q7

Q6a. (IF NOT ALREADY ANSWERED) What are those skills?

Q6b. Of the skills that you mentioned, which ones do you possess?

Q6c. Please tell me about how you developed your skill(s)?

Q7. Have you had any experiences inside or outside of your classes that have enabled you to be creative?

Yes

If R asks for definition

Say "Just whatever it means to you – anything *you* would call creative"

No → Skip to Q8

Q7a. (IF NOT ALREADY ANSWERED) Please describe those experiences.

Q8. Have you had any experiences inside or outside of your classes that have prevented you from being creative?

Yes

No → Skip to Q9

Q8a. (IF NOT ALREADY ANSWERED) Please describe those experiences.

Q9. Have you had any experiences inside or outside of your classes that have enabled you to solve problems?

Yes

If R asks for definition → Say "Just whatever problems come to your mind"

No → Skip to Q10

Q9a. (IF NOT ALREADY ANSWERED) Please describe those experiences.

Q10. Have you had any experiences inside or outside of your classes that have prevented you from solving problems?

Yes

No → Skip to Q11

Q10a. (IF NOT ALREADY ANSWERED) Please describe those experiences.

Q11. Have you had any experiences inside or outside of your classes that have enabled you to develop general engineering knowledge?

Yes

If R asks for definition

Say "Just whatever it means – anything that comes to your mind"

No → Skip to Q12

Q11a. (IF NOT ALREADY ANSWERED) Please describe those experiences.

Q12. Have you had any experiences inside or outside of your classes that have prevented you from developing general engineering knowledge?

Yes

No → Skip to Q13

Q12a. (IF NOT ALREADY ANSWERED) Please describe those experiences.

Q13. Where do you see evidence of your engineering aptitude?

If R asks what is aptitude

SAY “Just whatever it means to you – anything that comes to your mind”

Otherwise, after R responds go to Q14

Q14. On a scale from 0 – 10, (where 0 = not confident at all and 10 = extremely confident), how confident are you in your math ability? ______

Q14a. Describe the experiences that led you to rate yourself in this way. (REMIND THEM OF SCORE IF THEY ASK.)

Q15. On a scale from 0 – 10, (where 0 = not confident at all and 10 = extremely confident), how confident are you in your science ability? ______

Q15a. Describe the experiences that led you to rate yourself in this way. (REMIND THEM OF SCORE IF THEY ASK.)

Q16. On a scale from 0 – 10, (where 0 = not confident at all and 10 = extremely confident), how confident are you in your design ability? ______

Q16a. Describe the experiences that led you to rate yourself in this way. (REMIND THEM OF SCORE IF THEY ASK.)

Q17. Are there any aspects of engineering that you particularly like?

Yes → Q17a.   No → Skip to Q18

Q17a. (IF NOT ALREADY ANSWERED) What are some of those?

Q18. Are there any aspects of engineering that you particularly dislike?

Yes → Q18a.   No → Skip to Q19

Q18a. (IF NOT ALREADY ANSWERED) What are some of those?

Q19. In general, how do you feel about engineers?

Q19a. (IF NOT ALREADY ANSWERED) And why?

Q20. How do you believe members of other professions feel toward engineers?

Q20a. (IF NOT ALREADY ANSWERED) And why?

Q21. Are any of your family members or close acquaintances working engineers?

Yes

No → Skip to Q22

Q21a. (IF NOT ALREADY ANSWERED) Who?

Q21b. Did their experiences influence your decision to become an engineer?

Yes

No → Skip to Q22

Q21c. (IF NOT ALREADY ANSWERED) How?

Q22. How important is being an engineering student to how you feel about yourself?

Q22a. (IF NOT ALREADY ANSWERED) And why?

Q23. How committed are you to pursuing an engineering major?

Q23a. (IF NOT ALREADY ANSWERED) And why?

Q24. What do you see yourself doing after graduation?

Q25. Are there any aspects of your education at this institution that you find particularly difficult in achieving your academic goals?

Yes

No → Skip to Q26

Q25a. (IF NOT ALREADY ANSWERED) Please tell me about those difficulties.

Q25b. How do you deal with those difficulties?

Q26. Are there any aspects about being an engineering major at this institution that you find particularly difficult in achieving your academic goals?

Yes

No → Skip to Q27

Q26a. (IF NOT ALREADY ANSWERED) Please tell me about those difficulties.

Q26b. How do you deal with those difficulties?

Q27. Are there any aspects of your education at this institution that you find particularly helpful in achieving your academic goals?

Yes

No → Skip to Q28

Q27a. (IF NOT ALREADY ANSWERED) Please tell me about those helpful aspects.

Q28. Are there any aspects of being an engineering major at this institution that you find particularly helpful in achieving your academic goals?

Yes

No → Skip to SECTION II

Q28a. (IF NOT ALREADY ANSWERED) Please tell me about those helpful aspects.

SECTION II.
PERFORMANCE TASK (USED IN YEARS 1 AND 3)

INSTRUCTIONS:
At this time, I'd like to ask you to work on a short activity. While I hope that it is a fun activity for you, I would also like you to give it your best effort. You have up to ten minutes to work on it. Please let me know if you are done before that. Do you have any questions? OK, here is the activity—I'm going to read it with you, out loud (CHECK START TIME ON AUDIO RECORDER AND INDICATE IT IN THE BOX BELOW. THEN HAND **R** THE PERFORMANCE TASK FORM.).

Start time: | RECORD TIME HERE |

PTQ1: (NEXT READ THE FOLLOWING ALOUD TO **R)** Over the summer the Midwest experienced massive flooding of the Mississippi River. What factors would you take into account in designing a retaining wall system for the Mississippi?

TRANSITION:
(CHECK END TIME ON AUDIO RECORDER, AND IF NECESSARY): *Okay, it's been 10 minutes now, please stop.*

End time: | RECORD TIME HERE |

PTQ2: What questions came to your mind as you were brainstorming your list?

(THE QUESTIONS NEED TO BE FULLY FORMULATED. IF **R** OFFERS A FRAGMENT AS A QUESTION, INSTRUCT HIM/HER TO CLARIFY HOW HE/SHE USED IT IN A QUESTION AND TO STATE THE FULL QUESTION. IT IS OKAY FOR **R** TO BROWSE THROUGH THE LIST OF FACTORS HE/SHE HAS WRITTEN, BUT THERE IS NO NEED TO SUGGEST THIS IN YOUR INSTRUCTIONS. **R** SHOULD BE ABLE TO PROVIDE 5-10 QUESTIONS IN 2-3 MINUTES.)

TRANSITION:
(COLLECT PAPER) *Great! Thank you. We hope that you've enjoyed this activity and we want to make sure that you know that there are many right answers. We've used it to collect information from engineering students across the nation to understand the types of things students think about.*

Over the summer the Midwest experienced massive flooding of the Mississippi River. What factors would you take into account in designing a retaining wall system for the Mississippi?

SECTION II.
PERFORMANCE TASK (USED IN YEARS 2 AND 4)

INSTRUCTIONS:

At this time, I'd like to ask you to work on a short activity. This is the kind of activity that has many different kinds of answers. We would like you to give it your best effort. You have up to fifteen minutes to work on it. I will let you know when there is five minutes left, so you have an idea about how much time has passed. Please let me know if you are done before the fifteen minutes is up. Do you have any questions? OK, here is the activity. (CHECK START TIME ON AUDIO RECORDER AND INDICATE IT IN THE BOX BELOW. THEN HAND **R** THE PERFORMANCE TASK FORM.).

Start time: RECORD TIME HERE

PTQ1. (ALLOW THE STUDENT TO READ AND SOLVE THE PROBLEM ON THEIR OWN**)**

TRANSITION:

(CHECK END TIME ON AUDIO RECORDER, AND IF NECESSARY):
Okay, it's been 10 minutes now; you have 5 more minutes to solve the problem.
Okay, it's been 15 minutes now, please stop.

End time: RECORD TIME HERE

PTQ2. What questions came to your mind as you were solving the problem? Please voice your thoughts in the form of questions as if you are playing Jeopardy.

(THE QUESTIONS **MUST** BE FULLY FORMULATED. IF **R** OFFERS A FRAGMENT AS A QUESTION, REMIND **R** TO SPEAK AS IF HE/SHE IS PLAYING JEOPARDY, AND ASK **R** TO CLARIFY HOW HE/SHE USED THE FRAGMENT IN A QUESTION. IF **R** IS NOT FAMILIAR WITH JEOPARDY, TELL **R** THAT IT IS OKAY, AND THAT ALL HE/SHE NEEDS TO DO IS TO RESPOND IN QUESTIONS ONLY. IT IS OKAY FOR **R** TO BROWSE THROUGH THE LIST OF SOLUTIONS HE/SHE HAS WRITTEN, BUT THERE IS NO NEED TO SUGGEST THIS IN YOUR INSTRUCTIONS. IF **R** OFFERS 2 QUESTIONS OR LESS, PROMPT HIM/HER AGAIN. **R** SHOULD BE ABLE TO PROVIDE 5-10 QUESTIONS IN 2-3 MINUTES.)

PTQ3. To what extent do you feel this is an engineering problem?

PTQ3a. (IF NOT ALREADY ANSWERED) And why?

PTQ4. What knowledge and skills helped you solve the problem?

PTQ5. Where did you develop your knowledge and skills to solve the problem?

PTQ5a. (IF NOT ALREADY ANSWERED) Please describe those experiences in more detail.

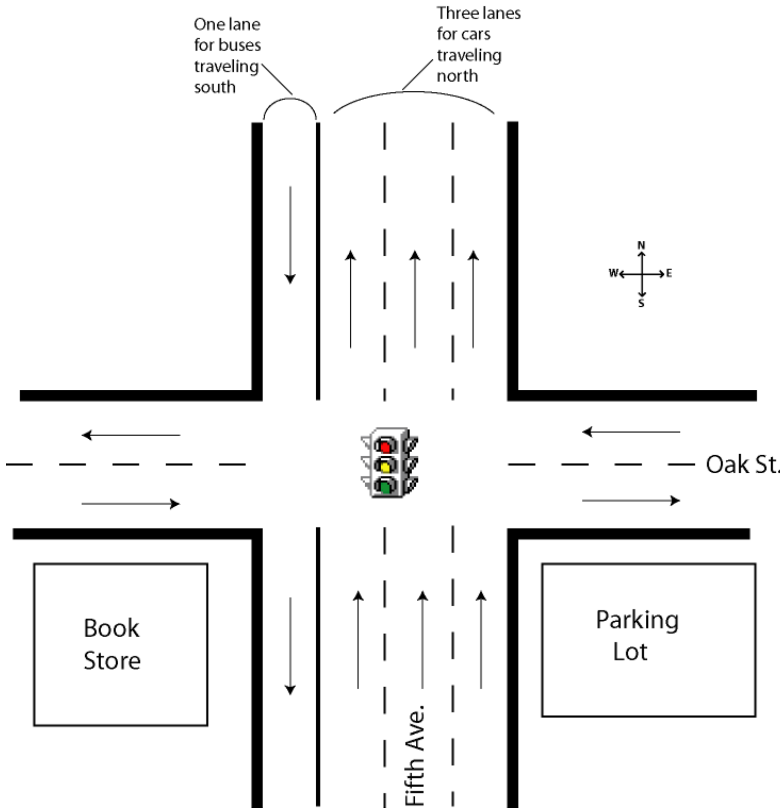
TRANSITION:

(COLLECT PAPER) *Great! Thank you. We hope that you've enjoyed this activity and we want to make sure that you know that there are many right answers. We've used it to collect information from engineering students across the nation to understand the types of things students think about.*

Respondent ID: _____________

As an engineer, you have been asked to solve a problem on the State University campus. Just like campuses across the country, the State University campus is often overcrowded with pedestrians crossing the streets.

One busy intersection on campus is the crossing of Fifth Ave. in front of the bookstore. Dangers at this intersection include heavy traffic and busses which run against the general traffic flow (see diagram below). The University would like to design a cost effective method for students to cross Fifth Ave. which would reduce the possibility of accidents at this intersection. You have been assigned to design a solution to this problem for presentation to the University Traffic Committee.



In the process of designing your solution you have been asked to respond to the set of questions on the following pages. The interviewer has more paper if you need it.

1 – What is the problem as you see it?

2 – List potential solution(s) for this problem.

3 – From your list in Question 2, choose the potential solution you think is best and provide a detailed evaluation of your solution.

4 – What kinds of additional information would help you solve this problem?

SECTION IV.
DEBRIEFING

(READ ALL OF THE FOLLOWING ALOUD TO **R**.)

Thank you very much for coming this morning (afternoon). Your time is very much appreciated and your comments have been very helpful.

The purpose of this interview is to better understand students' perceptions of their experiences inside and outside of the classroom. We are interested in your opinions and your reactions. In no way is this interview designed to individually evaluate a person's abilities. The task is not diagnostic, nor can it provide a measure of the "quality" of your performance. Your only requirement was to do the best job that you could.

The results of this research will provide useful information to engineering educators, in helping them to structure educational programs that students consider to be most effective and ideal in helping them through college.

You will be kept anonymous during all phases of this study including any experimental writings, published or not. Procedures for maintaining confidentiality are as follows: (1) individual participants' results will be pooled with group results; and (2) participants should not place any identifying information on data collection instruments. (Such identifiers include name, social security number, student identification number, specific birth data, telephone number, address, etc.)

DQ1. Is there any other information regarding your experience that you think would be useful for me to know?

Yes ↓ No

DQ1a. (IF NOT ALREADY ANSWERED) Please share that information with me.

Again, thank you for participating. (TURN TAPE-RECORDER OFF.)

SECTION V.
INTERVIEWER REFLECTION

INSTRUCTIONS:
After the respondent leaves the room, please take a couple of minutes to indicate your reactions and observations about the interview. An electronic copy of this form has been provided. Feel free to use this hard copy for your own notes, but please submit the electronic copy for official use.

Your name (the interviewer):	
Your race:	
Your gender:	
Your age:	

Respondent ID No.:	
Date of Interview:	
Please describe the respondent's attitude toward you and the interview:	
Please describe any unusual circumstances and/ or events that had any bearing on the interview such as interruptions, language difficulty, etc.:	
Please describe anything else that happened during the interview that has any bearings on the study's objectives:	
Additional comments:	

SECTION VI.
PROBES FOR FORMAL INTERVIEW

Interviewer's Probe	***Abbreviation***
Repeat Question……………………………	RQ
Anything else?...	AE or Else?
Any others?..	AO?
How do you mean?......................................	How mean?
Could you tell me more about your thinking on that?..	Tell more
Would you tell me what you have in mind?...	What in mind?
What do you mean?......................................	What mean?
Why do you feel that way?...........................	Why?
Which would be closer to the way you fell?...	Which closer?

SECTION VII.
POTENTIAL QUESTIONS R MAY ASK (AND APPROPRIATE ANSWERS):

1. What is a factor?
   You just need to " List the things that you would take into account in designing a retaining wall system for the Mississippi."

2. What is a retaining wall system?
   A system that keeps water inside the river.

3. What is massive flooding?
   When a lot of water does not stay inside the river.

4. Is a wall necessary? / Does it need to be a wall? / Why a retaining wall?
   You can interpret the question however you like.

5. Who asked to have the wall built?
   I don't have any information on that.

6. Midwest of what?
   The Midwest of the United States.

7. The whole Mississippi, or just part of it?
   You can do what you like.

8. List vs. pictures
   You can do what you like.

9. Quantity vs. quality of responses.
   You can do what you like.

10. What do they use now to control the flooding?
    I don't have any information on that.

11. Does this mean a retaining wall like on the sides of the river?
    Yes, it is a system that keeps water inside the river.

12. Is that what you want(ed)?
    That's great! Thanks!

Appendix 3-B
APS Engineering Task Protocols and ETD Data Sets

Problem-Scoping Task Protocol
(2004)

INSTRUCTIONS:
At this time, I'd like to ask you to work on a short activity. While I hope that it is a fun activity for you, I would also like you to give it your best effort. You have up to ten minutes to work on it. Please let me know if you are done before that. Do you have any questions? OK, here is the activity—I'm going to read it with you, out loud (CHECK START TIME ON AUDIO RECORDER AND INDICATE IT IN THE BOX BELOW. THEN HAND **R** THE PROBLEM-SCOPING TASK FORM.).

Start time:

PTQ1: (NEXT READ THE FOLLOWING ALOUD TO **R)** Over the summer the Midwest experienced massive flooding of the Mississippi River. What factors would you take into account in designing a retaining wall system for the Mississippi?

TRANSITION:
(CHECK END TIME ON AUDIO RECORDER, AND IF NECESSARY): *Okay, it's been 10 minutes now, please stop.*

End time:

PTQ2: What questions came to your mind as you were brainstorming your list?

(THE QUESTIONS NEED TO BE FULLY FORMULATED. IF **R** OFFERS A FRAGMENT AS A QUESTION, INSTRUCT HIM/HER TO CLARIFY HOW HE/SHE USED IT IN A QUESTION AND TO STATE THE FULL QUESTION. IT IS OKAY FOR **R** TO BROWSE THROUGH THE LIST OF FACTORS HE/SHE HAS WRITTEN, BUT THERE IS NO NEED TO SUGGEST THIS IN YOUR INSTRUCTIONS. **R** SHOULD BE ABLE TO PROVIDE 5-10 QUESTIONS IN 2-3 MINUTES.)

TRANSITION:
(COLLECT PAPER) *Great! Thank you. We hope that you've enjoyed this activity and we want to make sure that you know that there are many right answers. We've used it to collect information from engineering students across the nation to understand the types of things students think about.*

Performance Task (2005)

INSTRUCTIONS:
At this time, I'd like to ask you to work on a short activity. This is the kind of activity that has many different kinds of answers. We would like you to give it your best effort. You have up to fifteen minutes to work on it. I will let you know when there is five minutes left, so you have an idea about how much time has passed. Please let me know if you are done before the fifteen minutes is up. Do you have any questions? OK, here is the activity. (CHECK START TIME ON AUDIO RECORDER AND INDICATE IT IN THE BOX BELOW. THEN HAND **R** THE PERFORMANCE TASK FORM.).

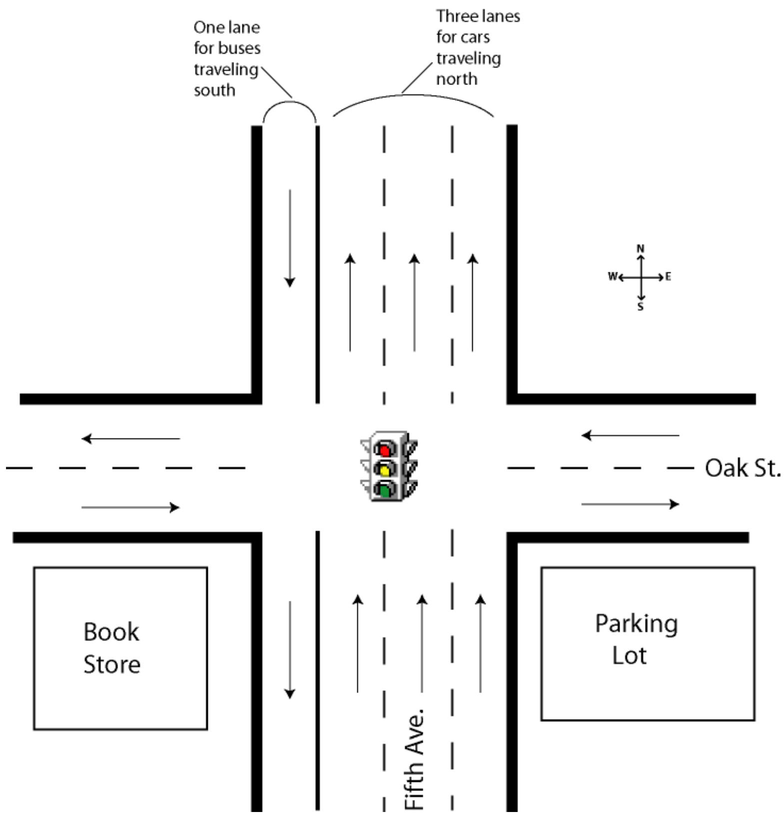
Start time: RECORD TIME HERE

PTQ1. (ALLOW THE STUDENT TO READ AND SOLVE THE PROBLEM ON THEIR OWN**)**

Respondent ID: _____________

As an engineer, you have been asked to solve a problem on the State University campus. Just like campuses across the country, the State University campus is often overcrowded with pedestrians crossing the streets.

One busy intersection on campus is the crossing of Fifth Ave. in front of the bookstore. Dangers at this intersection include heavy traffic and busses which run against the general traffic flow (see diagram below). The University would like to design a cost effective method for students to cross Fifth Ave. which would reduce the possibility of accidents at this intersection. You have been assigned to design a solution to this problem for presentation to the University Traffic Committee.



In the process of designing your solution you have been asked to respond to the set of questions on the following pages. The interviewer has more paper if you need it.

1 – What is the problem as you see it?

2 – List potential solution(s) for this problem.

3 – From your list in Question 2, choose the potential solution you think is best and provide a detailed evaluation of your solution.

4 – What kinds of additional information would help you solve this problem?

TRANSITION:

(CHECK END TIME ON AUDIO RECORDER, AND IF NECESSARY):
Okay, it's been 10 minutes now; you have 5 more minutes to solve the problem.
Okay, it's been 15 minutes now, please stop.

End time: RECORD TIME HERE

PTQ2. What questions came to your mind as you were solving the problem? Please voice your thoughts in the form of questions as if you are playing Jeopardy.

(THE QUESTIONS **MUST** BE FULLY FORMULATED. IF **R** OFFERS A FRAGMENT AS A QUESTION, REMIND **R** TO SPEAK AS IF HE/SHE IS PLAYING JEOPARDY, AND ASK **R** TO CLARIFY HOW HE/SHE USED THE FRAGMENT IN A QUESTION. IF **R** IS NOT FAMILIAR WITH JEOPARDY, TELL **R** THAT IT IS OKAY, AND THAT ALL HE/SHE NEEDS TO DO IS TO RESPOND IN QUESTIONS ONLY. IT IS OKAY FOR **R** TO BROWSE THROUGH THE LIST OF SOLUTIONS HE/SHE HAS WRITTEN, BUT THERE IS NO NEED TO SUGGEST THIS IN YOUR INSTRUCTIONS. IF **R** OFFERS 2 QUESTIONS OR LESS, PROMPT HIM/HER AGAIN. **R** SHOULD BE ABLE TO PROVIDE 5-10 QUESTIONS IN 2-3 MINUTES.)

PTQ3. To what extent do you feel this is an engineering problem?

PTQ3a. (IF NOT ALREADY ANSWERED) And why?

PTQ4. What knowledge and skills helped you solve the problem?

PTQ5. Where did you develop your knowledge and skills to solve the problem?

PTQ5a. (IF NOT ALREADY ANSWERED) Please describe those experiences in more detail.

PTQ6. Did you feel confident in your ability to complete this task?

PTQ6a. (IF NOT ALREADY ANSWERED) And why?

TRANSITION:

(COLLECT PAPER) *Great! Thank you. We hope that you've enjoyed this activity and we want to make sure that you know that there are many right answers. We've used it to collect information from engineering students across the nation to understand the types of things students think about.*

Performance Task (2006)

TRANSITION FOR ETHNOGRAPHIC INTERVIEWS:
The last part of today's session has a different format from the interview we just completed. I will be reading instructions and questions from a script.

INSTRUCTIONS:
At this time, I'd like to ask you to work on a short activity. While I hope that it is a fun activity for you, I would also like you to give it your best effort. You have up to ten minutes to work on it. Please let me know if you are done before that. Do you have any questions?

OK, here is the activity—I'm going to read it with you, out loud. You might remember this activity if you were asked to do it two years ago as part of this study. (CHECK START TIME ON AUDIO RECORDER AND INDICATE IT IN THE BOX BELOW. THEN HAND **R** THE PERFORMANCE TASK FORM.).

Start time: ___ : ___ : ___
HH MM SS

PTQ1: (NEXT READ THE FOLLOWING ALOUD TO **R**) *Over the summer the Midwest experienced massive flooding of the Mississippi River. What factors would you take into account in designing a retaining wall system for the Mississippi?*

TRANSITION:
(CHECK END TIME ON AUDIO RECORDER, AND IF NECESSARY): *Okay, it's been 10 minutes now, please stop.*

End time:

PTQ2: What questions came to your mind as you were brainstorming your list?

(THE QUESTIONS **MUST** BE FULLY FORMULATED. IF **R** OFFERS A FRAGMENT AS A QUESTION, REMIND **R** TO SPEAK AS IF HE/SHE IS PLAYING JEOPARDY, AND ASK **R** TO CLARIFY HOW HE/SHE USED THE FRAGMENT IN A QUESTION. IF **R** IS NOT FAMILIAR WITH JEOPARDY, TELL **R** THAT IT IS OKAY, AND THAT ALL HE/SHE NEEDS TO DO IS TO RESPOND IN QUESTIONS ONLY. IT IS OKAY FOR **R** TO BROWSE THROUGH THE LIST OF SOLUTIONS HE/SHE HAS WRITTEN, BUT THERE IS NO NEED TO SUGGEST THIS IN YOUR INSTRUCTIONS. IF **R** OFFERS 2 QUESTIONS OR LESS, PROMPT HIM/HER AGAIN. **R** SHOULD BE ABLE TO PROVIDE 5-10 QUESTIONS IN 2-3 MINUTES.)

(IF YOU HAVE A YEAR 1 MIDWEST FLOODS WRITTEN RESPONSE FOR **R**, GIVE IT TO THEM AND PROCEED TO PTQ3. IF NOT, SKIP AHEAD TO PTQ5, WHICH IS MARKED WITH A ▼.)

Here's a copy of your list of factors from back in 2004, when you first did the Mississippi flooding activity.

PTQ3: *Take a look at both the response you just wrote today and your response from two years ago. What similarities and differences do you notice between the two responses?*

PTQ4: *You've told me a little about how your responses are similar or different. How about how you came up with them? Consider how you thought about the activity and how you came up with the factors you wrote down, both today and two years ago. What similarities and differences do you notice?*

(IT'S FINE IF **R** ALREADY BEGAN COMPARING THOUGHT PROCESSES (VS. COMPARING RESPONSES) IN ANSWERING THE PREVIOUS QUESTION (PTQ3). ASK THEM TO CONTINUE, E.G., "*Do you notice any other similarities or differences in the way you came up with your response?*")

▼
PTQ5: *Have you had any past experiences that helped you do the written activity?*

(IF SO, ASK **R** TO DESCRIBE THE EXPERIENCES.)

PTQ6: *Have you had any <u>educational</u> experiences that helped you do this activity?*

(IF SO, ASK **R** TO DESCRIBE THE EXPERIENCES. **R** MIGHT HAVE ALREADY DISCUSSED EDUCATIONAL EXPERIENCES IN RESPONDING TO PTQ5. IF SO, ASK THEM TO CONTINUE, E.G., "*Are there any other educational experiences that helped you do the activity?*", OR ASK FOR ADDITIONAL DETAILS ABOUT THE EDUCATIONAL EXPERIENCES, IF TIME PERMITS.)

(IF YOU DID HAVE A YEAR 1 MIDWEST FLOODS WRITTEN RESPONSE FOR **R**, SKIP AHEAD TO THE CLOSING TRANSITION BELOW, MARKED WITH A ■.)

TRANSITION FOR STUDENTS WHO DID NOT DO THE ACTIVITY IN YEAR 1:
Now, I'd like to ask you some questions about a recent natural disaster in the U.S.

PTQ7: *How familiar are you with Hurricane Katrina and the flooding in New Orleans? Could you tell me what you know about these events?*

PTQ8: *Did what you know about these events affect how you approached the Mississippi flooding activity today?*

(IF SO, ASK **R** TO DESCRIBE HOW THEIR KNOWLEDGE AFFECTED THEIR APPROACH TO THE ACTIVITY.)

CLOSING TRANSITION FOR ALL STUDENTS:
(COLLECT BOTH 2004 AND TODAY'S RESPONSE PAGES.) *Great! Thank you. We hope that you've enjoyed this activity and we want to make sure that you know that there are many right answers. We've used it to collect information from engineering students across the nation to understand the types of things students think about.*

Performance Task 2007

TRANSITION FROM ETHNOGRAPHIC INTERVIEW:
The last part of today's session has a different format from the interview we just completed. I will be reading instructions and questions from a script.

INSTRUCTIONS:
At this time, I'd like to ask you to work on a short activity. This is the kind of activity that has many different kinds of answers. We would like you to give it your best effort. You have up to fifteen minutes to work on it. I will let you know when there is five minutes left, so you have an idea about how much time has passed. Please let me know if you are done before the fifteen minutes is up. Do you have any questions? OK, here is the activity. You might remember this activity if you were asked to do it two years ago as part of this study. (CHECK START TIME ON AUDIO RECORDER AND INDICATE IT IN THE BOX BELOW. THEN HAND **R** THE FOUR-PAGE PERFORMANCE TASK PACKET.)

Start time:	: : HH MM SS

PTQ1. (ALLOW THE STUDENT TO READ AND SOLVE THE PROBLEM ON THEIR OWN**)**

TRANSITION:
(CHECK END TIME ON AUDIO RECORDER, AND IF NECESSARY):
Okay, it's been 10 minutes now; you have 5 more minutes to solve the problem.
Okay, it's been 15 minutes now, please stop.

End time:	: : HH MM SS

(IF YOU HAVE A YEAR 2 STREET CROSSING WRITTEN RESPONSE FOR **R**, GIVE IT TO THEM AND PROCEED TO PTQ2 ON THE NEXT PAGE. IF NOT, SKIP AHEAD TO PTQ4, WHICH IS MARKED WITH A ▼.)

2007 rev.

Here's a copy of your responses from back in 2005, when you first did the street crossing activity.

PTQ2: *Take a look at both the responses you just wrote today and your responses from two years ago. What similarities and differences do you notice between the two sets of responses?*

PTQ3: *You've told me a little about how your responses are similar or different. How about how you came up with them? Consider how you thought about the activity and how you came up with the responses you wrote down, both today and two years ago. What similarities and differences do you notice?*

(IT'S FINE IF **R** ALREADY BEGAN COMPARING THOUGHT PROCESSES (VS. COMPARING RESPONSES) IN ANSWERING THE PREVIOUS QUESTION (PTQ2). ASK THEM TO CONTINUE, E.G., *"Do you notice any other similarities or differences in the way you came up with your response?*")

▼

PTQ4: *To what extent do you feel this is an engineering problem?*

PTQ4a: (IF NOT ALREADY ANSWERED) *And why?*

PTQ5: *What knowledge and skills helped you solve the problem?*

PTQ6: *Where did you develop your knowledge and skills to solve the problem?*

PTQ6a: (IF NOT ALREADY ANSWERED) *Please describe those experiences in more detail.*

PTQ7: *Are there any everyday situations from your life that remind you of the situation described in the problem?*

TRANSITION:
(COLLECT PAPER) *Great! Thank you. We hope that you've enjoyed this activity and we want to make sure that you know that there are many right answers. We've used it to collect information from engineering students across the nation to understand the types of things students think about.*

APS Engineering Thinking & Doing Group data set reference (2008.04.24)

	data set	*method*	*Year 1*	*2*	*3*	*4*
1a	Engineering design task: Midwest floods	engineering design task	✓		✓	
1b	Engineering design task: Street crossing			✓		✓
2	Most/least important design activities	survey	✓	✓	✓	✓
3	5 terms describing "engineering", "design"	survey	✓		✓	✓
4	Confidence in, course experience with, and course prep. for design activities	survey		✓	✓	✓
5†	Skills important for engineering	structured interview	✓	✓	✓	
6	Perceived importance of engr. knowledge, skills (technical, professional, interpersonal)	survey	✓	✓	✓	✓
7a	Engineering design task: Most/least needed information for playground design	survey	✓			✓
7b	Most/least needed information for typical engineering problem	survey			✓	
8a	Most important skills and knowledge for engineering (from ABET, *Engr. of 2020* list)	survey			✓	✓
8b	Self assessment of preparation to use engineering skills and knowledge (from ABET, *Engr. of 2020 list*)	survey				✓
9	5 activities engineers do at work	survey			✓	✓
10a	Importance of various kinds of context in engineering	survey			✓	
10b	Self assessment of preparation to consider various kinds of context in engineering	survey				✓
11	Engineering design task: Five factors important for evaluating silicon chip factory location	survey				✓
12	Experience in academic research and professional engineering	survey				✓
13	Overall academic satisfaction	survey		✓	✓	✓

†not an ETD data set; included for reference as potential set for joint analysis with ETD data

Appendix 3-C
APS Interview Manual Example

Academic Pathways Study – Winter/Spring 2006
Interviewer's Manual
Table of Contents
Version 1 (1/25/06)

Background Information for Interviewers

Campus Contacts for the Formal Interviews:

- List contacts for Technical Public Institution, Urban Private University, Suburban Private University, and Large Public University.

Campus Contacts for the Ethnographic Interviews:

- List contacts for Technical Public Institution, Urban Private University, Suburban Private University, and Large Public University.

APS Librarian: Librarian [aaaa@yahoo.com]

CAEE APS Database: Database Manager [bbbb@withinc.com]

Intranets: Intranets Manager [cccc@engr.lpub.edu]

Performance-Scoping Task: Researcher [dddd@cs.lpub.edu]

Calendar Scheduling:

- List contacts for Technical Public Institution, Urban Private University, Suburban Private University, and Large Public University.

Please contact CAEE Assistant Director [cccc@engr.lpub.edu] for general assistance with the scheduling tool.

General Help and Information: Please cc and/or call the researcher [phone #] on all questions related to the interview protocols, process, etc. so we can keep track of what issues are coming up and also direct you to the right persons and resources.

Interview Descriptions:

- No students will receive both interview types.
- All 40 students per campus will do the performance task as part of the interview
- There will be a total of 48 events organized as follows:
    - 24 formal interviews and performance tasks with the unobserved students
    - 16 ethnographic interviews and performance task with the eight observed students and eight unobserved students who were "combo" students during the '04 interview year

Formal Interview Packets: What you need to have in hand before each interview

For each formal interview, print out a copy of each of the following for each respondent:

1. APS Formal Interview Protocol 2006
2. Your School's Preamble
3. Performance Task Sheet
4. Extra Blank Paper for Performance Task
5. Interviewer Reflection Sheet

The only sheets each respondent actually sees are: 1) the Performance Task Sheet; and 2) the Preamble.

A packet with all of the above has been created with the following names:
- TPub APS Formal Interview Packet 2006
- UPri APS Formal Interview Packet 2006
- SPri APS Formal Interview Packet 2006
- LPub APS Formal Interview Packet 2006

<u>Formal Interview Reminders:</u>
- Follow the protocol.
- Ask complete questions.
- Remember to ask “And why” for certain questions.
- Do not skip/omit questions. If respondent asks you to skip a question, be sure to return to the question before administering the Performance Task.
- Do not initiate personal conversations.
- Use appropriate probes when respondents do not answer the question. (See Probes for Formal Interviews and Usefulness Document for question’s objectives.) However, **do not** ask new questions.
- Do not offer suggestions as to how the respondent should answer the question. (For example, do not say that other students have been answering the question such-and-such a way.)
- Make sure you complete the Interviewer Reflection form immediately after the interview is completed and preferably, before the next respondent arrives.
- Remember, this is **NOT** an ethnographic interview.
- Do not offer advice during the interviews. This is not a counseling session. (If a major issue arises, make a note of it in the Interviewer Reflection Document.)

<u>Ethnographic Interview Packets: What you need to have in hand before each interview</u>
For each ethnographic interview, print out a copy of each of the following for each respondent:
1. APS Ethnographic Interview Protocol 2006
2. Your School’s Preamble
3. Performance Task Sheet
4. Extra Blank Paper for Performance Task

The only sheets each respondent actually sees are: 1) the Performance Task Sheet; and 2) the Preamble.

A packet with all of the above has been created with the following names:
- TPub APS Ethnographic Interview Packet 2006
- UPri APS Ethnographic Interview Packet 2006
- SPri APS Ethnographic Interview Packet 2006
- LPub APS Ethnographic Interview Packet 2006

Before each respondent arrives:

- Check the batteries and the recorder. Make sure there is enough space on the memory card.
- Check the microphone battery.
- Make sure your interview room does not have any distractions (turn off phones, close door, etc.).

INTERVIEW EMAIL NOTIFICATION

Formal Interview

Email for a Person doing the Scheduling

Greetings from the Center for the Advancement of Engineering Education research team!

We will be conducting the APS interviews from (START DATE) through (END DATE). We anticipate that it will take approximately one hour to complete the interview. However, recognizing that interview length naturally will vary for each individual (for example some interviews may take a few as 45 minutes, while others may take up to an hour and 15 minutes), we are asking all participants to sign up for 1½ hour slots to avoid scheduling overlaps.

To arrange your interview, please call (NAME) at (Number) or report to (Building Name, Room #____) to select a date and time that is convenient to your schedule. The interviews will be held in the (Building Name, Room #____).

Your continuous participation in the APS is valuable to us. Thank you again for helping us to improve the quality of engineering education.

Sincerely,

Academic Pathways Study Coordinator
Center for the Advancement of Engineering Education

Email for Calendar System Scheduling

Greetings from the Center for the Advancement of Engineering Education research team!

We will be conducting the APS interviews from (START DATE) through (END DATE). We anticipate that it will take approximately one hour to complete the interview. However, recognizing that interview length naturally will vary for each individual (for example some interviews may take as few as 45 minutes, while others may take up to an hour and 15 minutes), we are asking all participants to sign up for 1½ hour slots to avoid scheduling overlaps.

To arrange your interview, please log on to our on-line interview scheduling system at:

(LINK)

In the "LAST NAME" field, type: #LoginID#
In the "PASSWORD" field, type: #Password#

You have until 4/14/2006, 5:00 pm to sign up. You will not be able make any changes on the system. If you need to make a change after the 14th due to circumstances beyond your control, please contact your interviewer directly at the email address provided by the system. If you have difficulty using the scheduling system, please email (NAME) at (EMAIL ADDRESS).

The interviews will be held at the (Building Name, Room #____). Your interviewer will greet you at (location).

Your continuous participation in the APS is valuable to us. Thank you again for helping us to improve the quality of engineering education.

Sincerely,

Academic Pathways Study Coordinator
Center for the Advancement of Engineering Education

Ethnographic Interview

Email for a Person doing the Scheduling

Greetings from the Center for the Advancement of Engineering Education research team!

We will be conducting the APS interviews from (START DATE) through (END DATE). We anticipate that it will take approximately 90 minutes to complete the interview. However, recognizing that interview length naturally will vary for each individual, we are asking all participants to sign up for two-hour slots to avoid scheduling overlaps.

To arrange your interview, please call (NAME) at (Number) or report to (Building Name, Room #____) to select a date and time that is convenient to your schedule. The interviews will be held in the (Building Name, Room #____).

Your continuous participation in the APS is valuable to us. Thank you again for helping us to improve the quality of engineering education.

Sincerely,

Academic Pathways Study Coordinator
Center for the Advancement of Engineering Education

Email for Calendar System Scheduling

Greetings from the Center for the Advancement of Engineering Education research team!

We will be conducting the APS interviews from (START DATE) through (END DATE). We anticipate that it will take approximately 90 minutes to complete the interview. However, recognizing that interview length naturally will vary for each individual, we are asking all participants to sign up for two-hour slots to avoid scheduling overlaps.

To arrange your interview, please log on to our on-line interview scheduling system at:

(LINK)

In the “LAST NAME” field, type: #LoginID#
In the “PASSWORD” field, type: #Password#

You have until 4/14/2006, 5:00 pm to sign up. You will not be able make any changes on the system. If you need to make a change after the 14th due to circumstances beyond your control, please contact your interviewer directly at the email address provided by the system. If you have difficulty using the scheduling system, please email (NAME) at (EMAIL ADDRESS).

The interviews will be held at the (Building Name, Room #____). Your interviewer will greet you at (location).

Your continuous participation in the APS is valuable to us. Thank you again for helping us to improve the quality of engineering education.

Sincerely,

Academic Pathways Study Coordinator
Center for the Advancement of Engineering Education

Preambles

Technical Public Institution Preamble

Preamble for Investigative Procedures
NSF Center for the Advancement of Engineering Education
Urban Private University

This is an investigation in the Center for Engineering Education. This study is being conducted by a CAEE researcher. The purpose of this study is to gain an in-depth understanding of how engineering students explore and utilize the educational opportunities available to them in college, plan and carry out their curriculums (successfully or unsuccessfully), and navigate the process of becoming engineers.

The purpose of the individual interview is to obtain a deeper understanding of students' perceptions, expectations, motivations, practices, and experiences in engineering. We are interested in your perceptions of your experiences inside and outside of the classroom. In no way is this interview designed to individually evaluate a person's abilities. The interview is not diagnostic. Please answer the interview questions to the best of your ability.

We anticipate minimal psychological risks and personal time inconvenience. Participants will be compensated $175.00 per year for participating in a combination of survey, interview, and observation methods. Annual payments will be made at the end of spring semester upon continuous participation for that school year.

All of the information that we gather on this project will remain strictly anonymous and will not identify you in any way. The interview sessions will be audio taped, and the ethnographic sessions will be audio taped, photographed, and videotaped so that we can review them later. However, all identifying information will be removed and replaced by code numbers. Participant codes will be kept in a logbook, which will be stored in a locked file cabinet separate from the actual data information. We will keep all materials in a secure place in our university office.

The participants should be 18 years of age or older and in good health. If you are younger than 18, please contact the investigator immediately.

The Project Researcher may be contacted at [phone #] in the event that you have any questions regarding your participation in this project. If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact - anonymously, if you wish - the Office of Executive Secretary, Urban Private University Institutional Review Board at [phone #].

Urban Private University Preamble

Preamble for Investigative Procedures
NSF Center for the Advancement of Engineering Education
Urban Private University

This is an investigation in the Center for the Advancement of Engineering Education. This study is being conducted by a CAEE researcher. The purpose of this study is to gain an in-depth understanding of how engineering students explore and utilize the educational opportunities available to them in college, plan and carry out their curriculums (successfully or unsuccessfully), and navigate the process of becoming engineers.

The purpose of the individual interview is to obtain a deeper understanding of students' perceptions, expectations, motivations, practices, and experiences in engineering. We are interested in your perceptions of your experiences inside and outside of the classroom. In no way is this interview designed to individually evaluate a person's abilities. The interview is not diagnostic. Please answer the interview questions to the best of your ability.

We anticipate minimal psychological risks and personal time inconvenience. Participants will be compensated $175.00 per year for participating in a combination of survey, interview, and observation methods. Annual payments will be made at the end of spring semester upon continuous participation for that school year.

All of the information that we gather on this project will remain strictly anonymous and will not identify you in any way. The interview sessions will be audio taped, and the ethnographic sessions will be audio taped, photographed, and videotaped so that we can review them later. However, all identifying information will be removed and replaced by code numbers. Participant codes will be kept in a logbook, which will be stored in a locked file cabinet separate from the actual data information. We will keep all materials in a secure place in our university office.

The participants should be 18 years of age or older and in good health. If you are younger than 18, please contact the investigator immediately.

The Project Researcher may be contacted at [phone #] in the event that you have any questions regarding your participation in this project. If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact - anonymously, if you wish - the Office of Executive Secretary, Urban Private University Institutional Review Board at [phone #].

Suburban Private University Preamble

Preamble for Investigative Procedures
NSF Center for the Advancement of Engineering Education
Suburban Private University

This is an investigation in the Center for Design Research. This study is being conducted by a CAEE researcher. The purpose of this study is to gain an in-depth understanding of how engineering students explore and utilize the educational opportunities available to them in college, plan and carry out their curriculums (successfully or unsuccessfully), and navigate the process of becoming engineers.

The purpose of the individual interview is to obtain a deeper understanding of students' perceptions, expectations, motivations, practices, and experiences in engineering. We are interested in your perceptions of your experiences inside and outside of the classroom. In no way is this interview designed to individually evaluate a person's abilities. The interview is not diagnostic. Please answer the interview questions to the best of your ability.

We anticipate minimal psychological risks and personal time inconvenience. Participants will be compensated $175.00 per year for participating in a combination of survey, interview, and observation methods. Annual payments will be made at the end of spring semester upon continuous participation for that school year.

All of the information that we gather on this project will remain strictly anonymous and will not identify you in any way. The interview sessions will be audio taped, and the ethnographic sessions will be audio taped, photographed, and videotaped so that we can review them later. However, all identifying information will be removed and replaced by code numbers. Participant codes will be kept in a logbook, which will be stored in a locked file cabinet separate from the actual data information. We will keep all materials in a secure place in our university office.

The participants should be 18 years of age or older and in good health. If you are younger than 18, please contact the investigator immediately.

The Project Researcher, may be contacted at [phone #] in the event that you have any questions regarding your participation in this project. If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact - anonymously, if you wish - the Administrative Panels Office, Suburban Private University [contact info].

Large Public University Preamble

PREAMBLE FOR INVESTIGATIVE PROCEDURES
ACADEMIC PATHWAYS LONGITUDINAL STUDY
LARGE PUBLIC UNIVERSITY

This is an investigation in the College of Education. This study is being conducted by CAEE researchers. The purpose of this study is to gain an in-depth understanding of how engineering students explore and utilize the educational opportunities available to them in college, plan and carry out their curriculums (successfully or unsuccessfully), and navigate the process of becoming engineers.

The purpose of the individual interview is to obtain a deeper understanding of students' perceptions, expectations, motivations, practices, and experiences in engineering. We are interested in your perceptions of your experiences inside and outside of the classroom. In no way is this interview designed to individually evaluate a person's abilities. The interview is not diagnostic. Please answer the interview questions to the best of your ability.

We anticipate minimal psychological risks and personal time inconvenience. Participants will be compensated $175.00 per year for participating in a combination of survey, interview, and observation methods. Annual payments will be made at the end of spring semester upon continuous participation for that school year.

All of the information that we gather on this project will remain strictly anonymous and will not identify you in any way. The interview sessions will be audio taped, and the ethnographic sessions will be audio taped, photographed, and videotaped so that we can review them later. However, all identifying information will be removed and replaced by code numbers. Participant codes will be kept in a logbook, which will be stored in a locked file cabinet separate from the actual data information. We will keep all materials in a secure place in our university office.

The participants should be 18 years of age or older and in good health. If you are younger than 18, please contact the investigator immediately.

The Principal Investigator and the Research Associate, may be contacted at [phone #] in the event that you have any questions regarding your participation in this project. If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact - anonymously, if you wish - the Human Subjects Division [contact info].

ACADEMIC PATHWAYS STUDY WINTER 2006
FORMAL INTERVIEW PROTOCOL
TECHNICAL PUBLIC INSTITUTION/URBAN PRIVATE UNIVERSITY
SUBURBAN PRIVATE UNIVERSITY/LARGE PUBLIC UNIVERSITY

SECTION I.

INSTRUCTIONS

Good morning (afternoon, evening). My name is ___. Thank you for coming. This interview involves two parts. The first part is an interview in which I will ask you about your experiences as a student at this university. The purpose is to get your perceptions of your experiences inside and outside of the classroom. There are no right or wrong, or desirable or undesirable answers. I would like you to feel comfortable with saying what you really think and how you really feel. The second part is a short pencil-and-paper task, and I will give you specific instructions for completing that task once we have finished with the interview. The entire process should take approximately an hour to complete.

The results of this research will provide useful information to engineering educators in structuring effective educational programs to help them succeed in college.

TAPE RECORDER INSTRUCTIONS

If it is okay with you, I will be recording our conversation to get all the details but at the same time be able to carry on an attentive conversation with you. I assure you that all your comments will remain confidential. I will be compiling a report, which will contain all participants' comments, but have no references to individuals.

PREAMBLE/CONSENT FORM INSTRUCTIONS

Before we get started, please take a few minutes to read this preamble (Hand Respondent (R) preamble.) (After R returns preamble, turn tape recorder on.)

Verbally ID the Recording

1) Date; 2) Interviewer Name; 3) Time; 4) Location (Room # and School); 5) Type of Interview (Formal); 6) Respondent ID

Q1. What is your major?

Q1a. When did you declare this major?

Q2. Are you a member of any engineering student organizations on campus?

Yes → Q2a

No → Skip to Q3

Q2a. What are those organizations?

Q2b. What are the most helpful aspects of that/those organization(s)?

Q3. In your own words, would you please define engineering?

Q4. Are there particular skills that you would say are important for an engineer to have?

Yes → Q4a

No → Skip to Q5

Q4a. (IF NOT ALREADY ANSWERED) What are those skills?

Q4b. Of the skills that you mentioned, which ones do you possess?

Q4c. Please tell me how you developed your skill(s)?

Q5. Have you had any engineering internship experiences?

Yes → Q5a

No → Skip to Q6

Q5a. (IF NOT ALREADY ANSWERED) Please describe those experiences.

Q6. Have you had any experiences inside or outside of your classes that have enabled you to develop general engineering knowledge?

Yes

If R asks for definition

Say "Whatever it means to you – anything that comes to your mind"

No → Skip to Q7

Q6a. (IF NOT ALREADY ANSWERED) Please describe those experiences.

Q7. Have you had any experiences inside or outside of your classes that have prevented you from developing general engineering knowledge?

Yes

No → Skip to Q8

Q7a. (IF NOT ALREADY ANSWERED) Please describe those experiences.

Q8. Have you had any experiences inside or outside of your classes that have enabled you to solve problems?

Yes

If R asks for definition

Say "Whatever problems come to your mind"

No → Skip to Q9

Q8a. (IF NOT ALREADY ANSWERED) Please describe those experiences.

Q9. Have you had any experiences inside or outside of your classes that have prevented you from solving problems?

Yes

No → Skip to Q10

Q9a. (IF NOT ALREADY ANSWERED) Please describe those experiences.

Q10. Where do you see evidence of your engineering abilities?

If R asks what type of abilities

Otherwise, after R responds go to Q11

SAY "Whatever it means to you – anything that comes to your mind"

Q11. On a scale from 0 – 10, (where 0 = not confident at all and 10 = extremely confident), how confident are you in your math ability? ______ (ONLY ACCEPT WHOLE NUMBERS.)

Q11a. Describe the experiences that led you to rate yourself in this way. (REMIND THEM OF SCORE IF THEY ASK.)

Q12. On a scale from 0 – 10, (where 0 = not confident at all and 10 = extremely confident), how confident are you in your science ability? _____ (ONLY ACCEPT WHOLE NUMBERS.)

Q12a. Describe the experiences that led you to rate yourself in this way. (REMIND THEM OF SCORE IF THEY ASK.)

Q13. On a scale from 0 – 10, (where 0 = not confident at all and 10 = extremely confident), how confident are you in your design ability? _____ (ONLY ACCEPT WHOLE NUMBERS.)

Q13a. Describe the experiences that led you to rate yourself in this way. (REMIND THEM OF SCORE IF THEY ASK.)

Q14. Are there any aspects of engineering that you particularly like?

Yes | No → Skip to Q15

Q14a. (IF NOT ALREADY ANSWERED) What are some of those?

Q15. Are there any aspects of engineering that you particularly dislike?

Yes | No → Skip to Q16

Q15a. (IF NOT ALREADY ANSWERED) What are some of those?

Q16. In general, how do you feel about engineers?

Q16a. (IF NOT ALREADY ANSWERED) And why?

Q17. As a student, how do you identify with practicing engineers?

If R asks for clarification

SAY "In what ways do you see yourself as a practicing engineer?"

Otherwise, after R responds go to Q18

Q18. How do you believe members of other professions feel toward engineers?

Q18a. (IF NOT ALREADY ANSWERED) And why?

Q19. How important is being an engineering student to how you feel about yourself?

Q19a. (IF NOT ALREADY ANSWERED) And why?

Q20. How committed are you to pursuing an engineering major?

Q20a. (IF NOT ALREADY ANSWERED) And why?

Q21. What does diversity mean to you?

Q22. To what extent do you consider your school to be diverse?

Q22a. (IF NOT ALREADY ANSWERED) And why?

Q23. Does your gender affect your views of becoming an engineer?

Yes

No → Skip to Q24

Q23a. (IF NOT ALREADY ANSWERED) How?

Q24. Does your racial identity affect your views of becoming an engineer?

Yes

No → Skip to Q25

Q24a. (IF NOT ALREADY ANSWERED) How?

Q25. Are any of your family members or close acquaintances working engineers?

Yes

No → Skip to Q26

Q25a. (IF NOT ALREADY ANSWERED) Who?

Q25b. Did their experiences influence your decision to become an engineer?

Yes

No → Skip to Q26

Q25c. (IF NOT ALREADY ANSWERED) How?

Q26. Do you have a mentor?

Yes

No → Skip to Q27

Q26a. (IF NOT ALREADY ANSWERED) How did you get affiliated with your mentor?

Q26b. Has your mentor influenced your decision to continue majoring in engineering?

Yes

No → Skip to Q27

Q26c. (IF NOT ALREADY ANSWERED) How?

Q27. When is your expected graduation date?

Q27a. What do you see yourself doing after graduation? (Have R be specific)

If R says graduate school

ASK "What degree would you pursue and what type of graduate program would you like to enroll in?"

If R says working

ASK "What type of job would you like to have?"

Q28. At this institution, are there any aspects of majoring in engineering that are particularly difficult in achieving your academic goals?

Yes

No → Skip to Q29

Q28a. (IF NOT ALREADY ANSWERED) Please tell me about those difficulties.

Q28b. How do you deal with those difficulties?

Q29. At this institution, are there any aspects of majoring in engineering that are particularly helpful in achieving your academic goals?

Yes

No → Skip to SECTION II

Q29a. (IF NOT ALREADY ANSWERED) Please tell me about those helpful aspects.

Section 3: Formal Interview Debriefing

(READ ALL OF THE FOLLOWING ALOUD TO **R**.)

Thank you very much for coming this morning (afternoon, evening). Your time is very much appreciated and your comments have been very helpful.

The purpose of this interview is to better understand students' perceptions of their experiences inside and outside of the classroom. We are interested in your opinions and your reactions. In no way is this interview designed to individually evaluate a person's abilities. The task is not diagnostic, nor can it provide a measure of the "quality" of your performance. Your only requirement was to do the best job that you could.

Your identity will be kept anonymous during all phases of this study including any experimental writings, published or not. Procedures for maintaining confidentiality are as follows: (1) individual participants' results will be pooled with group results; and (2) participants should not place any identifying information on data collection instruments. (Such identifiers include name, social security number, student identification number, specific birth data, telephone number, address, etc.)

DQ1. Is there any other information regarding your experience as an engineering major or at this institution that you think would be useful for me to know?

Yes → DQ1a

No

DQ1a. (IF NOT ALREADY ANSWERED) Please share that information with me.

Again, thank you for participating. (TURN TAPE-RECORDER OFF.)

Section 4: Formal Interview Interviewer Reflection

INSTRUCTIONS:
After the respondent leaves the room, please take a couple of minutes to indicate your reactions and observations about the interview. An electronic copy of this form has been provided. Feel free to use this hard copy for your own notes, but please submit the electronic copy for official use.

Your name (the interviewer):	
Your race:	
Your gender:	
Your age:	

Respondent ID No.:	
Date of Interview:	
Please describe the respondent's attitude toward you and the interview:	
Please describe any unusual circumstances and/ or events that had any bearing on the interview such as interruptions, language difficulty, etc.:	
Please describe anything else that happened during the interview that has any bearings on the study's objectives:	
Additional comments:	

Probes for Formal Interview

Interviewer's Probe	Abbreviation
Repeat Question……………………………	RQ
Anything else?...	AE or Else?
Any others?..	AO?
How do you mean?......................................	How mean?
Could you tell me more about your thinking on that?..	Tell more
Would you tell me what you have in mind?...	What in mind?
What do you mean?.....................................	What mean?
Why do you feel that way?...........................	Why?
Which would be closer to the way you feel?...	Which closer?

Submission Instructions for Formal Interviews

Formal Interview Protocol
Be sure to write the Respondent's ID Number on the first page of your Formal Interview Protocol sheet. (The paper document is the protocol sheet that the interviewer used during the interview and wrote notes on.) Keep the original protocol at your institution in a secure location.

Digital Audio Files
At the end of the interview, upload the audio file in the **Interview Data** folder of the **CAEE Academic Pathways Database**. Please read the section on "**CAEE APS Database File Naming Protocol**" for more information. Save a copy of the audio file on a compact disc to be kept at your institution.

Please read the section on "The Transcription Process: For the Researcher" for more information.

Interviewer Reflection
Each interviewer will create an Interviewer Reflection document for each respondent. Here is an example of how this document would be named according to the File Naming Protocol:

RespondentID-INTS-060329-3-N1_1-KE.doc

RespondentID	Respondent ID
INTS	Formal Interview
Date	Date in "YYMMDD" format
2	EventID indicating that this is data from the second formal interview
N1_1	ItemID consisting of: **N**otes (Data Type), **1** (Item Number), **1** (Revision Number)
KE	ResearcherID initials
.doc	Word file extension

At the completion of all of the Formal Interviews, each school will have 24 Interviewer Reflection documents, one for each respondent. These 24 files should be zipped into one file using a program such as Aladdin's Stuffit or WinZip. The one zipped file of each schools collection of Interviewer Reflections should be given a name similar to the following:

SCH01-INTS-3-N1_1.zip

SCH01	School and Cohort 1
INTS	Formal Interview
3	EventID indicating that this is data from the third formal interview
N1_1	ItemID consisting of: **N**otes (Data Type), **1** (Item Number), **1** (Revision Number)
.zip	Zipped file extension

This one zipped file should be uploaded into the CAEE APS database.

Academic Pathways Study
Ethnographic Interview Protocol
Interviewer's Guide
January 23, 2006

This document is intended as a **guide** to be used by interviewers in conducting the APS Ethnographic Interviews. It is not a "script." Because ethnographic interviews are intended to be semi-structured and open-ended, the exact wording of the questions will change depending on the context. Furthermore, the questions below are not meant to "stand alone," but rather to elicit responses that will be followed up on by the interviewer in order to explore the participant's perspective further.

The questions are listed in the order that we would like topics to be introduced. However, you might find that a participant brings up a topic on her/his own before the scheduled point in the interview. For example, a participant might mention issues of gender or ethnicity before you have reached these topics in Question 17. In this case, it is useful and perfectly appropriate to explore the topic when it is first introduced. (The later "slot" for that topic can then be used to address the area further, if in your judgment there is more insight into the participant's perspective to be gained from this.)

There is no scripted introduction to be used in the interviews with the 8 ethnographic participants – we want you to adopt the style, phrasing, and tone that are most comfortable for you. In general, we would suggest that you first introduce, or re-introduce, yourself. Remind the participant that this is the yearly interview that he or she has agreed to participate in, and that the interview will last approximately 2 hours. Tell the participant that you will be talking with her/him about a number of topics that are of interest for the Academic Pathways Study. These topics are about the student and his/her experiences in and out of school. Stress that you're interested in ***the student's*** ideas, opinions, and perspectives, and let her/him know that you appreciate whatever he/she is able to tell you about the topics you'll be exploring.

We have tried to indicate the kinds of follow up questions you might make in the context of the questions below. However, following up on evaluative statements is generally important, and warrants mentioning here. Whenever possible, follow up on subjects' evaluative statements: e.g., S: "That was a hard class" …Int: "What was hard about it?" or "How was it hard?"; S: "I like math"...Int: "What do you like about math? Can you give me a specific example?"

Before interviewing a subject, remember to re-read and familiarize yourself with relevant data collected on that subject, including fieldnotes, the Year 1 ethnographic interview, and any informal interviews that may have been conducted. Also review the current state of the analysis of that subject's data. This will allow you, on a case-by-case basis, to tailor questions to a particular subject. This will greatly increase the comparative power of the interviews for the longitudinal aspect of the study.

Please feel free to use your judgment to explore potential points of interest that might arise, whether or not they are included in the questions below. Sometimes the most important issues have not been anticipated by the researchers at the outset.

Academic Pathways Study Ethnographic Interview
Interviewer's Guide
January 23, 2006

1. Tell me how things are going for you.

a. *Explore further on specifics of response, if student doesn't provide details:* e.g., if student says, "It's been a lot harder than I thought," ask, "In what ways?"

Note: Follow the subject's lead on how to handle this question – in some cases, it might be best used as an icebreaker, just to begin the conversation and move on to other questions. However, some subjects (most, based on our informal interviews at LPub this year) will have quite a lot to say, on a range of topics. In this case, don't be too quick to move off of this question – explore all of the issues the subject seems willing to get into.

b. *Before moving on to other questions, give subject a chance to say more, e.g.,* "What else is happening with you these days?"

2. We talked about this some last year, but I'd like to ask about it again: Can you tell me how you became interested in engineering?

a. Explore further, if needed, with: What were some of the experiences that were important in getting you interested in engineering?

3. Thinking about yourself before you came to [School Name] – are there things that you would say prepared you to succeed in engineering?

4. What are you majoring in *(or planning to major in)*?

a. How did you choose (xxx)?

b. What other majors did you consider?

c. What other kinds of engineering did you consider?

d. Are there certain fields of engineering that you just can't see yourself going into? Why?

5. Can you take me through a typical day for you here at [School Name]?

6. I'd like to ask about your classes and other academic experiences you've had since you've been here.

a. Have you had academic experiences here so far that you would describe as particularly good? Can you tell me about one of those? *If necessary, make sure to follow up with a question like:* "So what was it that made that a good experience?"

b. Have you had academic experiences that you would describe as particularly bad? Can you tell me about one of those? *Again, if necessary, make sure to follow up with a question like:* "So what was it that made that a bad experience?"

7. How would you describe yourself as a student?

a. Make sure to explore further on issues of change and development brought up by the subject, e.g., "I'm a lot different now than I was last year."

8. Let me ask you to think about the other engineering students you've come across here. Would you say that in general they are more different from you or more similar?

a. *Explore further:* "How are they similar?" (or "How are they different?")

9. Have you had much contact with non-engineering students? Would you say that there are things that distinguish engineering students from students in other majors?

a. *Explore further as needed to get details.*

10. What would you say has been the most difficult thing here for you so far? *[Students might mention non-academic difficulties. Make sure to explore further to get at academic difficulties.]*

a. How did you handle (or how are you handling) that?

The following sub-questions can be asked if time permits.

b. What else have you found difficult?

i. How have you handled that?

c. Do you have strategies for handling difficult situations?

i. *Explore further for specific examples.*

11. What's been easy for you here so far?

a. Explore further if subject doesn't elaborate.

12. Has anything surprised you about your classes?

13. Let me ask you about your strategies for deciding what classes to take.

a. What kinds of things do you think about when you're deciding what classes to take?

b. Do you talk to other people when you're making your decisions about classes?

i. Explore further to get at who these other people are as well as the role they play.

Note: Be prepared to explore further on issues such as the following: what is an easy (or good, or interesting, etc.) course, what is a hard (or bad, or boring, etc.) course; what's an easy (or good, etc.) professor, what's a hard (or bad, etc.) professor; and how do they know about particular professors, courses, etc.

14. Are there any groups that you've become part of since you came here to [Name of Institution]?

a. Explore further for each group (or, if there are a lot, for what the subject would say are the "most important" ones)

i. Can you tell me about [group]?

Note: This may need some prompting to establish the range of places we are interested in, both on and off campus, both social and para-professional. Explore further to see if they have answered with respect to both on and off campus groups.

15. Think about your professors here at [Name of Institution]. What would you say they think it means to be a good engineer?

a. How does that fit with your own image of a good engineer?

16. Knowing what you know now, as you look back on the time that you've spent here, is there anything that you would do differently?

17. One of the things that our research team is interested in is diversity in engineering and engineering education, in terms of race, ethnicity, and gender. I'd like to ask you some questions related to this.

a. (This is a question that you've already answered on the survey, but your survey responses aren't available to me yet.) Can you tell me how you identify yourself racially or ethnically?

b. Are there supports or barriers, advantages or disadvantages, for you as a [ethnic identification] engineering student?

i. How about for people of other racial or ethnic groups?

c. Do you think that there are differences between the experiences of male and female engineering students?

d. How has it been for you here, as a [male/female] engineering student?

18. I want to ask you to think about the rest of the time that you'll be spending at [School Name].

a. What are you looking forward to during the rest of your time here?

b. What are you concerned about?

19. Okay, let's imagine it's a few years from now, and you've graduated with a degree in (student's planned major).

a. What's next for you?

i. Or, if not planning on becoming an engineer, explore why they've made this decision.

b. What do you imagine yourself doing on a day-to-day basis?

i. Or, if not planning on becoming an engineer: What do you imagine engineers do on a day-to-day basis?

c. What would you say it takes to be a good (insert student's career choice)?

d. How are you at (insert characteristics student mentions)?

e. Are there things about yourself that you think you need to work on to become a successful (xxx)?

20. Here's a more personal question. I've been asking a lot of questions so far about your academic experiences. What else do you do in your life besides being an engineering student?

(Question 23 is partially redundant with question 17; ask if time permits.)

21. Here's a scenario I want to ask you about: There's a high school student who's interested in pretty much what you were interested in when you were in high school. This student comes to you for advice. Knowing what you now know, what advice would you give her/him?

22. If you could whisper in the ear of the people who set up the pre-engineering (or engineering) program here at [Name of Institution], what advice would you give them about improving things?

23. Is there anything that I haven't asked you about that you think I should? Anything else that's relevant in an interview like this, do you think?

24. Do you have any questions you'd like to ask me?

Submission Instructions for Ethnographic Interviews

Ethnographic Interview Protocol
Be sure to write the Respondent's ID Number on the first page of your Ethnographic Interview Protocol sheet. (The paper document is the protocol sheet that the interviewer used during the interview and wrote notes on.) Keep the original protocol at your institution in a secure location.

Digital Audio Files
At the end of the interview, upload the audio file in the **Interview Data** folder of the **CAEE Academic Pathways Database**. Please read the section on "**CAEE APS Database File Naming Protocol**" for more information. Save a copy of the audio file on a compact disc to be kept at your institution.

Performance Task Protocol and Respondent Question Sheet

Respondent ID: ____________________

PERFORMANCE TASK

TRANSITION FOR ETHNOGRAPHIC INTERVIEWS:
The last part of today's session has a different format from the interview we just completed. I will be reading instructions and questions from a script.

INSTRUCTIONS:
At this time, I'd like to ask you to work on a short activity. While I hope that it is a fun activity for you, I would also like you to give it your best effort. You have up to ten minutes to work on it. Please let me know if you are done before that. Do you have any questions?

OK, here is the activity—I'm going to read it with you, out loud. You might remember this activity if you were asked to do it two years ago as part of this study. (CHECK START TIME ON AUDIO RECORDER AND INDICATE IT IN THE BOX BELOW. THEN HAND **R** THE PERFORMANCE TASK FORM.).

Start time:	: : HH MM SS

PTQ1: (NEXT READ THE FOLLOWING ALOUD TO **R**) *Over the summer the Midwest experienced massive flooding of the Mississippi River. What factors would you take into account in designing a retaining wall system for the Mississippi?*

TRANSITION:
(CHECK END TIME ON AUDIO RECORDER, AND IF NECESSARY): *Okay, it's been 10 minutes now, please stop.*

End time:	: : HH MM SS

PTQ2: What questions came to your mind as you were brainstorming your list?

(THE QUESTIONS **MUST** BE FULLY FORMULATED. IF **R** OFFERS A FRAGMENT AS A QUESTION, REMIND **R** TO SPEAK AS IF HE/SHE IS PLAYING JEOPARDY, AND ASK **R** TO CLARIFY HOW HE/SHE USED THE FRAGMENT IN A QUESTION. IF **R** IS NOT FAMILIAR WITH JEOPARDY, TELL **R** THAT IT IS OKAY, AND THAT ALL HE/SHE NEEDS TO DO IS TO RESPOND IN QUESTIONS ONLY. IT IS OKAY FOR **R** TO BROWSE THROUGH THE LIST OF SOLUTIONS HE/SHE HAS WRITTEN, BUT THERE IS NO NEED TO SUGGEST THIS IN YOUR INSTRUCTIONS. IF **R** OFFERS 2 QUESTIONS OR LESS, PROMPT HIM/HER AGAIN. **R** SHOULD BE ABLE TO PROVIDE 5-10 QUESTIONS IN 2-3 MINUTES.)

(IF YOU HAVE A YEAR 1 MIDWEST FLOODS WRITTEN RESPONSE FOR **R**, GIVE IT TO THEM AND PROCEED TO PTQ3. IF NOT, SKIP AHEAD TO PTQ5, WHICH IS MARKED WITH A ▼.)

Here's a copy of your list of factors from back in 2004, when you first did the Mississippi flooding activity.

PTQ3: Take a look at both the response you just wrote today and your response from two years ago. What similarities and differences do you notice between the two responses?

PTQ4: You've told me a little about how your responses are similar or different. How about how you came up with them? Consider how you thought about the activity and how you came up with the factors you wrote down, both today and two years ago. What similarities and differences do you notice?

(IT'S FINE IF **R** ALREADY BEGAN COMPARING THOUGHT PROCESSES (VS. COMPARING RESPONSES) IN ANSWERING THE PREVIOUS QUESTION (PTQ3). ASK THEM TO CONTINUE, E.G., "*Do you notice any other similarities or differences in the way you came up with your response?*")

▼

PTQ5: Have you had any past experiences that helped you do the written activity?

(IF SO, ASK **R** TO DESCRIBE THE EXPERIENCES.)

PTQ6: Have you had any <u>educational</u> experiences that helped you do this activity?

(IF SO, ASK **R** TO DESCRIBE THE EXPERIENCES. **R** MIGHT HAVE ALREADY DISCUSSED EDUCATIONAL EXPERIENCES IN RESPONDING TO PTQ5. IF SO, ASK THEM TO CONTINUE, E.G., "*Are there any other educational experiences that helped you do the activity?*", OR ASK FOR ADDITIONAL DETAILS ABOUT THE EDUCATIONAL EXPERIENCES, IF TIME PERMITS.)

(IF YOU <u>DID</u> HAVE A YEAR 1 MIDWEST FLOODS WRITTEN RESPONSE FOR **R**, SKIP AHEAD TO THE CLOSING TRANSITION BELOW, MARKED WITH A ■.)

TRANSITION FOR STUDENTS WHO DID <u>NOT</u> DO THE ACTIVITY IN YEAR 1:
Now, I'd like to ask you some questions about a recent natural disaster in the U.S.

PTQ7: *How familiar are you with Hurricane Katrina and the flooding in New Orleans? Could you tell me what you know about these events?*

PTQ8: *Did what you know about these events affect how you approached the Mississippi flooding activity today?*

(IF SO, ASK **R** TO DESCRIBE HOW THEIR KNOWLEDGE AFFECTED THEIR APPROACH TO THE ACTIVITY.)

■
CLOSING TRANSITION FOR ALL STUDENTS:
(COLLECT BOTH 2004 AND TODAY'S RESPONSE PAGES.) *Great! Thank you. We hope that you've enjoyed this activity and we want to make sure that you know that there are many right answers. We've used it to collect information from engineering students across the nation to understand the types of things students think about.*

Over the summer the Midwest experienced massive flooding of the Mississippi River. What factors would you take into account in designing a retaining wall system for the Mississippi?

Submission Instructions for the Performance Task

Timing: Jot down the approximate start and end times while administering the task. After the respondent has left, double check the start and end times by reviewing the audio recording. Record the start and end times in minutes and seconds (e.g., start 43:21, end 49:16) on the Performance Task Sheet (the sheet where respondent has listed factors).

Labeling: At the end of the formal interview, write the Respondent ID and the start and stop times on the Performance Task Sheet.

What to do with the Performance Task Response Sheets: Make a photocopy, keep the photocopy in a secure location, and then send the original (via FedEx/UPS/or some other service that will track the package) to: [researcher contact information]

You may send the Performance Task sheets to the researcher in one batch.

Academic Pathways Study

Exit Interview Protocol

Technical Public Institution/Urban Private University/ Suburban Private University

2005-2006

1. Can you tell me about your reasons for majoring in engineering when you started at (name of school)?

> *Note: For this question in particular, it will be worth knowing how a given subject has answered this question (or similar questions) previously. We wouldn't suggest being confrontational (i.e., "But wait, that's not what you said last year…"), but previous responses can usefully inform follow-ups for this question.*
>
> *This can be a very useful question analytically, in that it can be compared to what students said in their Year 1 interviews. We expect that students might answer this question retrospectively, from the perspective of someone having left.*
>
> ***Please probe the answer to gauge whether the student had a prior connection to engineering through family or friends or some other type of exposure. Did the student's understanding of what engineering would be like change? Question #4, below, gets at this as well.***

2. Think about your expectations when you started last year. Did things go as you expected? What did? What didn't?

3. What's your current major? How did you choose XXX? How is it going?

4.a. When did you first start to think about switching out of engineering? *(or, if more appropriate, <u>into</u> their current major – some students might frame leaving engineering as a positive switch into something that was more appealing to them.)*

Follow up with, e.g., "What was going on at the time to make you start considering this?," and explore each of the things they discuss.

4.b. So from that point, can you talk me through the process until now?

> Follow up with, e.g., "What was switching like for you? Were there difficult moments? Were there moments when you doubted the direction you were headed in? Were there moments when you were certain you were headed in the right direction?

Were there any particularly important events/moments/etc.?" Any specifics should be explored further for more detail.

5.a. I'd like to ask about some of your specific experiences. Let's start with your classes. Did you have any classes that you would say were particularly good ones? *(Follow up on why they were good, looking for details.)* Did you have any classes that you would say were particularly bad ones? *(Follow up on why they were good, looking for details.)*

5.b. How about out of class? Any particularly good/bad experiences? *(Follow up as above)*

Note: If student volunteers non-academic out of class experiences, let them talk about those. We'd suggest then directing them back to out of class academic experiences (e.g., tutoring, office hours, etc.) **The mentor questions might come up here as well.**

6. How would you say you're feeling at this point about leaving engineering?

7. What's different for you now that you're (no longer an engineering major/ an xxx major)?

8. What's ahead for you? What are you planning for when you leave (name of school)?

9. If you could talk to the people who run the engineering program, what would you tell them?

10. Do you have anything to add to what you've said so far?

Academic Pathways Study
Exit Interview

Large Public University
2005-2006

1. Can you tell me about your reasons for intending to major in engineering when you started at LPub?

    1a. Were you aware of the engineering admission process?

Note: For this question in particular, it will be worth knowing how a given subject has answered this question (or similar questions) previously. We wouldn't suggest being confrontational (i.e., "But wait, that's not what you said last year…"), but previous responses can usefully inform follow-ups for this question.

This can be a very useful question analytically, in that it can be compared to what students said in their Year 1 interviews. We expect that students might answer this question retrospectively, from the perspective of someone having left.

Please probe the answer to gauge whether the student had a prior connection to engineering through family or friends or some other type of exposure. Did the student's understanding of what engineering would be like change? Question #4, below, gets at this as well.

2. Think about your expectations when you started last year. Did things go as you expected? What did? What didn't?

3. What's your current major? How did you choose XXX? How is it going?

4.a. When did you first start to think about switching out of engineering? *(or, if more appropriate, <u>into</u> their current major – some students might frame leaving engineering as a positive switch into something that was more appealing to them.)*

Follow up with, e.g., "What was going on at the time to make you start considering this?," and explore each of the things they discuss.

4.b. So from that point, can you talk me through the process until now?

Follow up with, e.g., "What was switching like for you? Were there difficult moments? Were there moments when you doubted the direction you were headed in? Were there moments when you were certain you were headed in the right direction? Were there any particularly important events/moments/etc.?" Any specifics should be explored further for more detail.

5.a. I'd like to ask about some of your specific experiences. Let's start with your classes. Did you have any classes that you would say were particularly good ones? *(Follow up on why they were good, looking for details.)* Did you have any classes that you would say were particularly bad ones? *(Follow up on why they were good, looking for details.)*

5.b. How about out of class? Any particularly good/bad experiences? *(Follow up as above)*

> Note: If student volunteers non-academic out of class experiences, let them talk about those. We'd suggest then directing them back to out of class academic experiences (e.g., tutoring, office hours, etc.) **The mentor questions might come up here as well.**

6. How would you say you're feeling at this point about leaving engineering?

7. What's different for you now that you're (no longer an engineering major/ an xxx major)?

8. What's ahead for you? What are you planning for when you leave (name of school)?

9. If you could talk to the people who run the engineering program, what would you tell them?

10. Do you have anything to add to what you've said so far?

CAEE APS Database File Naming Protocol

This information is taken directly from the Administrativia section of the APS workspace on the CAEE Database. *For questions or more information, please contact the database administrator.*

Data File Naming

Names of data file within the APS database as proposed here has 6 standard components (plus one optional component,) organized in the following order:

1. StudentID: coded per CAEEID
2. MethodType: instrument or method
3. EventID: event_sequence or event_date, or combination
4. ItemID: item_type, item_number and revision_number
5. ResearcherID: name initials
6. (optional) Pseudonym: reference subject's "name"
7. FilenameExtension: document_type

To improve readability and facilitate accurate computer-based parsing, filename components are separated by hyphens. By design, the resultant filename will uniquely identify the context of each data file in the APS database. This filenaming convention would result in filenames that look like

StudentID-MethodType-EventID-ItemID-ResearcherID-Pseudonym. FExt

As examples, we may have:

TPub01F00003-INTS-3-A1_1-GT.dss
UPri01F00025-INTS-3-T1_3-KE.rtf
SPri01F00008-ETH-060306-N1_1-TLB.rtf
LPub01M00034-INSP-3-S1_1-KO.pdf

This document is a work in progress and may be revised to reflect new needs and functions of the APS database. It is important that this proposed filenaming protocol, not only meet the immediate needs related to the current study of cohort-1, but can also be carried forward to integrate data for future APS cohort studies.

StudentID

In the APS database, we must avoid identifying our study's student participants by real names or other recognizable real-world information, in association with collected data. To abstract a participant's identity, we have developed a coding scheme. This CAEE Student ID code uniquely identifies each student participant and can be broken down into 4 parts. It looks something like: "TPub01F00003". The first part, "TPub", is the school's official acronym (i.e. Technical Public Institution). The second part, "01", is the cohort id. The third part, "F", refers to the gender, female. The fourth an final part, "00003", is a sequentially generated number identifier of the student at the indicated school.

For cohort-1, we have TPub, UPri, SPri, and LPub as the 4 possible school acronyms. When expanding the study in cohort-3, and cohort-4, most U.S. schools have unique acronyms. If we should encounter two or more schools with identical acronyms, we can append a lower case letter (a,b,c...) in sequence to differentiate these schools. Internal to the APS database, there is a table that connects this acronym (known as UnivID) to the full name of the school and its related descriptive data (e.g., university's full name, semester/quarter system, etc.).

With this StudentID code displayed in the filename, a researcher can quickly tell at a glance that the data file is associated with a specific student who attends a given school, is of a given gender, and participates as a member of a specific cohort.

If student data were aggregated into container documents by school, the containers' filenames would only include the school acronym and the cohort id (e.g. "TPub01"). No gender and student identifying sequence number would be included.

MethodType

The MethodType component in the filename identifies the data instrument or method being used to collect the data contained in the file. This portion of the filename is typically 3-4 letters long. For our research as planned, the following MethodTypes would be used:

SURV	survey data
INTS	structured interview data,
INTE	ethnographic interview data
INTX	exit interview data
INSP	problem scoping exercise data within structured interview session
PERF	performance task data
ETH?	ethnography data

EventID

The EventID is used to identify the particular instance of the data collection event. The EventID, taken together with MethodType, allow us to refer to a specific data set in a sequence, such as Survey 2, or Structured Interview 1. We will use numeric digits such as {1, 2, 3} to specify the EventID.

Ethnographers will typically contribute new files on a regular basis throughout the year. It may be more appropriate for such research methods to use date in lieu of a sequence number to represent the data gathering event. When applied, the date would be formatted as "YYMMDD", so as to facilitate chronological sorting. This date information should not substitute for the inclusion of more detailed date information inside the file document itself.

ItemID

The ItemID is used to identify one or more data items collected together within the context of a single data collection event. It is composed of three parts, in order:

1. DataType,
2. ItemNumber, and
3. RevisionNumber.

For example, in the course of structured interview #1, we may produce one audio recording file, one interview notes document, and 2 PDF scan files. In this scenario, we would have 4 files with

MethodType = INTS
EventID=1

and the following distinguishing ItemIDs

ItemID=A1_1 (Audio File)
ItemID=N1_1 (Notes File)
ItemID=S1_1 (Scan File #1)
ItemID=S2_1 (Scan File #2)

If after review, the notes file with ItemID=N1_1was revised and resubmitted to the database, the revised file would take on ItemID=N1_2.

At the current time, the following DataType codes are proposed:

A	audio recordings
V	video recordings
N	notes (field notes, interview notes)
T	text transcriptions
R	transcript revision requests
X	delimited columnar data
P	digital photos
S	scanned paper documents

ResearcherID

The ResearcherID identifies the researcher who is primarily responsible for collecting the data in the file. The researcher's initials (in all capital letters) will be used. If we should encounter a situation in which a new researcher has initials identical to an existing researcher, we would append a number to the new researcher's initials for the ResearcherID. For example, if we have a researcher Gwendelyn Talbot and we add a new researcher Greg Taylor, Gwendelyn Talbot would have ResearcherID "GT" and Greg Taylor would be assigned "GT1".

Pseudonym

Ethnographers will typically contribute new files on a regular basis throughout the year. In such cases, the CAEE student ID may be hard to write and refer to in discussion. The student pseudonym, appended to the root part of the document name and also recorded in the APS database, would be the identifier that ethnography researchers would use to refer to the student subject.

Student pseudonyms would be created by the research teams at each university, and may be something like "Lego1". Each pseudonym is unique within the subject group at each school; it is not permitted to have another "Lego1" within that school's subject group. However, it is entirely acceptable to have "Lego1" at another school. This way, researchers have full autonomy and flexibility to choose pseudonyms without fear of conflicts with those chosen by researchers at other universities.

Pseudonym, this filename component, is optional and is not likely used outside of ethnography documents.

FilenameExtension

We use familiar filename extensions to identify their respective applications and data types. The following example filename extensions would be used with associated applications:

.rtf	Microsoft Word, Mac TextEdit
.doc	Microsoft Word
.dot	Microsoft Word (Template)

.xls	Microsoft Excel (spreadsheet)
.csv	Microsoft Excel (comma separated values)
.dss	Olympus Audio Recorder/Player
.pdf	Adobe Acrobat Reader, Mac Preview
.txt	Microsoft Notepad, Mac TextEdit
.zip	WinZip, Windows Explorer (XP), Stuffit Expander
.jpg	Internet Explorer, Netscape, Mozilla, Safari
.tif	(tagged image format)

The Transcription Process: For the Researcher

For questions or more information, please contact the APS Librarian.

The two main steps for the transcription process are:

I. File Uploading
   a. File Naming Protocol

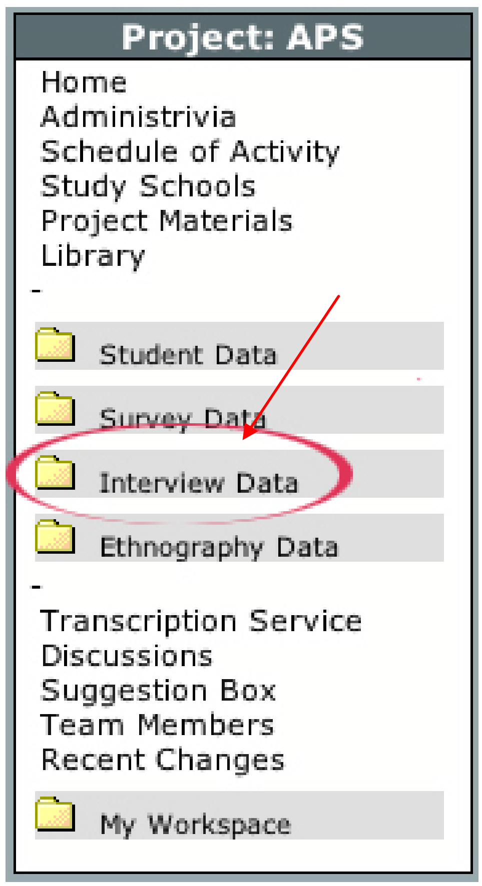
II. Reviewing returned transcripts from transcription company

----

I. File Uploading

Once an interview has been recorded in the .dss format, the following steps need to be taken:

1. Login to the APS database
2. Click on the "**Interview Data**" folder that is on the left side-bar menu (see below)



3. Inside this folder, there will be the following areas:
   a. **"In" Area**
   b. **Return Area**
   c. **Final Area**
   d. **Transcription Area**
4. Click on the **Inbox for all interview audio files**

5. This is the area where all NEW interview audio files (in the .dss format) need to be placed. Every Friday at 2pm, this area will be checked for new files and all new files will be organized into a batch to be sent to the transcriber. Researchers should upload all new interview files at the end of each day to this area. **PLEASE REMEMBER to use the appropriate file naming protocol as specified.**
6. Once the file has been uploaded, please write a "Description" which includes the following information (please put each piece of information on a separate line):
    a. CAEE ID
    b. Researcher
    c. Misc info and notes (if needed)

II. Reviewing Returned Transcripts from Transcription Service

1. Once the interview audio files have been sent to the transcriber, transcriber will return the files as interview transcripts in Rich Text Format (.rtf files). These files will be placed in the **Return Area**, sorted by school and placed in the respective school's folder.
2. A mass email notification will be sent to all of the researchers notifying them that new transcripts have been returned from transcriber and are ready to be reviewed.
3. Researchers should review only their transcript files. The transcript files will be in .rtf format, and the original file names will be kept. Researchers should be able to identify which files are theirs by seeing the appropriate initials in the file name, as specified by the file naming protocol.
4. Review the transcript.
    1. If no changes need to be made, then email the transcriber that the transcript file is ready to be finalized. Once finalized, the transcript will be placed in the **Final Area** inside the **Final Transcripts** folder.
    2. If the transcript needs to be completely re-transcribed, then make notes about the observed problems and re-submit the transcript (in .rtf format), the original audio file, and any notes taken about the problems or changes that need to be made. Then place these files (still using the file naming convention) into the **Re-submission inbox**, located inside the **Inbox for all interview audio files**. These re-submitted files will go through the same process with the transcriber as the original files.
5. All of the original audio files will be located in the **Audio Archive** in the **Final Area**.
6. All versions of transcript revisions and notes that have been re-submitted to the transcriber will be located in the **Transcript Revisions & Notes** folder in the **Final Area**.

Appendix 3-D
APS Semi-structured Ethnographic Interview Guide Examples

Academic Pathways Study Ethnographic Interview Protocol
Interviewer's Guide
March 7, 2004

This document is intended as a **guide** to be used by interviewers in conducting the APS Ethnographic Interviews. It is not a "script." Because ethnographic interviews are intended to be semi-structured and open-ended, the exact wording of the questions will change depending on the context. Furthermore, the questions below are not meant to "stand alone," but rather to elicit responses that will be followed up on by the interviewer in order to explore the participant's perspective further.

The questions are listed in the order that we would like topics to be introduced. However, you might find that a participant brings up a topic on his or her own before the scheduled point in the interview. For example, a participant might mention issues of gender or ethnicity before you have reached these topics in question 18. In this case, it is useful and perfectly appropriate to explore the topic when it is first introduced. (The later "slot" for that topic can then be used to address the topic further, if in your judgment there is more insight into the participant's perspective to be gained from this.)

There is no scripted introduction to be used in the interviews with the 8 ethnographic participants – we want you to adopt the style, phrasing, and tone that is most comfortable for you. In general, we would suggest that you first introduce, or re-introduce, yourself. Remind the participant that this is the yearly interview that he or she has agreed to participate in, and that the interview will last approximately 2 hours.[1] Tell the participant that you will be talking with them about a number of topics that are of interest for the Academic Pathways Study. These topics are about themselves and their experiences in and out of school. Stress that you're interested in ***their*** ideas, opinions, and perspectives, and let them know that you appreciate whatever they're able to tell you about the topics you'll be exploring with them.

Please feel free to use your judgment to explore potential points of interest that might arise, whether or not they are included in the questions below. Sometimes the most important issues are those that aren't anticipated by the researchers at the outset.

[1] The ethnographic interview will last less than 2 hours with the 8 participants who will be participating in both the formal and the ethnographic interviews.

Academic Pathways Study Ethnographic Interview
Interviewer's Guide
March 7, 2004

1. Let's start by talking a bit about your time in high school.

    a. Where did you go to high school? *NOTE: This is intended as a warm up question, just to get the interview underway, and can be followed up with a few other "small talk" questions, like "Where is that?" etc.*

    b. How would you describe yourself as a student in high school?

2. Can you tell me how you decided to come to [School Name]?

3. Can you tell me how you became interested in engineering?

    a. Explore further, if needed, with: What were some of the experiences that were important in getting you interested in engineering?

4. Thinking about yourself before you came to [School Name] – are there things that you would say prepared you to succeed in engineering?

5. Tell me about your first year at [School Name] so far. How are things going?

    a. *Explore further on specifics of response, if student doesn't provide details:* e.g., if student says, "It's been a lot harder than I thought," ask, "In what ways?"

6. Can you take me through a typical day for you here at [School Name]?

7. I'd like to ask about your classes and other academic experiences you've had since you've been here.

a. Have you had academic experiences here so far that you would describe as particularly good? Can you tell me about one of those? *If necessary, make sure to follow up with a question like:* "So what was it that made that a good experience?"

b. Have you had academic experiences that you would describe as particularly bad? Can you tell me about one of those? *Again, if necessary, make sure to follow up with a question like:* "So what was it that made that a bad experience?"

8. I asked you earlier to describe the student you were in high school. How would you describe yourself as a student now?

a. If relevant, explore further to get student to account for the differences.

9. Let me ask you to think about the other engineering students you've come across here. Would you say that in general they are more different from you or more similar?

a. *Explore further:* "How are they similar?" (or "How are they different?")

10. Have you had much contact with non-engineering students? Would you say that there are things that distinguish engineering students from students in other majors?

a. *Explore further as needed to get details.*

11. What would you say has been the most difficult thing here for you so far? *[Students might mention non-academic difficulties. Make sure to explore further to get at academic difficulties.]*

a. How did you handle (or how are you handling) that?

The following sub-questions can be asked if time permits.

b. What else have you found difficult?

i. How have you handled that?

c. Do you have strategies for handling difficult situations?

i. Explore further for specific examples.

12. What's been easy for you here so far?

a. Explore further if subject doesn't elaborate.

13. Has anything surprised you about your classes?

14. Let me ask you about your strategies for deciding what classes to take.

a. What kinds of things do you think about when you're deciding what classes to take?

b. Do you talk to other people when you're making your decisions about classes?

i. Explore further to get at who these other people are as well as the role they play.

Note: Be prepared to explore further on issues such as the following: what is an easy (or good, or interesting, etc.)) course, what is a hard (or bad, or boring, etc.) course; what's an easy (or good, etc.) professor, what's a hard (or bad, etc.) professor; and how do they know about particular professors, courses, etc.

15. Are there any groups that you've become part of since you came here to [Name of Institution]?

a. *Explore further for each group (or, if there are a lot, for what the subject would say are the "most important" ones)*

i. Can you tell me about [group].

ii. What role has [group] played in your education?

Note: This may need some prompting to establish the range of places we are interested in, both on and off campus, both social and para-professional. Explore further to see if they have answered with respect to both on and off campus groups.

16. Think about your professors here at [Name of Institution]. What would you say they think it means to be a good engineer?

a. How does that fit with your own image of a good engineer ?

17. Knowing what you know now, as you look back on the time that you've been here so far, is there anything that you would do differently?

18. One of the things that our research team is interested in is diversity in engineering and engineering education, in terms of race, ethnicity, and gender. I'd like to ask you some questions related to this.

a. (This is a question that you've already answered on the survey, but your survey responses aren't available to me yet.) Can you tell me how you identify yourself racially or ethnically?

b. Are there supports or barriers, advantages or disadvantages, for you as a [ethnic identification] engineering student?

i. How about for people of other racial or ethnic groups?

c. Do you think that there are differences between the experiences of male and female engineering students?

d. How has it been for you here, as a [male/female] engineering student?

19. What are you planning to major in?

a. How did you choose (xxx)?

b. Have you considered other majors?

c. Have you considered other kinds of engineering?

d. Are there certain fields of engineering that you just can't see yourself going into? Why?

20. Let me ask you to think about the next several years that you'll be spending at [School Name].

a. What are you looking forward to in your time here?

b. What are you concerned about?

21. Okay, let's imagine it's a few years from now, and you've graduated with a degree in (student's planned major).

a. What's next for you?

i. *Or, if not planning on becoming an engineer, explore why they've made this decision.*

b. What do you imagine yourself doing on a day-to-day basis?

i. *Or, if not planning on becoming an engineer:* What do you imagine engineers do on a day-to-day basis?

c. What would you say it takes to be a good (insert student's career choice)?

d. How are you at (insert characteristics student mentions)?

e. Are there things about yourself that you think you need to work on to become a successful (xxx)?

22. Here's a more personal question. I've been asking a lot of questions so far about your academic experiences. What else do you do in your life besides being an engineering student?

(Question 23 is partially redundant with question 17; ask if time permits.)

23. Here's a scenario I want to ask you about: There's a high school student who's interested in pretty much what you were interested in when you were in high school. This student comes to you for advice. Knowing what you now know, what advice would you give them?

24. If you could whisper in the ear of the people who set up the pre-engineering (or engineering) program here at [Name of Institution], what advice would you give them about improving things?

25. Is there anything that I haven't asked you about that you think I should? Anything else that's relevant in an interview like this, do you think?

26. Do you have any questions you'd like to ask me?

Academic Pathways Study Ethnographic Interview
Interviewer's Guide
February 23, 2007

This document is intended as a **guide** to be used by interviewers in conducting the APS Ethnographic Interviews. It is not a "script." Because ethnographic interviews are intended to be semi-structured and open-ended, the exact wording of the questions will change depending on the context. Furthermore, the questions below are not meant to "stand alone," but rather to elicit responses that will be followed up on by the interviewer in order to explore the participant's perspective further.

The questions are listed in the order that we would like topics to be introduced. However, you might find that a participant brings up a topic on her/his own before the scheduled point in the interview. For example, a participant might mention issues of gender or ethnicity before you have reached these topics in Question 17. In this case, it is useful and perfectly appropriate to explore the topic when it is first introduced. (The later "slot" for that topic can then be used to address the area further, if in your judgment there is more insight into the participant's perspective to be gained from this.)

There is no scripted introduction to be used in the interviews with the 8 ethnographic participants – we want you to adopt the style, phrasing, and tone that are most comfortable for you. In general, we would suggest that you first introduce, or re-introduce, yourself. Remind the participant that this is the yearly interview that he or she has agreed to participate in, and that the interview will last approximately 2 hours. Tell the participant that you will be talking with her/him about a number of topics that are of interest for the Academic Pathways Study. These topics are about the student and his/her experiences in and out of school. Stress that you're interested in ***the student's*** ideas, opinions, and perspectives, and let her/him know that you appreciate whatever he/she is able to tell you about the topics you'll be exploring.

We have tried to indicate the kinds of follow up questions you might make in the context of the questions below. However, following up on evaluative statements is generally important, and warrants mentioning here. Whenever possible, follow up on subjects' evaluative statements: e.g., S: "That was a hard class" …Int: "What was hard about it?" or "How was it hard?"; S: "I like math"...Int: "What do you like about math? Can you give me a specific example?"

Before interviewing a subject, remember to *re-read and familiarize yourself with relevant data* collected on that subject, including fieldnotes, the Year 1-3 ethnographic interviews, and any informal interviews that may have been conducted. Also review the current state of the analysis of that subject's data. This will allow you, on a case-by-case basis, to tailor questions to a particular subject. This will greatly increase the comparative power of the interviews for the longitudinal aspect of the study. We are including a formula for constructing a question based on this data in the interview this year. A good place to start might be looking at what a student was "concerned about" when they were asked the question in the year 3 interview.

So, find an interesting topic you would like to ask the student about based on the data collected from previous years focusing upon year 3 interviews or concerns students brought up in the informal interviews in the Fall of ‘06. If the piece of data you are using comes from an old interview, then a natural place to ask them about this topic again would be the same question it came up the first time. For example, lets say in year 3 interview a subject, “Leslie” said that she was really worried about finding a job before graduation. When I get to question #18 this year, before I ask the question I will say “Leslie, last year in our interview you talked about finding a job before graduation, can you talk about how that has gone?

So our formula would be….
[Last year/when I observed you…] you talked about **[insert student’s topic of concern/excitement…]**, talk about how that has gone this year.

In the protocol below we have inserted this placeholder in a few places where we believe that the question is important. Please feel free to use your judgment to explore potential points of interest that might arise based on your review of your past transcripts. Sometimes the most important issues have not been anticipated by the researchers at the outset.

Academic Pathways Study Ethnographic Interview
Interviewer's Guide
February 23, 2007

1) Tell me how things are going for you?

a. Explore further on specifics of response, if student does not provide details: e.g., if student says, "It's been a lot harder than I thought," ask, "In what ways?"

> *Note: Follow the subject's lead on how to handle this question. In some cases, it might be best used as an icebreaker, just to begin the conversation and move on to other questions. However, some subjects (most, based on our informal interviews at LPub this year) will have quite a lot to say, on a range of topics. In this case, don't be too quick to move off of this question – explore all of the issues the subject seems willing to get into.*

b. Before moving on to other questions, give subject a chance to say more, e.g., "What else is happening with you these days?"

c. *Either here or in the context of another question ask the student the question that revisits previous years' interviews or field work and is specific to them.*

[Last year or this past Fall/when I observed you…] you were concerned about [insert student's topic of concern/excitement…], talk about how that has gone this year.

2) We talked about this some last year, but I'd like to ask about it again: Can you tell me how you became interested in engineering?

a. Explore further, if needed, with: What were some of the experiences that were important in getting you interested in engineering?

b. [If they do not mention a specific person] Was there an individual who influenced or guided you to study engineering?

3) Thinking about yourself before you came to [School Name] – are there things that you would say prepared you to succeed in engineering?

4) What are you majoring in *(or planning to major in)*?

a. How did you choose (xxx)?

b. What other majors did you consider?

c. What other kinds of engineering did you consider?

d. Are there certain fields of engineering that you just can't see yourself going into? Why?

4x) Did you have an internship during the last four years? Tell me about it. What did you do on a day-to-day basis? How has that internship related to school?

5) Can you take me through a typical day for you here at [School Name]?

6) I'd like to ask about your classes and other academic experiences you've had since you've been here.

a) Have you had academic experiences that you would describe as particularly bad? Can you tell me about one of those? *Again, if necessary, make sure to follow up with a question like:* "So what was it that made that a bad experience?"

b) Have you had academic experiences here so far that you would describe as particularly good? Can you tell me about one of those? *If necessary, make sure to follow up with a question like:* "So what was it that made that a good experience?"

c) Tell me about your capstone/senior project?

7) How would you say that you changed as both a person and student since you were a freshman? How are you the same? (*ask them at the same time and let them respond)*

8) Let me ask you to think about the other engineering students you've come across here. Would you say that in general they are more different from you or more similar?

a. *Explore further:* "How are they similar?" (or "How are they different?")

9) Have you had much contact with non-engineering students? Would you say that there are things that distinguish engineering students from students in other majors?

a. *Explore further as needed to get details.*

10) What would you say has been the most difficult thing here for you so far? *[Students might mention non-academic difficulties. Make sure to explore further to get at academic difficulties.]*

Note: this would be a good spot to use the placeholder noted above:
[Last year/when I observed you…] you talked about [insert student's topic of concern/excitement…], <u>being difficult for you</u>, talk about how that has gone this year?

a. How did you handle (or how are you handling) that?

11) What's been easy for you here so far?

a. Explore further if subject doesn't elaborate.

12) Has anything surprised you about your engineering education? Did you believe that it would be different than what you experienced?

13) If you were to advise me, as a freshman student, about what classes to take --- when, in what combinations, and taught by whom, what would you tell me?

a. Asides from courses is there anything else that you would advise me as far as getting involved with the engineering community on campus?

14) Are there any groups that you've become part of since you came here to [Name of Institution]?

a. Explore further for each group (or, if there are a lot, for what the subject would say are the "most important" ones)

i. Can you tell me about [group]?

Note: This may need some prompting to establish the range of places we are interested in, both on and off campus, both social and para-professional. Explore further to see if they have answered with respect to both on and off campus groups.

b. Is there someone you met (professor, engineer, advisor) since you began school here who you would say has filled a mentor role for your engineering interests?

16) Knowing what you know now, as you look back on the time that you've spent here, is there anything that you would do differently?

17) One of the things that our research team is interested in is diversity in engineering and engineering education, in terms of race, ethnicity, and gender. I'd like to ask you some questions related to this.

Note: this series of questions may be another area where the placeholder will work well: [Last year/when I observed you…] you talked about [insert student's topic of concern/excitement…], talk about how that has gone this year.

a (This is a question that you've already answered on the survey, but your survey responses aren't available to me yet.) Can you tell me how you identify yourself racially or ethnically?

b. Are there supports or barriers, advantages or disadvantages, for you as a [ethnic identification] engineering student?

i. How about for people of other racial or ethnic groups?

c. Do you think that there are differences between the experiences of male and female engineering students?

d. How has it been for you here, as a [male/female] engineering student?

18) I want to ask you to think about the rest of the time that you'll be spending at [School Name].

a. What are you looking forward to during the rest of your time here?

b. What are you concerned about?

19. This is likely the last time we'll interview you, so I'd like you to talk about what happens for you after this interview.

a) Tell us what happens next for you? This summer? This fall? Beyond?

Note: this should be another question where the placeholder may be relevant: [Last year/when I observed you…] you talked about [insert student's topic of concern/excitement…], talk about how that has gone this year.

Here we are trying to get the students to frame their future on their terms. If these topics don't come up probe to steer the conversation to topics including, but not limited to:

i) when he/she is graduating (if graduating at all)?

ii) Job search, how it went? Does he/she already have job?, etc.

iii) What about grad school?

iv) Options other than working in engineering? (teaching, starting a business)

v) What about ten years from now?

b) What do you imagine yourself doing on a day-to-day basis?

i) AND, if not planning on becoming an engineer: What do you imagine engineers do on a day-to-day basis?

20. Here's a more personal question. I've been asking a lot of questions so far about your academic experiences. What else do you do in your life besides being an engineering student?

22. If you could whisper in the ear of the people who set up your engineering program here at [Name of Institution], what advice would you give them about improving things?

26. You are asked to testify in front of a congressional committee that is investigating the entire institution of engineering. As a [xxx] engineer, defend your discipline.

a) Why do we need [xxx] engineers?

b) What have [xxx] engineers done to make my life better?

23) This is the last of our four interviews with you. I'd like you to comment on what you thought about this interview process. Is there anything that is relevant to this study that you think I've missed?

Respondent ID: ____________________

PERFORMANCE TASK

TRANSITION FROM ETHNOGRAPHIC INTERVIEW:
The last part of today's session has a different format from the interview we just completed. I will be reading instructions and questions from a script.

INSTRUCTIONS:
At this time, I'd like to ask you to work on a short activity. This is the kind of activity that has many different kinds of answers. We would like you to give it your best effort. You have up to fifteen minutes to work on it. I will let you know when there is five minutes left, so you have an idea about how much time has passed. Please let me know if you are done before the fifteen minutes is up. Do you have any questions? OK, here is the activity. You might remember this activity if you were asked to do it two years ago as part of this study. (CHECK START TIME ON AUDIO RECORDER AND INDICATE IT IN THE BOX BELOW. THEN HAND **R** THE FOUR-PAGE PERFORMANCE TASK PACKET.)

Start time:	: : HH MM SS

PTQ1. (ALLOW THE STUDENT TO READ AND SOLVE THE PROBLEM ON THEIR OWN**)**

TRANSITION:
(CHECK END TIME ON AUDIO RECORDER, AND IF NECESSARY):
Okay, it's been 10 minutes now; you have 5 more minutes to solve the problem.
Okay, it's been 15 minutes now, please stop.

End time:	: : HH MM SS

(IF YOU HAVE A YEAR 2 STREET CROSSING WRITTEN RESPONSE FOR **R**, GIVE IT TO THEM AND PROCEED TO PTQ2 ON THE NEXT PAGE. IF NOT, SKIP AHEAD TO PTQ4, WHICH IS MARKED WITH A ▼.)

2007 rev.

Here's a copy of your responses from back in 2005, when you first did the street crossing activity.

PTQ2: *Take a look at both the responses you just wrote today and your responses from two years ago. What similarities and differences do you notice between the two sets of responses?*

PTQ3: *You've told me a little about how your responses are similar or different. How about how you came up with them? Consider how you thought about the activity and how you came up with the responses you wrote down, both today and two years ago. What similarities and differences do you notice?*

(IT'S FINE IF **R** ALREADY BEGAN COMPARING THOUGHT PROCESSES (VS. COMPARING RESPONSES) IN ANSWERING THE PREVIOUS QUESTION (PTQ2). ASK THEM TO CONTINUE, E.G., "*Do you notice any other similarities or differences in the way you came up with your response?*")

▼

PTQ4: *To what extent do you feel this is an engineering problem?*

PTQ4a: (IF NOT ALREADY ANSWERED) *And why?*

PTQ5: *What knowledge and skills helped you solve the problem?*

PTQ6: *Where did you develop your knowledge and skills to solve the problem?*

PTQ6a: (IF NOT ALREADY ANSWERED) *Please describe those experiences in more detail.*

PTQ7: *Are there any everyday situations from your life that remind you of the situation described in the problem?*

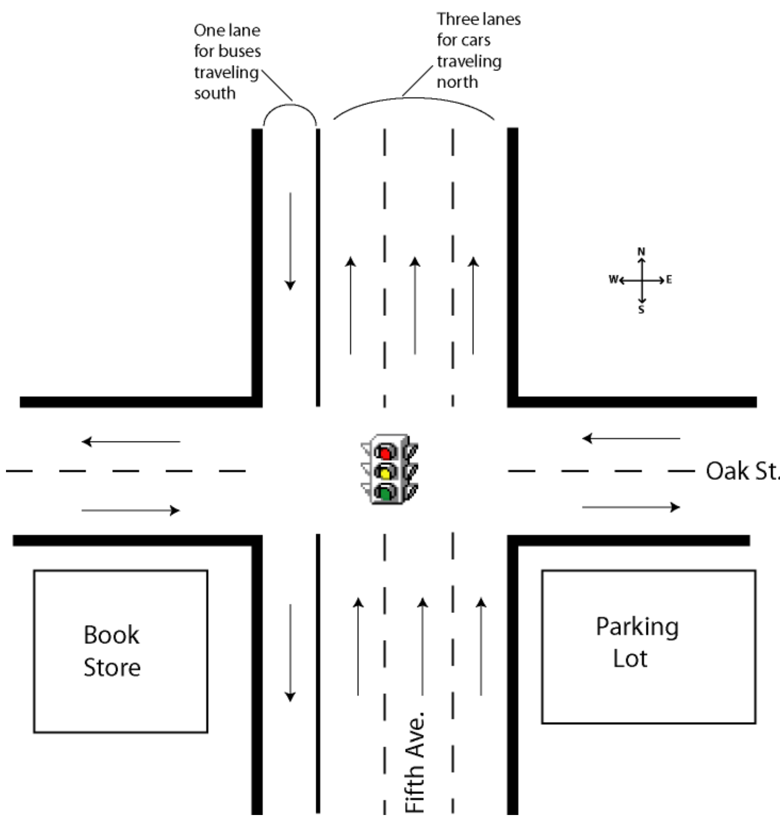
TRANSITION:

(COLLECT PAPER) *Great! Thank you. We hope that you've enjoyed this activity and we want to make sure that you know that there are many right answers. We've used it to collect information from engineering students across the nation to understand the types of things students think about.*

Respondent ID: ____________

As an engineer, you have been asked to solve a problem on the State University campus. Just like campuses across the country, the State University campus is often overcrowded with pedestrians crossing the streets.

One busy intersection on campus is the crossing of Fifth Ave. in front of the bookstore. Dangers at this intersection include heavy traffic and busses which run against the general traffic flow (see diagram below). The University would like to design a cost effective method for students to cross Fifth Ave. which would reduce the possibility of accidents at this intersection. You have been assigned to design a solution to this problem for presentation to the University Traffic Committee.



In the process of designing your solution you have been asked to respond to the set of questions on the following pages. The interviewer has more paper if you need it.

2007 rev.

1 – What is the problem as you see it?

2 – List potential solution(s) for this problem.

3 – From your list in Question 2, choose the potential solution you think is best and provide a detailed evaluation of your solution.

4 – What kinds of additional information would help you solve this problem?

Appendix 3-E
Workplace Interview Guides: BCC

Interview Guide for New Engineers
How do new engineers begin their careers and succeed at [company]?

Background Information for Interview Process

Focused Interview • *Maximize range* • *Elicit specific reports* • *Elicit depth—cognitive, affective, evaluative* • *Elicit personal context through prior experiences and personal attributes*	Help interviewee: • Recall past reactions to past events, not present reactions to past events • Link responses to past situation (concrete, not introspection) • Avoid superficial responses • Focus on past situation, not interview
Critical Incidents • *Complete activity* • *Clear intent and consequences*	Incidents • Learning • Exchange • Technical • Social • Task oriented • Group process oriented • Supervisor oriented • Organization oriented
Developing Expertise	How is technical (vs. social/people) defined? Wow factor Applying eng. knowledge and skills to practice Identifying most valuable knowledge/skills from school Perceptual changes of engineering in practice Patterns of continuing education and development
Socialization	Adjusting to fit: assimilating Learning (content) --tasks, group procedures, supervisor expectations, org culture/values Learning (process) informal --trigger, select strategy, implement, assess Social exchange (LMX, CMX) --actors, resources, exchange structure, exchange process (initiate, transact, reciprocate) --amount of interaction --direct, general, productive (negotiated) --LMX: respect, trust, responsibility, autonomy, mutual obligation --role clarity --perceptions of success, commitment, satisfaction

Interview Guide for New Engineers

Introduction	Introductory remarks 1. State purpose and sponsorship of study 2. Group sampled/interviewed (answer “Why me?”) 3. Anonymity of data (show how anonymity will be guarded)
Overview of Study	I am with [school] and am are working with HR at [company]. We are interested in improving the educational programs for engineers and the onboarding programs at [company]. Specifically, what helps you work successfully within [company].
Identify incidents **Expertise** ***Problem solving process*** ***Tasks & procedures*** **Socialization** ***Learning process*** ***Exchange process*** **Behaviors** **Thoughts** **Emotions**	Think back to when you started working here. What was the [first, second, third] incident or experience you had: *technical* in which you had to apply your engineering knowledge/skills to solve a problem or accomplish some task *social* that taught you something about how things get done here? That is, the way things are done here and what was expected of you. *[Identify 2-3 critical incidents each (technical & social)]* *Time* When did this incident happen? *Place* Where did this incident take place? *Antecedents* What were the general circumstances leading up to this incident? *Personal Context* What were your circumstances surrounding this incident? *Actors* Who was involved? *Behaviors and interactions* What exactly did the others do? *Behaviors and interactions* What exactly did you do? *Consequences* What was the outcome of this incident? *Motivations* Why did you do this? *Move to technical section* ↴

<table>
<tr>
<td>Expertise: Engineering knowledge, skills, attributes (KSAs) at entry and at present: how changed?</td>
<td>For 2-3 technical incidents

Problem-solving and tasks/procedures
Applying knowledge of engineering
Management of projects
Team work with coworkers, others, supervisor
</td>
</tr>
<tr>
<td></td>
<td>I assume you spend your time at work doing technical type of work, but also you have to work with other people and the procedures of the organization. First of all, I want to focus our discussion today on how you apply your technical knowledge to solving problems and doing engineering tasks.

Think back about a specific technical problem or task
What was the problem?

How did you define/frame the problem?
Conceive
Design

What knowledge and skills did you apply to work on the problem?

Where did you learn the knowledge and skills (topic)?.
How did you learn the topic? Bookwork, labwork
Implement
Operate

What questions/concerns did you have?
How did you find answers?

What do you wish you knew then?
Where did you get the knowledge you were missing?

What did you learn from this situation?
What would you do differently (what did you learn from this experience)?

Operate

Are these typical or unique events among your peers?

Transition

Difference between school and work

Move to social/learning section ↴</td>
</tr>
</table>

Socialization: Informal Learning and Relationship Building	*For 2-3 social incidents* *For each incident, discuss the learning process and learned outcomes related to cognitive affectual, and social*
Transition to social	Now, I would like to talk about the social/people aspects of your work. Specifically, I'd like to talk about how you learned the [company] way to work with other people, other departments, and how you learn what others expect of you on the job.
NORMS **Cognitive** *knowledge* **Behavior** *skills*	**About a specific incident:** Describe what you expected to occur/ought to occur (previous knowledge, mental model) Actually occurred Describe how you handled the experience. Describe what you learned from that incident. *[specific knowledge, skills, meanings, understandings]* *[Specify cognitions in concrete details: range, specificity, depth, personal context]* Do you think this is a typical/common experience?
Affect *feelings, emotions, moods, motivations*	Describe how you felt about that incident. *[specific feelings, emotions, moods, motivations]* *[Specify feelings, emotion, mood, motivation in concrete details: range, specificity, depth, personal context]*
Social *participation, communication, cooperation*	Describe how you interacted with others before, during, and after the incident. *[Specify participation, communication, and cooperation in concrete details: range, specificity, depth, personal context]*
Social Exchange *supervisor, coworkers* *respect, trust, and obligation*	• Describe your relationship with your supervisor. • Describe your relationship with your coworkers. • *Probe for indications of respect (engagement in decision-making), trust (degree of autonomy and responsibility), and mutual obligations (commitment)*
Understanding of success	What do you think will help you and/or others succeed here? What could [company] do to help new engineers succeed? What do you see yourself doing in 3-5 years?
Closing	Any other comments? Advice? For new hires. For school?

Interview Guide for Supervisors
How do new engineers begin their careers and succeed?

Background Information for Interview Process

Focused Interview • *Maximize range* • *Elicit specific reports* • *Elicit depth—cognitive, affective, evaluative* • *Elicit personal context through prior experiences and personal attributes*	Help interviewee: • Recall past reactions to past events, not present reactions to past events • Link responses to past situation (concrete, not introspection) • Avoid superficial responses • Focus on past situation, not interview
Critical Incidents • *Complete activity* • *Clear intent and consequences*	Incidents • Learning • Exchange • Technical • Social • Task oriented • Group process oriented • Supervisor oriented • Organization oriented
Developing Expertise	How is technical (vs. social/people) defined? Wow factor Applying eng. knowledge and skills to practice Identifying most valuable knowledge/skills from school Perceptual changes of engineering in practice Patterns of continuing education and development
Socialization	Adjusting to fit: assimilating Learning (content) --tasks, group procedures, supervisor expectations, org culture/values Learning (process) informal --trigger, select strategy, implement, assess Social exchange (LMX, CMX) --actors, resources, exchange structure, exchange process (initiate, transact, reciprocate) --amount of interaction --direct, general, productive (negotiated) --LMX: respect, trust, responsibility, autonomy, mutual obligation --role clarity --perceptions of success, commitment, satisfaction

Interview Guide for Supervisors

Introduction	Introductory remarks 4. State purpose and sponsorship of study 5. Group sampled/interviewed (answer "Why me?") 6. Anonymity of data (show how anonymity will be guarded)
Overview of Study	I am with [school] and am are working with HR at [company]. Our interest has to do with how new engineering graduates make the transition from school to work. Specifically, what helps them work successfully within [company].
Identify roles **Identify incidents** **Expertise** ***Problem solving process*** ***Tasks & procedures*** **Socialization** ***Learning process*** ***Exchange process*** **Behaviors** **Thoughts** **Emotions**	What are your roles as a supervisor related to supervising a new engineer(s)? - *Most important* - *Least important* Think back (over the past year) about a specific incident in which you interacted as a supervisor with a new engineer. What was the [first, second, third] incident or experience you had: Describe the incident: - *Context, antecedents* - *Roles* - *Behavior* - *Consequences* - *Relationship factors* - *Exchange factors* - *Expectations* *Time* When did this incident happen? *Place* Where did this incident take place? *Antecedents* What were the general circumstances leading up to this incident? *Personal Context* What were your circumstances surrounding this incident? *Actors* Who was involved? *Behaviors and interactions* What exactly did the others do? *Behaviors and interactions* What exactly did you do? *Consequences* What was the outcome of this incident? *Motivations* Why did you do this? *Move to learning section* ↴

Expertise: Engineering knowledge, skills, attributes (KSAs) at entry and at present: how changed?	*For 2-3 technical incidents* • *Problem-solving and tasks/procedures* • *Applying knowledge of engineering* • *Management of projects* • *Team work with coworkers, others, supervisor*
	First of all, I want to focus our discussion on your observations about how new engineers apply their technical knowledge to solving problems and doing engineering tasks. • What skills do you look for in a new hire? • What important technical skills do you think new hires often lack? • Any characteristics of new hires in the way they solve problems/ work on projects? • What knowledge and skills did you think should apply to work on the problem? • What questions/concerns do you typically have with new hires? • How do you become comfortable with their abilities? • How do help them learn the details of their job? mentors senior eng. • Do you see any differences between new grads and experienced new hires? What are they? • Anything you would do differently? Are these typical or unique events among your peers? *Move to social/learning section* ↴

Socialization: Learning & Relationship Building	
Role	Describe what you see as your role as a manager/supervisor. Describe how you helped the new hire learn what to know and the proper way to do things. Describe what you have learned over time about managing new people. *[specific knowledge, skills, meanings, understandings]*
Culture	Describe important characteristics of the culture of the company. *[Artifacts, values, assumptions]* What are some of the key values and assumptions of the company?
Norms **Social** *participation, communication, cooperation*	Describe what you expected the new employee to know and do. **-** *Attitudes, Knowledge, Skills, Behavior* Describe how you interact with those that report to you. *[Specify participation, communication, and cooperation in concrete details: range, specificity, depth, personal context]* How do you foster engagement with new hires? How do you integrate new hires into the company?
Social Exchange *supervisor, coworkers* *respect, trust, and obligation*	• Describe how you develop productive relationships with new employees. • How do you develop trust, autonomy, and commitment with employee? • What are the stages of development for new employees? *[first year; first 5 years]* • • How/what kind of help from others? • Probe for indications of ***respect*** *(engagement in decision-making),* ***trust*** *(degree of autonomy and responsibility), and* ***mutual obligations*** *(commitment)*
Understanding of success **Perceptions of commitment**	• What do you think helps new employees succeed here? • What are the attributes of stars/quick starters? • What can you/[company] do to foster success?
Closing	Any other comments?

Appendix 3-F
Workplace Interview Guide: County-State-Aerospace

- Tell me how things are going for you?
- How has your work as a ____ engineer met your expectations?
- How was your education prepared you for the kinds of work that you are doing now? How so? How not?
- Based upon your experience working as an ____ engineer are there any classes you wish you had taken or worked harder in?
- What about teamwork?
- Take me through a typical day at your workplace?
- Describe some things that you learned in your workplace that you never imagined being important to work as an engineer. Has there been anything you encountered in the workplace that you never imagined being a part of engineering?
- How would you say that you have changed as a person and as an engineer since you graduated?
- Describe some of your co-workers? How are you similar and/or different than them? Were these similarities and differences surprising? Do you find there is a level of competition in the workplace?
- What has been easy for you thus far in workplace? What have been some difficulties you have encountered?
- If you could whisper in the ear of the people who set up your engineering program here at [Name of Institution], what advice would you give them about improving things?
- Where do you see yourself in five to ten years? What's next for you? Grad school? Staying with your current job?

Appendix 3-G
APS Longitudinal Cohort Exit Interview Guides

Academic Pathways Study
Exit Interview
Technical Public Institution/Urban Private University/
Suburban Private University/Large Public University
2005-2006

1. Can you tell me about your reasons for majoring in engineering when you started at (name of school)?

Note: For this question in particular, it will be worth knowing how a given subject has answered this question (or similar questions) previously. We wouldn't suggest being confrontational (i.e., "But wait, that's not what you said last year…"), but previous responses can usefully inform follow-ups for this question.

This can be a very useful question analytically, in that it can be compared to what students said in their Year 1 interviews. We expect that students might answer this question retrospectively, from the perspective of someone having left.

Please probe the answer to gauge whether the student had a prior connection to engineering through family or friends or some other type of exposure. Did the student's understanding of what engineering would be like change? Question #4, below, gets at this as well.

2. Think about your expectations when you started last year. Did things go as you expected? What did? What didn't?

3. What's your current major? How did you choose XXX? How is it going?

4.a. When did you first start to think about switching out of engineering? *(or, if more appropriate, <u>into</u> their current major – some students might frame leaving engineering as a positive switch into something that was more appealing to them.)*

Follow up with, e.g., "What was going on at the time to make you start considering this?," and explore each of the things they discuss.

4.b. So from that point, can you talk me through the process until now?

Follow up with, e.g., "What was switching like for you? Were there difficult moments? Were there moments when you doubted the direction you were headed *in? Were there moments when you were certain you were headed in the right direction? Were there any particularly important events/moments/etc.?" Any specifics should be explored further for more detail.*

5.a. I'd like to ask about some of your specific experiences. Let's start with your classes. Did you have any classes that you would say were particularly good ones? *(Follow up on why they were good, looking for details.)* Did you have any classes that you would say were particularly bad ones? *(Follow up on why they were good, looking for details.)*

5.b. How about out of class? Any particularly good/bad experiences? *(Follow up as above)*

Note: If student volunteers non-academic out of class experiences, let them talk about those. We'd suggest then directing them back to out of class academic experiences (e.g., tutoring, office hours, etc.) ***The mentor questions might come up here as well.***

6. How would you say you're feeling at this point about leaving engineering?

7. What's different for you now that you're (no longer an engineering major/ an xxx major)?

8. What's ahead for you? What are you planning for when you leave (name of school)?

9. If you could talk to the people who run the engineering program, what would you tell them?

10. Do you have anything to add to what you've said so far?

Academic Pathways Study
Exit Interview
Large Public University
2005-2006

1. Can you tell me about your reasons for intending to major in engineering when you started at LPub?

1a. Were you aware of the engineering admission process?

Note: For this question in particular, it will be worth knowing how a given subject has answered this question (or similar questions) previously. We wouldn't suggest being confrontational (i.e., "But wait, that's not what you said last year…"), but previous responses can usefully inform follow-ups for this question.

This can be a very useful question analytically, in that it can be compared to what students said in their Year 1 interviews. We expect that students might answer this question retrospectively, from the perspective of someone having left.

Please probe the answer to gauge whether the student had a prior connection to engineering through family or friends or some other type of exposure. Did the student's understanding of what engineering would be like change? Question #4, below, gets at this as well.

2. Think about your expectations when you started last year. Did things go as you expected? What did? What didn't?

3. What's your current major? How did you choose XXX? How is it going?

4.a. When did you first start to think about switching out of engineering? *(or, if more appropriate, <u>into</u> their current major – some students might frame leaving engineering as a positive switch into something that was more appealing to them.)*

Follow up with, e.g., "What was going on at the time to make you start considering this?," and explore each of the things they discuss.

4.b. So from that point, can you talk me through the process until now?

Follow up with, e.g., "What was switching like for you? Were there difficult moments? Were there moments when you doubted the direction you were headed in? Were there moments when you were certain you were headed in the right direction? Were there any particularly important events/moments/etc.?" Any specifics should be explored further for more detail.

5.a. I'd like to ask about some of your specific experiences. Let's start with your classes. Did you have any classes that you would say were particularly good ones? *(Follow up on why they were good, looking for details.)* Did you have any classes that you would say were particularly bad ones? *(Follow up on why they were good, looking for details.)*

5.b. How about out of class? Any particularly good/bad experiences? *(Follow up as above)*

> *Note: If student volunteers non-academic out of class experiences, let them talk about those. We'd suggest then directing them back to out of class academic experiences (e.g., tutoring, office hours, etc.)* ***The mentor questions might come up here as well.***

6. How would you say you're feeling at this point about leaving engineering?

7. What's different for you now that you're (no longer an engineering major/ an xxx major)?

8. What's ahead for you? What are you planning for when you leave (name of school)?

9. If you could talk to the people who run the engineering program, what would you tell them?

10. Do you have anything to add to what you've said so far?

Appendix 4-A
Longitudinal Cohort (PIE) Survey Examples

Academic Pathways Study Winter'04 Survey

Please click the SUBMIT button only after you have completed the survey. You will then need to enter your login and password. For best viewing results, please maximize your browser window.

1. What is your expected year of graduation from college?

- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010 or later

2. What do you intend to major in? (Currently, your first choice)

- Aeronautical Engineering
- Chemical Engineering
- Civil and Environmental Engineering
- Computer Science
- Electrical Engineering
- Management Science and Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Other Engineering
- Arts and Humanities
- Education
- Physical Science/Math
- Social Science
- Other:

3. What do you intend to major in? (Currently, your second choice)

- Aeronautical Engineering
- Chemical Engineering
- Civil and Environmental Engineering
- Computer Science
- Electrical Engineering
- Management Science and Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Other Engineering
- Arts and Humanities
- Education
- Physical Science/Math
- Social Science
- N/A
- Other:

4. What is the highest academic degree that you intend to obtain in engineering? (Mark one)

- None
- Bachelor's
- Master's
- Ph.D.
- Other
- I do not know

5. If you are thinking of going to graduate school (NOT in engineering), please mark your probable area of study.

- Business
- Education
- Medicine
- Law
- MA/Ph.D.
- Public Service
- Other
- N/A

6. About how many hours do you spend in a typical 7-day week doing each of the following?

0 1-5 6-10 11-15 16-20 21-25 26-30 more than 30

Preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)

Working for pay on campus

Working for pay off campus

Participating in co-curricular activities (organizations, campus publications, student government, social fraternity or sorority, intercollegiate or intramural sports, etc.)

Relaxing and socializing (watching TV, partying, exercising, etc.)

Providing care for dependents living with you (parents, children, spouse, etc.)

Commuting to class (driving, walking, etc.)

7. For each reason for studying engineering, please indicate how strongly you disagree or agree with the statement:

Strongly Disagree Disagree Neutral Agree Strongly Agree

I enjoy figuring out how things work

Technology plays an important role in solving society's problems

Engineers make more money than most other professionals

My parent(s) are making me study engineering

Engineers are innovative

Engineers have contributed greatly to fixing problems in the world

Engineers are well paid

Engineering is an occupation that is respected by other people

My parents want me to be an engineer

An engineering degree will guarantee me a job when I graduate

Engineers are creative

8. **For each statement, please indicate how strongly you disagree or agree with the statement:**

Strongly Disagree Disagree Neutral Agree Strongly Agree

I prefer working/studying alone

I enjoy the subjects of science and mathematics the most

Creative thinking is one of my strengths

Studying in a group is better than studying by myself

I have strong problem solving skills

I enjoy taking liberal arts courses more than science and math courses

I enjoy problems that can be solved in different ways

My instructors often remind students that they need to do better than other students to obtain high grades

I have easy access to work spaces where I can participate in peer study/discussion sessions with my fellow students

I am encouraged by my instructors to initiate orparticipate in peer study sessions with my fellow students

My instructors grade on a curve.

9. **Please indicate the importance to you personally of each of the following:**

Not Important Somewhat Important Very Important Essential

Getting higher grades than my classmates

Influencing social values

Becoming an authority in my field

Keeping good ideas to myself unless it is to my advantage to share them

Helping to promote racial understanding

Becoming a community leader

Helping others who are in difficulty

When playing any game, to win

Developing a meaningful philosophy of life

Becoming a practicing engineer

Getting along with others

Working as part of a team

Becoming a student government official

Establishing relationships with engineering students

Establishing relationships with non-engineering students

10. **Compared with when you entered this college, how would you describe your:**

Much Weaker Weaker No Change Stronger Much Stronger

Analytical and problem solving skills

Critical thinking skills

General knowledge

Knowledge of a particular field or discipline

Interest in studying engineering

11. **Please rate your satisfaction with this institution on each of the aspects of campus life listed below. If you do not have experience with this aspect, mark "n/a."**

Very dissatisfied Dissatisfied Neutral Satisfied Very satisfied N/A

Opportunities for community service

Quality of instruction by faculty

Availability of faculty

Quality of instruction by teaching assistants

Availability of TAs

12. **Please rate your satisfaction with each of the following at this institution. If you do not use the service or facility, mark "n/a."**

Very dissatisfied Dissatisfied Neutral Satisfied Very satisfied N/A

Computer facilities

Libraries

Classrooms

Tutoring

Academic advising

Laboratories

13. **Since entering this college, indicate how often you: (Mark one for each item)**

Not at all Rarely Occasionally Frequently

Felt that your courses inspired you to think in new ways

Felt you did not have enough time to pursue nonacademic activities

Worried about keeping up with your schoolwork

Felt you did not have a "social life"

Worried about how you would pay for school

Felt stressed

Participated in a peer study group

14. **Think about the math classes you have taken. Since entering college, indicate how often you: (Mark N/A if you have not taken any math classes)**

Not at all | Rarely | Occasionally | Frequently | N/A

Came late to math class

Skipped math class

Turned in math assignments that did not reflect your best work

Turned in math assignments late

Thought math classes were boring

15. **Think about the science classes you have taken. Since entering college, indicate how often you: (Mark N/A if you have not taken any science classes)**

Not at all | Rarely | Occasionally | Frequently | N/A

Came late to science class

Skipped science class

Turned in science assignments that did not reflect your best work

Turned in science assignments late

Thought science classes were boring

16. **Think about the engineering classes you have taken. Since entering college, indicate how often you: (Mark N/A if you have not taken any engineering classes)**

Not at all | Rarely | Occasionally | Frequently | N/A

Came late to engineering class

Skipped engineering class

Turned in engineering assignments that did not reflect your best work

Turned in engineering assignments late

Thought engineering classes were boring

17. **Think about the liberal arts (not math, science or engineering) classes you have taken. Since entering college, indicate how often you: (Mark N/A if you have not taken any math classes)**

Not at all | Rarely | Occasionally | Frequently | N/A

Came late to liberal arts class

Skipped liberal arts class

Turned in liberal arts assignments that did not reflect your best work

Turned in liberal arts assignments late

Thought liberal arts classes were boring

18. **Since entering this college, how often have you interacted with the following people (e.g. by phone, e-mail, Instant Messenger, or in person)? (Mark one for each item)**

	Never	1-2 times/term	1-2 times/month	Once a week	2-3 times/week	Daily
Faculty during office hours	○	○	○	○	○	○
Faculty outside of class or office hours	○	○	○	○	○	○
Teaching Assistants during office hours	○	○	○	○	○	○
Teaching Assistants outside of class or office hours	○	○	○	○	○	○

19. **Rate yourself on each of the following traits as compared with the average person your age. We want the most accurate estimate of how you see yourself. (Mark one in each row.)**

	Lowest 10%	Below Average	Average	Above Average	Highest 10%
Self confidence (intellectual)	○	○	○	○	○
Self confidence (social)	○	○	○	○	○
Self understanding	○	○	○	○	○
Leadership ability	○	○	○	○	○
Public speaking ability	○	○	○	○	○
Math ability	○	○	○	○	○
Science ability	○	○	○	○	○
Computer and programming skills	○	○	○	○	○
Written communication skills	○	○	○	○	○
Business ability	○	○	○	○	○

20. **How important do you think each of the following skills and abilities is to becoming a successful engineer? (Mark one in each row.)**

	Not Important	Somewhat Important	Important	Very Important	Crucial
Public speaking ability	○	○	○	○	○
Math ability	○	○	○	○	○
Science ability	○	○	○	○	○
Computer and programming skills	○	○	○	○	○
Written communication skills	○	○	○	○	○
Business ability	○	○	○	○	○

21. **What percentage of the courses you have taken thus far have been taught primarily by graduate students?**

- ○ None
- ○ Very little
- ○ Less than half
- ○ About half
- ○ More than half

All or nearly all

22. **What portion of the courses you have taken so far have used the following teaching methods?**

	None	Very little	Less than half	About half	More than half	All or nearly all
Lectures						
Individual Projects						
Team Projects						
Labs						
Seminars						

23. **Do you see your self studying or practicing engineering next year?**

- Yes
- No
- I do not know

24. **Your sex:**

- Male
- Female

25. **How old will you be on December 31st of this year? (Mark one)**

- 16 or younger
- 17
- 18
- 19
- 20
- 21-24
- 25-29
- 30-39
- 40-54
- 55 or older

26. **Please indicate your ethnic background: (Mark all that apply)**

- White/Caucasian
- African American/Black
- American Indian/Alaska Native
- Asian American/Asian
- Native Hawaiian/Pacific Islander
- Mexican American/Chicano
- Puerto Rican
- Other Latino
- Other

27. **Citizenship Status:**

- U.S. Citizen
- Permanent Resident (green card)
- Neither

28. **What is your marital status?**

- Not married
- Married
- Divorced
- Separated
- Widowed

29. **How many dependents do you have?**

- None

- 1
- 2
- 3
- 4
- 5 or more

30. **What year did you graduate from high school?**

31. **How would you describe the community where you attended high school?**

- Rural
- Small town
- Suburban
- Urban

32. **What was your average grade in high school? (Mark one)**

- A or A+
- A
- B+
- B
- B
- C+
- C
- D

33. **Do any of your immediate family members hold an engineering degree? (Mark all that apply)**

- No
- Yes, both parents
- Yes, father only
- Yes, mother only
- Yes, sibling(s)

34. **What is the highest level of education that your mother completed? (Mark one box)**

- Did not finish high school
- Graduated from high school
- Attended college but did not complete degree
- Completed an Associate's degree (A.A., A.S., etc.)
- Completed a Bachelor's degree (B.A., B.S., etc.)
- Completed a Master's degree (M.A., M.S., etc.)
- Completed a Professional degree (J.D., M.D., etc.)
- Completed a Doctoral degree (Ph.D.)

35. **What is the highest level of education that your father completed? (Mark one box)**

- Did not finish high school
- Graduated from high school
- Attended college but did not complete degree
- Completed an Associate's degree (A.A., A.S., etc.)
- Completed a Bachelor's degree (B.A., B.S., etc.)
- Completed a Master's degree (M.A., M.S., etc.)
- Completed a Professional degree (J.D., M.D., etc.)
- Completed a Doctoral degree (Ph.D.)

36. **What is your best estimate of your parents' total income last year? Consider income from all sources before taxes. (Mark one)**

- Less than $10,000
- $10,000-14,999
- $15,000-19,999
- $20,000-24,999
- $25,000-29,999
- $30,000-39,999
- $40,000-49,999
- $50,000-59,999
- $60,000-74,999

- $75,000-99,999
- $100,000-149,999
- $150,000-199,999
- $200,000-249,999
- $250,000 or more

37. **How do you meet your college expenses? Fill in the response that best approximates the amount of support from each of the various sources.**

	None	Very little	Less than half	About half	More than half	All or nearly all
Self (job, savings, etc.)						
Parents						
Spouse or partner						
Employer support						
Scholarships and grants						
Loans						
Other sources						

38. **Do you have any concern about your ability to finance your college education? (Mark one)**

- None (I am confident that I will have sufficient funds)
- Some (but I probably will have enough funds)
- Major (not sure I will have enough funds to complete college)

39. **Which of the following best describes where you are living now while attending college?**

- Dormitory or other campus housing (not fraternity/sorority house)
- Residence (house, apartment, etc.) within walking distance of the institution
- Residence (house, apartment, etc.) within driving distance of the institution
- Fraternity or sorority house

40. **With whom do you live during the school year? (Mark all that apply)**

- No one, I live alone
- One or more other students
- My spouse or partner
- My child or children
- My parents
- Other relatives
- Friends who are not students at the institution I am attending
- Other people

41. **Do you have any of the following physical, learning, or health disabilities? (Mark all that apply)**

- Mobility impaired
- Blind or visually impaired
- Deaf or hard-of-hearing
- Other:

42. **Do you receive any of the following assistive technology or other accommodations from the disability support services office on campus? (Mark all that apply)**

- Tutoring
- Tape recording of lectures
- Extended time on tests
- Other:

43. **In your SCHOOL-RELATED ACTIVITIES, how often do you use the following technologies? (Mark one for each item.)**

Never Sometimes Often Very frequently N/A

Desktop computer

Laptop computer

Web Browser

Email

Instant Messaging (IM) Programs

Cell Phone

Text Messaging on a Cell Phone

Personal Digital Assistant (PDA) (e.g., Palm, Blackberry)

Game Console

Computer Games / Simulations

Scientific or Graphing Calculator

General-purpose Calculator

Portable Music Players (e.g., CD or MP3 player)

Audio Recording Device

Video conferencing or Web-Cam

Digital Camera

Chat Rooms

Engineering Specific Software

General Purpose Software (e.g., Officeapplications)

44. **In your PERSONAL LIFE outside of school, how often do you use the following technologies? (Mark one for each item.)**

Never Sometimes Often Very frequently N/A

Desktop computer

Laptop computer

Web Browser

Email

Instant Messaging (IM) Programs

Cell Phone

Text Messaging on a Cell Phone

Personal Digital Assistant (PDA) (e.g., Palm, Blackberry)

Game Console

Computer Games / Simulations

Scientific or Graphing Calculator

General-purpose Calculator

Portable Music Players (e.g., CD or MP3 player)

Audio Recording Device

Video conferencing or Web-Cam

Digital Camera

Chat Rooms

Engineering Specific Software

General Purpose Software (e.g., Office applications)

45. **How often do you carry the following technologies with you? (Mark one for each item.)**

Never Sometimes Often Very frequently N/A

Laptop computer

Cell Phone without Text Messaging

Cell Phone with Text Messaging

Personal Digital Assistant (PDA) (e.g., Palm, Blackberry)

Scientific or Graphing Calculator

General-purpose Calculator

Portable Music Players (e.g., CD or MP3 player)

Audio Recording Device

Digital Camera

46. **List all of the electronic and computer technologies (i.e., like those listed in the previous question) you made even momentary use of yesterday and say what each was used for**

47. **Yesterday was a: (Mark one.)**

- Week day
- Weekend day

48. **What is the first word or phrase you think of to describe your favorite professor? (Please respond in the space provided.)**

49. **Do you believe your peers would agree with this description: (Mark one)**

- Yes
- No
- I don't know

50. **Some students participate in design competitions, internships, and clubs. In the space provided identify engineering related activities you have participated in outside of class. (If this is not applicable to you, please write "None.")**

51. **What percentage of your friends in college (on this campus or other campuses) are studying engineering? (Mark one.)**

- None
- Very few

- Less than half
- About half
- More than half
- All or nearly all

52. **Since entering this college, indicate how often you have done the following with other engineering students: (Mark one for each item.)**

	Not at all	Rarely	Occasionally	Frequently
Worked on class projects				
Held a study group				
Took a specific lecture-type class				
Took a specific laboratory class				
Worked on homework				
Reviewed class material				
Prepared for class exams				
Wrote class reports				

53. **In what ways do you interact with other engineering students outside of the classroom? (If this is not applicable to you, please write "none.")**

54. **In the space provided identify any classes (in high school or college so far) that have STRONGLY REINFORCED your interest in studying engineering. (If this is not applicable to you, write "none.")**

55. **In the space provided identify any classes (in high school or college so far) that have STRONGLY WEAKENED your interest in studying engineering. (If this is not applicable to you, write "none.")**

56. **What intellectual, personal, financial, and other challenges do you feel you may need to overcome to graduate with an engineering degree? If this is not applicable to you, write "none."**

57. **In the space provided, list 5 terms you would use to describe "engineering":**

58. **If you were asked the same question next week, how likely is it that you would list the same 5 terms?**

- Not likely
- Somewhat likely
- Likely
- Very likely
- Extremely likely

59. **In the space provided, list 5 terms you would use to describe "design":**

60. **If you were asked the same question next week, how likely is it that you would list the same 5 terms?**

- Not likely
- Somewhat likely
- Likely
- Very likely
- Extremely likely

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

Survey Design

Help

General Questions Order Preview Finish

This is a preview of how this survey will look. In the preview the survey navigation buttons are inactive, use the section number buttons to view different sections. Some navigation buttons may not appear on your final survey, depending on what access it is assigned. The survey will use the background color of the document in which it is embedded. If you have no further changes click **Finish** at the bottom of this page.

ACADEMIC PATHWAYS STUDY SPRING'05 SURVEY

PLEASE CLICK THE SUBMIT BUTTON ONLY AFTER YOU HAVE COMPLETED THE SURVEY. FOR BEST VIEWING RESULTS, PLEASE MAXIMIZE YOUR BROWSER WINDOW.

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

1. **What is your expected year of graduation from college?**

- ○ 2003
- ○ 2004
- ○ 2005
- ○ 2006
- ○ 2007
- ○ 2008
- ○ 2009
- ○ 2010 or later

2. **Do you intend to complete a major in engineering?**

- ○ Definitely Not
- ○ Probably Not
- ○ Not Sure
- ○ Probably Yes
- ○ Definitely Yes

3. **What do you intend to major in?**

- ○ Aeronautical Engineering
- ○ Chemical Engineering
- ○ Civil and Environmental Engineering
- ○ Computer Science
- ○ Electrical Engineering
- ○ Management Science and Engineering
- ○ Materials Science and Engineering
- ○ Mechanical Engineering
- ○ Other Engineering ________
- ○ Arts and Humanities
- ○ Education
- ○ Natural Science/Math
- ○ Social Science
- ○ Other Non-engineering

4. **If you intend to DOUBLE MAJOR, what is the second major you intend to complete? (Mark N/A if you do not intend to double major.)**

- ○ Aeronautical Engineering
- ○ Chemical Engineering
- ○ Civil and Environmental Engineering
- ○ Computer Science
- ○ Electrical Engineering
- ○ Management Science and Engineering
- ○ Materials Science and Engineering
- ○ Mechanical Engineering
- ○ Other Engineering ________
- ○ Arts and Humanities
- ○ Education

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

- Natural Science/Math
- Social Science
- Other Non-engineering
- N/A

5. **Do you intend to practice, conduct research in, or teach engineering for at least 3 years after graduation?**

- Definitely Not
- Probably Not
- Not Sure
- Probably Yes
- Definitely Yes

6. **If you are thinking of going to graduate school NOT IN ENGINEERING, please mark your most probable area of study. Otherwise, mark N/A.**

- Business
- Education
- Medicine
- Law
- MA/Ph.D.
- Public Service
- Other
- N/A

7. **We are interested in knowing why you are studying engineering now. Please indicate below the extent to which the following reasons apply to you:**

	Not a Reason	Minimal Reason	Moderate Reason	Major Reason
Technology plays an important role in solving society's problems	○	○	○	○
Engineers make more money than most other professionals	○	○	○	○
My parent(s) would disapprove if I chose a major other than engineering	○	○	○	○
Engineers have contributed greatly to fixing problems in the world	○	○	○	○
Engineers are well paid	○	○	○	○
Engineering is an occupation that is respected by other people	○	○	○	○
My parent(s) want me to be an engineer	○	○	○	○
An engineering degree will guarantee me a job when I graduate	○	○	○	○
Engineers are creative problem solvers	○	○	○	○
A faculty member, academic advisor, teaching assistant or other university affiliated person has encouraged and/or inspired me to study engineering	○	○	○	○
A non-university affiliated mentor has encouraged and/or inspired me to study engineering	○	○	○	○

8. **Please indicate how strongly you disagree or agree with each of the statement:**

	Disagree Strongly	Disagree	Agree	Agree Strongly
I prefer studying in a group to studying by myself	○	○	○	○

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

I am a competitive person	○	○	○	○
I prefer working as part of a team to working alone	○	○	○	○
I get along well with others in study situations	○	○	○	○
I strive to get higher grades than my classmates	○	○	○	○
The educational institution I am attending promotes competitive work	○	○	○	○
My instructors often remind students that they need to do better than other students to obtain high grades	○	○	○	○
I have easy access to work spaces where I can participate in peer study/discussion sessions with my fellow students	○	○	○	○
I am encouraged by my instructors to initiate or participate in peer study sessions with my fellow students	○	○	○	○
I am a collaborative person	○	○	○	○
The educational institution I am attending promotes collaborative work	○	○	○	○

9. **Please indicate how strongly you disagree or agree with each of the statement:**

	Disagree Strongly	Disagree	Agree	Agree Strongly
Creative thinking is one of my strengths	○	○	○	○
I am familiar with what a practicing engineer does	○	○	○	○
I am skilled at solving problems that can have multiple solutions	○	○	○	○

10. **Rate yourself on each of the following traits as compared to your classmates. We want the most accurate estimate of how you see yourself. (Mark one in each row.)**

	Lowest 10%	Below Average	Average	Above Average	Highest 10%
Self confidence (social)	○	○	○	○	○
Leadership ability	○	○	○	○	○
Public speaking ability	○	○	○	○	○
Math ability	○	○	○	○	○
Science ability	○	○	○	○	○
Computer skills	○	○	○	○	○
Communication skills	○	○	○	○	○
Ability to apply math and science principles in solving real world problems	○	○	○	○	○
Business ability	○	○	○	○	○
Ability to perform in teams	○	○	○	○	○
Critical Thinking skills	○	○	○	○	○

11. **How important do you think each of the following skills and abilities is to becoming a successful engineer? (Mark one in each row.)**

	Not Important	Somewhat Important	Very Important	Crucial
Self confidence (social)	○	○	○	○
Leadership ability	○	○	○	○
Public speaking ability	○	○	○	○
Math ability	○	○	○	○
Science ability	○	○	○	○
Computer skills	○	○	○	○
Communication skills	○	○	○	○

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

Ability to apply math and science principles in solving real world problems	○	○	○	○
Business ability	○	○	○	○
Ability to perform in teams	○	○	○	○

12. **Please rate your satisfaction with this institution on each of the aspects of campus life listed below. If you do not have experience with this aspect, mark N/A.**

	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied	N/A
Quality of instruction by faculty	○	○	○	○	○
Quality of advising by faculty	○	○	○	○	○
Availability of faculty	○	○	○	○	○
Quality of instruction by teaching assistants	○	○	○	○	○
Quality of advising by teaching assistants	○	○	○	○	○
Availability of teaching assistants	○	○	○	○	○

13. **Please rate your satisfaction with each of the following at this institution. If you do not use the service or facility, mark N/A.**

	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied	N/A
Computer facilities	○	○	○	○	○
Libraries	○	○	○	○	○
Classrooms	○	○	○	○	○
Tutoring	○	○	○	○	○
Academic advising	○	○	○	○	○
Laboratories	○	○	○	○	○

14. **Since January, how often have you taken courses which required your engagement in individual and/or group projects?**

- ○ Never
- ○ Rarely
- ○ Occasionally
- ○ Frequently

15. **Think about the engineering classes you have taken since January (engineering, math, and science classes). Indicate how often you: (Mark N/A if you have not taken any engineering related classes.)**

	Never	Rarely	Occasionally	Frequently	N/A
Came late to engineering class	○	○	○	○	○
Skipped engineering class	○	○	○	○	○
Turned in engineering assignments that did not reflect your best work	○	○	○	○	○
Turned in engineering assignments late	○	○	○	○	○
Thought engineering classes were boring	○	○	○	○	○

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

16. **Think about the liberal arts classes you have taken since January (not engineering, math, and science). Indicate how often you: (Mark N/A if you have not taken any non-engineering related classes.)**

	Never	Rarely	Occasionally	Frequently	N/A
Came late to liberal arts class	○	○	○	○	○
Skipped liberal arts class	○	○	○	○	○
Turned in liberal arts assignments that did not reflect your best work	○	○	○	○	○
Turned in liberal arts assignments late	○	○	○	○	○
Thought liberal arts classes were boring	○	○	○	○	○

17. **How often have you interacted with the following people since January(e.g. by phone, e-mail, Instant Messenger, or in person)? (Mark one for each item.)**

	Never	1-2 times per Term	1-2 times per Month	Once per Week	2-3 times per Week	Daily
Faculty during class	○	○	○	○	○	○
Faculty during office hours	○	○	○	○	○	○
Faculty outside of class or office hours	○	○	○	○	○	○
Teaching Assistants during class	○	○	○	○	○	○
Teaching Assistants during office hours	○	○	○	○	○	○
Teaching Assistants outside of class or office hours	○	○	○	○	○	○

18. **What portion of the courses you have taken since January have been taught primarily by graduate students?**

- ○ None
- ○ Very little
- ○ Less than half
- ○ About half
- ○ More than half
- ○ All or nearly all

19. **Since January, what portion of your classes used the following teaching methods?**

	None	Very little	Less than half	About half	More than half	All or nearly all
Lectures	○	○	○	○	○	○
Individual Projects	○	○	○	○	○	○
Team Projects	○	○	○	○	○	○
Labs	○	○	○	○	○	○
Seminars	○	○	○	○	○	○

20. **To what extent have your courses required your engagement in individual and/or group projects?**

- ○ Too Few
- ○ Enough
- ○ Too many

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

21. **Some people are involved in non-engineering activities on or off campus, such as hobbies, civic or church organizations, campus publications, student government, social fraternity or sorority, sports, etc. How important is it for you to be involved in these kind of activities?**

- ○ Not Important
- ○ Somewhat Important
- ○ Very Important
- ○ Essential

22. **How often are you involved in the kinds of non-engineering activities described above?**

- ○ Never
- ○ Rarely
- ○ Occasionally
- ○ Frequently

23. **Thinking about your college experience since January, please indicate how much pressure you are feeling related to the following:**

	No Pressure	Reasonable Pressure	Extreme Pressure
Course load (amount of course material being covered)	○	○	○
Course pace (the pace at which the course material is being covered)	○	○	○
Balance between social and academic life	○	○	○

24. **How well are you meeting the workload demands of your coursework?**

- ○ I am meeting all of the demands easily
- ○ I am meeting all of the demands, but it is hard work
- ○ I am meeting most of the demands, but cannot meet some
- ○ I can meet some of the demands, but cannot meet most
- ○ I cannot meet any of the demands

25. **How stressed do you feel in your coursework right now?**

- ○ No stress
- ○ Some stress
- ○ Reasonable stress
- ○ Significant stress
- ○ Extreme stress

26. **Do you have any concern about your ability to finance your college education?**

- ○ None (I am confident that I will have sufficient funds)
- ○ Some (but I probably will have sufficient funds)
- ○ Major (not sure if I will have sufficient funds to complete college)

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

27. **How do you meet your college expenses?**

	None	Very little	Less than half	About half	More than half	All or nearly all
Self (income)	○	○	○	○	○	○
Self (savings)	○	○	○	○	○	○
Parents and family	○	○	○	○	○	○
Employer support	○	○	○	○	○	○
Schalorships and grants	○	○	○	○	○	○
Loans	○	○	○	○	○	○

28. **Do you have family members who are practicing engineers?**

- ○ Yes
- ○ No

29. **Do you have close friends who are practicing engineers?**

- ○ Yes
- ○ No

30. **How much exposure have you had to a professional engineering environment as a visitor, intern, or employee?**

- ○ No exposure
- ○ Limited exposure
- ○ Moderate exposure
- ○ Extensive exposure

31. **About how many hours do you spend in a typical 7-day week doing each of the following?**

	0	1-5	6-10	11-15	16-20	21-25	26-30	more than 30
Preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)	○	○	○	○	○	○	○	○
Working for pay	○	○	○	○	○	○	○	○
Participating in co-curricular activities (organizations, campus publications, student government, social fraternity or sorority, intercollegiate or intramural sports, etc.)	○	○	○	○	○	○	○	○
Relaxing and socializing (watching TV, partying, exercising, etc.)	○	○	○	○	○	○	○	○
Providing care for dependents living with you (parents, children, spouse, etc.)	○	○	○	○	○	○	○	○
Commuting to class (driving, walking, etc.)	○	○	○	○	○	○	○	○

32. **Please rate the overall quality of your collegiate experience so far:**

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

- ◯ Very dissatisfied
- ◯ Dissatisfied
- ◯ Satisfied
- ◯ Very satisfied

33. **Your sex:**

- ◯ Male
- ◯ Female

34. **Please indicate your ethnic background: (Mark all that apply)**

- ☐ White/Caucasian
- ☐ African American/Black
- ☐ American Indian/Alaska Native
- ☐ Asian American/Asian
- ☐ Native Hawaiian/Pacific Islander
- ☐ Mexican American/Chicano
- ☐ Puerto Rican
- ☐ Other Latino
- ☐ Other

35. **Citizenship Status:**

- ◯ U.S. Resident
- ◯ Permenant Resident (Green Card)
- ◯ Neither

36. **What was your average grade in high school? (Mark one)**

- ◯ A or A+
- ◯ A-
- ◯ B+
- ◯ B
- ◯ B-
- ◯ C+
- ◯ C
- ◯ D

37. **What is the highest level education that your mother completed? (Mark one)**

- ◯ Did not finish high school
- ◯ Graduate from high school
- ◯ Attended college but did not complete degree
- ◯ Completed an Asssociate's degree (A.A., A.S., etc.)
- ◯ Completed a Bachelor's degree (B.A., B.S., etc.)

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

- ○ Completed a Master's degree (M.A., M.S., etc.)
- ○ Completed a Professional degree (J.D., M.D., etc.)
- ○ Complete a Doctoral degree (Ph.D.)

38. **Please rate the extent to which you agree that each of the following is reason that you are currently majoring in or considering majoring in engineering:**

	Strongly Disagree	Moderately Disagree	Disagree	Unsure	Agree	Moderately Agree	Strongly Agree
I think engineering is interesting	○	○	○	○	○	○	○
I am majoring in engineering for my own good	○	○	○	○	○	○	○
I am supposed to major in engineering	○	○	○	○	○	○	○
There may be good reasons to major in engineering, but personally, I don't see any	○	○	○	○	○	○	○
I think engineering is pleasant	○	○	○	○	○	○	○
I think engineering is good for me	○	○	○	○	○	○	○
Majoring in engineering is something that I have to do	○	○	○	○	○	○	○
I am majoring in (considering majoring in) engineering, but I am not sure if it is worth it	○	○	○	○	○	○	○
Majoring in engineering is fun	○	○	○	○	○	○	○
It is my personal decision	○	○	○	○	○	○	○
I don't have any choice	○	○	○	○	○	○	○
I don't know. I don't see what the activity brings me	○	○	○	○	○	○	○
I feel good when I am doing engineering activities	○	○	○	○	○	○	○
I believe engineering is important for me	○	○	○	○	○	○	○
I feel that I have to do it	○	○	○	○	○	○	○
I am doing it, but am not sure it is a good thing to pursue	○	○	○	○	○	○	○

39. **Please rate the extent to which you agree with the following statements:**

	Strongly disagree	Moderately Disagree	Disagree	Unsure	Agree	Moderately Agree	Strongly Agree
On the whole, I am satisfied with myself	○	○	○	○	○	○	○
At times, I think I am no good at all	○	○	○	○	○	○	○
I feel that I have a number of good qualities	○	○	○	○	○	○	○
I am able to do things as well as most other people	○	○	○	○	○	○	○
I feel I do not have much to be proud of	○	○	○	○	○	○	○
I certainly feel useless at times	○	○	○	○	○	○	○
I feel that I'm a person of worth, at least on an equal plane with others	○	○	○	○	○	○	○
I wish I could have more respect for myself	○	○	○	○	○	○	○
All in all, I am inclined to feel that I am a failure	○	○	○	○	○	○	○

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

I take a positive attitude toward myself	○	○	○	○	○	○	○

40. **Please rate the extent to which you agree with the following statements.**

	Strongly Disagree	Moderately Disagree	Disagree	Unsure	Agree	Moderately Agree	Strongly Agree
Overall, being a member of my ethnic group has very little to do with how I feel about myself	○	○	○	○	○	○	○
In general, being a member of my ethnic group is an important part of my self-image	○	○	○	○	○	○	○
My destiny is tied to the destiny of other members of my ethnic group	○	○	○	○	○	○	○
Being a member of my ethnic group is unimportant to my sense of what kind of person I am	○	○	○	○	○	○	○
I have a strong sense of belonging to my ethnic group community	○	○	○	○	○	○	○
I have a strong attachment to other members of my ethnic group	○	○	○	○	○	○	○
Being a member of my ethnic group is an important reflection of who I am	○	○	○	○	○	○	○
Being a member of my ethnic group is not a major factor in my social relationships	○	○	○	○	○	○	○
Overall, being a member of my gender has very little to do with how I feel about myself	○	○	○	○	○	○	○
In general, being a member of my gender is an important part of my self-image	○	○	○	○	○	○	○
My destiny is tied to the destiny of other members of my gender	○	○	○	○	○	○	○
Being a member of my gender is unimportant to my sense of what kind of person I am	○	○	○	○	○	○	○
I have a strong sense of belonging to my gender community	○	○	○	○	○	○	○
I have a strong attachment to other members of my gender	○	○	○	○	○	○	○
Being a member of my gender is an important reflection of who I am	○	○	○	○	○	○	○
Being a member of my gender is not a major factor in my social relationships	○	○	○	○	○	○	○

41. **Please rate the extent to which you agree with the following statements:**

	Strongly disagree	Moderately Disagree	Disagree	Unsure	Agree	Moderately Agree	Strongly Agree
Overall, being an engineering student has very little to do with how I feel about myself	○	○	○	○	○	○	○

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

In general, being an engineering student is an important part of my self-image	○	○	○	○	○	○	○
My destiny is tied to the destiny of other engineering students	○	○	○	○	○	○	○
Being an engineering student is unimportant to my sense of what kind of person I am	○	○	○	○	○	○	○
I have a strong sense of belonging to the engineering student community	○	○	○	○	○	○	○
I have a strong attachment to other engineering students	○	○	○	○	○	○	○
Being an engineering student is an important reflection of who I am	○	○	○	○	○	○	○
Being an engineering student is not a major factor in my social relationships	○	○	○	○	○	○	○
I feel good about engineers	○	○	○	○	○	○	○
I am happy that I am going to be an engineer	○	○	○	○	○	○	○
I feel that engineers have made major accomplishments and advancements	○	○	○	○	○	○	○
I often regret that I am going to become an engineer	○	○	○	○	○	○	○
I am proud to be an engineer	○	○	○	○	○	○	○
I feel that the engineering community has made valuable contributions to this society	○	○	○	○	○	○	○
Overall, engineers are considered good by others	○	○	○	○	○	○	○
In general, others respect engineers	○	○	○	○	○	○	○
Most people consider engineers, on the average, to be more ineffective than other professionals	○	○	○	○	○	○	○
Engineers are not respected by the broader society	○	○	○	○	○	○	○
In general, other professionals view engineers in a positive manner	○	○	○	○	○	○	○
Society views engineers as an asset	○	○	○	○	○	○	○
I identify with engineering students	○	○	○	○	○	○	○
I am glad to belong to a group of engineering students	○	○	○	○	○	○	○
I feel held back by engineering students	○	○	○	○	○	○	○
I think engineering students work well together	○	○	○	○	○	○	○
I see myself as an important part of engineering students on campus	○	○	○	○	○	○	○
I fit in well with the other engineering students	○	○	○	○	○	○	○
I consider engineering students to not be important	○	○	○	○	○	○	○
I feel uneasy with other engineering students	○	○	○	○	○	○	○
I feel strong ties to engineering students	○	○	○	○	○	○	○

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

42. **Of the twenty-three design activities below, please put a check mark next to the six MOST IMPORTANT.**

- [ ] Abstracting
- [ ] Brainstorming
- [ ] Building
- [ ] Communicating
- [ ] Decomposing
- [ ] Evaluating
- [ ] Generating alternatives
- [ ] Goal Setting
- [ ] Identifying Constraints
- [ ] Imagining
- [ ] Iterating
- [ ] Making decisions
- [ ] Making trade-offs
- [ ] Modeling
- [ ] Planning
- [ ] Prototyping
- [ ] Seeking Information
- [ ] Sketching
- [ ] Synthesizing
- [ ] Testing
- [ ] Understanding the problem
- [ ] Using creativity
- [ ] Visualizing

43. **Of the twenty-three design activities below, please put a check mark next to the six LEAST IMPORTANT.**

- [ ] Abstracting
- [ ] Brainstorming
- [ ] Building
- [ ] Communicating
- [ ] Decomposing
- [ ] Evaluating
- [ ] Generating alternatives
- [ ] Goal Setting
- [ ] Identifying Constraints
- [ ] Imagining
- [ ] Iterating
- [ ] Making decisions
- [ ] Making trade-offs
- [ ] Modeling
- [ ] Planning
- [ ] Prototyping
- [ ] Seeking Information
- [ ] Sketching
- [ ] Synthesizing
- [ ] Testing

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

- [ ] Understanding the problem
- [ ] Using creativity
- [ ] Visualizing

In questions 44-48, respond five times to the question "Who Am I?" ("Answer A" should be for your first response, "Answer B" for your second response, "Answer C" for your third response, "Answer D" for your fourth response, and "Answer E" for your fifth response.)

44. **Who am I? (Answer A)**

45. **Who am I? (Answer B)**

46. **Who am I? (Answer C)**

47. **Who am I? (Answer D)**

48. **Who am I? (Answer E)**

49. **Rank order your answer to the previous question in terms of how important it is to the way you generally feel about yourself. For each of your answers, mark a rank between 1 and 5. A rank of "1" indicates the most important component, and "5" indicates the least important component.**

	1	2	3	4	5
Answer A	○	○	○	○	○
Answer B	○	○	○	○	○
Answer C	○	○	○	○	○
Answer D	○	○	○	○	○
Answer E	○	○	○	○	○

50. **For the following engineering design activities, please indicate your level of confidence. For example, if you have little or no confidence in your ability to model engineering solutions, then mark poor. If you are extremely confident in your ability, mark excellent.**

	Poor	Fair	Good	Very Good	Excellent
Defining what the problem really is	○	○	○	○	○

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

Searching for and collecting information needed to solve the problem	◯	◯	◯	◯	◯
Thinking up potential solutions to the problem	◯	◯	◯	◯	◯
Detailing how to build the solution to the problem	◯	◯	◯	◯	◯
Assessing and passing judgment on a possible or planned solution to the problem	◯	◯	◯	◯	◯
Comparing and contrasting two solutions to the problem on a particular dimension such as cost	◯	◯	◯	◯	◯
Selecting one idea or solution to the problem from among those considered	◯	◯	◯	◯	◯
Communicating elements of the design in sketches, diagrams, lists, and written or oral reports	◯	◯	◯	◯	◯

51. **For the following engineering design activities, please indicate how often you engaged in the activity in your coursework in the current academic year.**

	Never	1-2 times per term	1-2 times a month	Once a week	2-3 times a week	Daily
Defining what the problem really is	◯	◯	◯	◯	◯	◯
Searching for and collecting information needed to solve the problem	◯	◯	◯	◯	◯	◯
Thinking up potential solutions to the problem	◯	◯	◯	◯	◯	◯
Detailing how to build the solution to the problem	◯	◯	◯	◯	◯	◯
Assessing and passing judgment on a possible or planned solution to the problem	◯	◯	◯	◯	◯	◯
Comparing and contrasting two solutions to the problem on a particular dimension such as cost	◯	◯	◯	◯	◯	◯
Selecting one idea or solution to the problem from among those considered	◯	◯	◯	◯	◯	◯
Communicating elements of the design in sketches, diagrams, lists, and written or oral reports	◯	◯	◯	◯	◯	◯

52. **For the following engineering design activities, please indicate how well you think your courses are preparing you to engage in the activity. For example, if you think they are not preparing you at all, then mark poor. If you think they are preparing you extremely well, then mark excellent.**

	Poor	Fair	Well	Very well	Excellent
Defining what the problem really is	◯	◯	◯	◯	◯
Searching for and collecting information needed to solve the problem	◯	◯	◯	◯	◯
Thinking up potential solutions to the problem	◯	◯	◯	◯	◯
Detailing how to build the solution to the problem	◯	◯	◯	◯	◯
Assessing and passing judgment on a possible or planned solution to the problem	◯	◯	◯	◯	◯
Comparing and contrasting two solutions to the problem on a particular dimension such as cost	◯	◯	◯	◯	◯
Selecting one idea or solution to the problem from among those considered	◯	◯	◯	◯	◯
Communicating elements of the design in sketches, diagrams, lists, and written or oral reports	◯	◯	◯	◯	◯

53. **What are your summer plans?**

INSTRUMENT STILL IN DEVELOPMENT - DO NOT DISTRIBUTE OUTSIDE APS!

Save | Submit Survey

The survey title and other general fields are on the **General** tab. Individual survey questions are added and modified on the **Questions** tab. Questions may be re-ordered or deleted from the **Order** tab. You may see a preview of your survey at any time, by going to the **Preview** tab. If you have no further changes click **Finish** to go back to the Management Interface.
Click here to open the Help window.

General | Questions | Order | Preview | Finish

phpESP

Survey Design

Help

General Questions Order Preview Finish

This is a preview of how this survey will look. In the preview the survey navigation buttons are inactive, use the section number buttons to view different sections. Some navigation buttons may not appear on your final survey, depending on what access it is assigned. The survey will use the background color of the document in which it is embedded. If you have no further changes click **Finish** at the bottom of this page.

Academic Pathways Study Spring'07 Survey

Stanford University

Please click the [Submit Survey] button to access the next page of the survey, and only after you have completed this page.
For best viewing results, please maximize your browser window.

1. **What is your expected year of graduation from college?**

- 2007
- 2008
- 2009
- 2010 or later

2. **Do you intend to complete a major in engineering?**

- Definitely Not
- Probably Not
- Not Sure
- Probably Yes
- Definitely Yes

3. **What do you intend to major in?**

- Aeronautical Engineering
- Chemical Engineering
- Civil and Environmental Engineering
- Computer Science
- Electrical Engineering
- Management Science and Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Other Engineering
- Arts and Humanities
- Education

- Natural Science/Math
- Social Science
- Other Non-engineering

4. **If you intend to DOUBLE MAJOR, what is the second major you intend to complete? (Mark N/A if you do not intend to double major.)**

- Aeronautical Engineering
- Chemical Engineering
- Civil and Environmental Engineering
- Computer Science
- Electrical Engineering
- Management Science and Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Other Engineering
- Arts and Humanities
- Education
- Natural Science/Math
- Social Science
- Other Non-engineering
- N/A

5. **Do you intend to practice, conduct research in, or teach engineering for at least 3 years after graduation?**

- Definitely Not
- Probably Not
- Not Sure
- Probably Yes
- Definitely Yes

6. **If you are thinking of going to graduate school in a field OTHER THAN engineering, please mark your most probable area of study. Otherwise, mark N/A.**

- Business
- Education
- Humanities and Social Sciences
- Law
- Medicine
- Natural Sciences/Math
- Public Service
- Other
- N/A

7. **We are interested in knowing why you are studying engineering now. Please indicate below the extent to which the following reasons apply to you:**

	Not a Reason	Minimal Reason	Moderate Reason	Major Reason
Technology plays an important role in solving society's problems	○	○	○	○
Engineers make more money than most other professionals	○	○	○	○
My parent(s) would disapprove if I chose a major other than engineering	○	○	○	○
Engineers have contributed greatly to fixing problems in the world	○	○	○	○
Engineers are well paid	○	○	○	○
My parent(s) want me to be an engineer	○	○	○	○
An engineering degree will guarantee me a job when I graduate	○	○	○	○
A faculty member, academic advisor, teaching assistant or other university affiliated person has encouraged and/or inspired me to study engineering	○	○	○	○
A non-university affiliated mentor has encouraged and/or inspired me to study engineering	○	○	○	○

8. **Please indicate how strongly you disagree or agree with each of the statements:**

	Disagree Strongly	Disagree	Agree	Agree Strongly
Creative thinking is one of my strengths	○	○	○	○
I am familiar with what a practicing engineer does	○	○	○	○
I am skilled at solving problems that can have multiple solutions	○	○	○	○

9. **Rate yourself on each of the following traits as compared to your classmates. We want the most accurate estimate of how you see yourself. (Mark one in each row.)**

	Lowest 10%	Below Average	Average	Above Average	Highest 10%
Self confidence (social)	○	○	○	○	○
Leadership ability	○	○	○	○	○
Public speaking ability	○	○	○	○	○
Math ability	○	○	○	○	○
Science ability	○	○	○	○	○
Communication skills	○	○	○	○	○
Ability to apply math and science principles in solving real world problems	○	○	○	○	○
Business ability	○	○	○	○	○
Ability to perform in teams	○	○	○	○	○
Critical thinking skills	○	○	○	○	○

10. **How important do you think each of the following skills and abilities is to becoming a successful engineer? (Mark one in each row.)**

	Not Important	Somewhat Important	Very Important	Crucial
Self confidence (social)	○	○	○	○
Leadership ability	○	○	○	○
Public speaking ability	○	○	○	○
Math ability	○	○	○	○
Science ability	○	○	○	○

Communication skills	○	○	○	○
Ability to apply math and science principles in solving real world problems	○	○	○	○
Business ability	○	○	○	○
Ability to perform in teams	○	○	○	○

11. **Please rate your satisfaction with this institution on each of the aspects of campus life listed below. If you do not have experience with this aspect, mark N/A.**

	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied	N/A
Quality of instruction by faculty	○	○	○	○	○
Quality of advising by faculty	○	○	○	○	○
Availability of faculty	○	○	○	○	○
Quality of instruction by teaching assistants	○	○	○	○	○
Quality of advising by teaching assistants	○	○	○	○	○
Availability of teaching assistants	○	○	○	○	○

12. **Please rate your satisfaction with each of the following at this institution. If you do not use this facility, mark N/A.**

	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied	N/A
Computer facilities	○	○	○	○	○
Libraries	○	○	○	○	○
Classrooms	○	○	○	○	○
Laboratories	○	○	○	○	○

13. **Think about the engineering classes you have taken during the current school year (engineering, math, and science classes). Indicate how often you: (Mark N/A if you have not taken any engineering related classes.)**

	Never	Rarely	Occasionally	Frequently	N/A
Came late to engineering class	○	○	○	○	○
Skipped engineering class	○	○	○	○	○
Turned in engineering assignments that did not reflect your best work	○	○	○	○	○
Turned in engineering assignments late	○	○	○	○	○

14. **Think about the liberal arts classes you have taken during the current school year (not engineering, math, and science). Indicate how often you: (Mark N/A if you have not taken any non-engineering related classes.)**

	Never	Rarely	Occasionally	Frequently	N/A
Came late to liberal arts class	○	○	○	○	○
Skipped liberal arts class	○	○	○	○	○
Turned in liberal arts assignments that did not reflect your best work	○	○	○	○	○
Turned in liberal arts assignments late	○	○	○	○	○

15. How often have you interacted with the following people during the current school year (e.g. by phone, e-mail, Instant Messenger, or in person)? (Mark one for each item.)

	Never	1-2 times per Term	1-2 times per Month	Once per Week	2-3 times per Week	Daily
Faculty during class	○	○	○	○	○	○
Faculty during office hours	○	○	○	○	○	○
Faculty outside of class or office hours	○	○	○	○	○	○
Teaching Assistants during class	○	○	○	○	○	○
Teaching Assistants during office hours	○	○	○	○	○	○
Teaching Assistants outside of class or office hours	○	○	○	○	○	○

16. What portion of the courses you have taken during the current school year have been taught primarily by graduate students?

- ○ None
- ○ Very little
- ○ Less than half
- ○ About half
- ○ More than half
- ○ All or nearly all

17. During the current school year, what portion of your classes have used the following teaching methods?

	None	Very little	Less than half	About half	More than half	All or nearly all
Lectures	○	○	○	○	○	○
Individual Projects	○	○	○	○	○	○
Team Projects	○	○	○	○	○	○
Labs	○	○	○	○	○	○
Seminars	○	○	○	○	○	○

18. Some people are involved in non-engineering activities on or off campus, such as hobbies, civic or church organizations, campus publications, student government, social fraternity or sorority, sports, etc. How important is it for you to be involved in these kind of activities?

- ○ Not Important
- ○ Somewhat Important
- ○ Very Important
- ○ Essential

19. How often are you involved in the kinds of non-engineering activities described above?

- ○ Never
- ○ Rarely
- ○ Occasionally

○ Frequently

20. **Thinking about your college experience during the current school year, please indicate how much pressure you are feeling related to the following:**

	No Pressure	Reasonable Pressure	Extreme Pressure
Course load (amount of course material being covered)	○	○	○
Course pace (the pace at which the course material is being covered)	○	○	○
Balance between social and academic life	○	○	○

21. **How well are you meeting the workload demands of your coursework?**

○ I am meeting all of the demands easily
○ I am meeting all of the demands, but it is hard work
○ I am meeting most of the demands, but cannot meet some
○ I can meet some of the demands, but cannot meet most
○ I cannot meet any of the demands

22. **How stressed do you feel in your coursework right now?**

○ No stress
○ Some stress
○ Reasonable stress
○ Significant stress
○ Extreme stress

23. **Do you have any concerns about your ability to finance your college education?**

○ None (I am confident that I will have sufficient funds)
○ Some (but I probably will have sufficient funds)
○ Major (not sure if I will have sufficient funds to complete college)

24. **How do you meet your college expenses?**

	None	Very little	Less than half	About half	More than half	All or nearly all
Self (income)	○	○	○	○	○	○
Self (savings)	○	○	○	○	○	○
Parents and family	○	○	○	○	○	○
Employer support	○	○	○	○	○	○
Scholarships and grants	○	○	○	○	○	○
Loans	○	○	○	○	○	○

25. **How much exposure have you had to a professional engineering environment as a visitor, intern, or employee?**

- No exposure
- Limited exposure
- Moderate exposure
- Extensive exposure

26. **About how many hours do you spend in a typical 7-day week doing each of the following?**

	0	1-5	6-10	11-15	16-20	21-25	26-30	more than 30
Preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)	○	○	○	○	○	○	○	○
Working for pay	○	○	○	○	○	○	○	○
Participating in co-curricular activities (organizations, campus publications, student government, social fraternity or sorority, intercollegiate or intramural sports, etc.)	○	○	○	○	○	○	○	○
Relaxing and socializing (watching TV, partying, exercising, etc.)	○	○	○	○	○	○	○	○
Providing care for dependents living with you (parents, children, spouse, etc.)	○	○	○	○	○	○	○	○
Commuting to class (driving, walking, etc.)	○	○	○	○	○	○	○	○

27. **Please rate the overall quality of your collegiate experience so far:**

- Very dissatisfied
- Dissatisfied
- Satisfied
- Very satisfied

28. **Which of the following statements best describes your situation with respect to an engineering major? (Mark one.)**

I started at this institution...

- Intending to major in engineering and never doubted the decision.
- Intending to major in engineering and have/had doubts.
- Considering engineering, but was open to other majors, too.
- Intending another major, but am now considering engineering.
- Completely undecided about what my major would be.

29. **My decision to CONTINUE with an engineering major *primarily* came from: (Mark one.)**

- Not applicable - I am not continuing in an engineering major.
- Experiences with **PRE-ENGINEERING**-related (math, physics, etc) coursework, faculty, and/or research/internship(s)

- ◯ Experiences with **ENGINEERING**-related coursework, faculty, and/or research/internship(s)
- ◯ Experiences with **OTHER** coursework, faculty, and/or research/internship(s)

30. **My DOUBTS about continuing in an engineering major *primarily* came from: (Mark one.)**

- ◯ Not applicable - I never doubted continuing in an engineering major.
- ◯ Experiences with **PRE-ENGINEERING**-related (math, physics, etc) coursework, faculty, and/or research/internship(s)
- ◯ Experiences with **ENGINEERING**-related coursework, faculty, and/or research/internship(s)
- ◯ Experiences with **OTHER** coursework, faculty, and/or research/internship(s)

31. **Since coming to college, have you had any research experience(s)?**

- ◯ No
- ◯ Yes, in engineering related areas
- ◯ Yes, in non-engineering related areas
- ◯ Yes, in both engineering and non-engineering related areas

32. **What is your expected grade point average this academic term?**

- ◯ A or A+ (3.9-4.0)
- ◯ A- (3.5-3.8)
- ◯ B+ (3.2-3.4)
- ◯ B (2.9-3.1)
- ◯ B- (2.5-2.8)
- ◯ C+ (2.2-2.4)
- ◯ C (1.9-2.1)
- ◯ C- (1.5-1.8)
- ◯ D (less than 1.4)

33. **Your sex:**

- ◯ Male
- ◯ Female

34. **How old will you be on December 31st of this year? (Mark one.)**

- ◯ 20 or younger
- ◯ 21
- ◯ 22
- ◯ 23
- ◯ 24
- ◯ 25-29
- ◯ 30-34

- 35-39
- 40-54
- 55 or older

35. **Please indicate your ethnic background: (Mark all that apply.)**

- White/Caucasian
- African American/Black
- American Indian/Alaska Native
- Asian American/Asian
- Native Hawaiian/Pacific Islander
- Mexican American/Chicano
- Puerto Rican
- Other Latino
- Other

36. **What is your marital status?**

- Not married
- Married
- Divorced
- Separated
- Widowed

37. **How many dependents do you have?**

- None
- 1
- 2
- 3
- 4
- 5 or more

38. **Are you:**

- A U.S. Citizen
- A Permanent Resident of the U.S.
- Other

39. **Were you born in the United States?**

- ◯ Yes
- ◯ If no, at what age did you immigrate to the U.S.? [ ]

40. **Did one or more of your parents/guardians immigrate to the United States?**

- ◯ Yes
- ◯ No

41. **Is English your first language?**

- ◯ Yes
- ◯ No

42. **What is the highest level of education that your mother completed? (Mark one.)**

- ◯ Did not finish high school
- ◯ Graduated from high school
- ◯ Attended college but did not complete degree
- ◯ Completed an Associate's degree (AA, AS, etc.)
- ◯ Completed a Bachelor's degree (BA, BS, etc.)
- ◯ Completed a Master's degree (MA, MS, etc.)
- ◯ Completed a Doctoral or Professional degree (JD, MD, PhD, etc.)

43. **What is the highest level of education that your father completed? (Mark one.)**

- ◯ Did not finish high school
- ◯ Graduated from high school
- ◯ Attended college but did not complete degree
- ◯ Completed an Associate's degree (AA, AS, etc.)
- ◯ Completed a Bachelor's degree (BA, BS, etc.)
- ◯ Completed a Master's degree (MA, MS, etc.)
- ◯ Completed a Doctoral or Professional degree (JD, MD, PhD, etc.)

44. **What is your best estimate of your parents' total income last year? Consider income from all sources before taxes. (Mark one.)**

- ◯ Less than $10,000
- ◯ $10,000-$14,999
- ◯ $15,000-$19,999
- ◯ $20,000-$24,999
- ◯ $25,000-$29,999
- ◯ $30,000-$39,999
- ◯ $40,000-$49,999
- ◯ $50,000-$59,999
- ◯ $60,000-$74,999

- $75,000-$99,999
- $100,000-$149,999
- $150,000-$199,999
- $200,000-$249,999
- $250,000 or more

45. **Would you describe your family as: (Mark one.)**

- Low income
- Middle income
- Upper-middle income
- High income

46. **What did you do last summer (2006) that was particularly important to you?**

47. **Did your experience last summer (2006) advance your interest in studying engineering?**

- Yes
- No

48. **Did you participate over the last summer (2006) in any of the following? (Mark all that apply.)**

- Engineering related internship/job
- Engineering related research
- Engineering related coursework
- N/A

49. **What do you plan to do after graduating from college?**

50. **Did you take the Academic Pathways of People Learning Engineering Survey (APPLES)?**

- ◯ Yes
- ◯ No
- ◯ I'm not sure

Please click the SUBMIT SURVEY button below to access the next page of the survey, and ONLY after you have completed this page. Once you click the button, you will not be able to return to this page.

Save | Submit Survey

The survey title and other general fields are on the **General** tab. Individual survey questions are added and modified on the **Questions** tab. Questions may be re-ordered or deleted from the **Order** tab. You may see a preview of your survey at any time, by going to the **Preview** tab. If you have no further changes click **Finish** to go back to the Management Interface.
Click here to open the Help window.

General | Questions | Order | Preview | Finish

p h p E S P

Survey Design

Help

General Questions Order Preview Finish

This is a preview of how this survey will look. In the preview the survey navigation buttons are inactive, use the section number buttons to view different sections. Some navigation buttons may not appear on your final survey, depending on what access it is assigned. The survey will use the background color of the document in which it is embedded. If you have no further changes click **Finish** at the bottom of this page.

ACADEMIC PATHWAYS STUDY SPRING 2007 SURVEY

PLEASE CLICK THE SUBMIT SURVEY BUTTON ONLY AFTER YOU HAVE COMPLETED THE SURVEY. FOR BEST VIEWING RESULTS, PLEASE MAXIMIZE YOUR BROWSER WINDOW.

1. **In the space provided, list 5 terms you would use to describe "engineering."**

2. **If you were asked the same question next week, how likely is it that you would list the same 5 terms?**

- Not likely
- Somewhat likely
- Likely
- Very likely
- Extremely likely

3. **In the space provided, list 5 activities you think engineers do at work.**

4. **If you were asked the same question next week, how likely is it that you would list the same 5 activities?**

- ◯ Not likely
- ◯ Somewhat likely
- ◯ Likely
- ◯ Very likely
- ◯ Extremely likely

5. **In the space provided, list 5 terms you would use to describe "design."**

6. **If you were asked the same question next week, how likely is it that you would list the same 5 terms?**

- ◯ Not likely
- ◯ Somewhat likely
- ◯ Likely
- ◯ Very likely
- ◯ Extremely likely

7. **Of the twenty-three design activities below, please put a check mark next to the SIX MOST IMPORTANT.**

- ☐ Abstracting
- ☐ Brainstorming
- ☐ Building
- ☐ Communicating
- ☐ Decomposing
- ☐ Evaluating
- ☐ Generating alternatives
- ☐ Goal setting
- ☐ Identifying constraints
- ☐ Imagining
- ☐ Iterating
- ☐ Making decisions
- ☐ Making trade-offs
- ☐ Modeling
- ☐ Planning
- ☐ Prototyping
- ☐ Seeking information
- ☐ Sketching
- ☐ Synthesizing

- [ ] Testing
- [ ] Understanding the problem
- [ ] Using creativity
- [ ] Visualizing

8. **Of the twenty-three design activities below, please put a check mark next to the SIX LEAST IMPORTANT.**

- [ ] Abstracting
- [ ] Brainstorming
- [ ] Building
- [ ] Communicating
- [ ] Decomposing
- [ ] Evaluating
- [ ] Generating alternatives
- [ ] Goal setting
- [ ] Identifying constraints
- [ ] Imagining
- [ ] Iterating
- [ ] Making decisions
- [ ] Making trade-offs
- [ ] Modeling
- [ ] Planning
- [ ] Prototyping
- [ ] Seeking information
- [ ] Sketching
- [ ] Synthesizing
- [ ] Testing
- [ ] Understanding the problem
- [ ] Using creativity
- [ ] Visualizing

9. **For the following engineering design activities, please indicate your level of confidence. For example, if you have little or no confidence in your ability to model engineering solutions, then mark poor. If you are extremely confident in your ability, mark excellent.**

	Poor	Fair	Good	Very Good	Excellent
Defining what the problem really is	○	○	○	○	○
Searching for and collecting information needed to solve the problem	○	○	○	○	○
Thinking up potential solutions to the problem	○	○	○	○	○
Detailing how to build the solution to the problem	○	○	○	○	○
Assessing and passing judgment on a possible or planned solution to the problem	○	○	○	○	○
Comparing and contrasting two solutions to the problem on a particular dimension such as cost	○	○	○	○	○
Selecting one idea or solution to the problem from among those considered	○	○	○	○	○
Communicating elements of the design in sketches, diagrams, lists, and written or oral reports	○	○	○	○	○

10. **For the following engineering design activities, please indicate how often you engaged in the activity in your coursework in the current academic year.**

	Never	1-2 times per term	1-2 times a month	Once a week	2-3 times a week	Daily
Defining what the problem really is	○	○	○	○	○	○
Searching for and collecting information needed to solve the problem	○	○	○	○	○	○
Thinking up potential solutions to the problem	○	○	○	○	○	○
Detailing how to build the solution to the problem	○	○	○	○	○	○
Assessing and passing judgment on a possible or planned solution to the problem	○	○	○	○	○	○
Comparing and contrasting two solutions to the problem on a particular dimension such as cost	○	○	○	○	○	○
Selecting one idea or solution to the problem from among those considered	○	○	○	○	○	○
Communicating elements of the design in sketches, diagrams, lists, and written or oral reports	○	○	○	○	○	○

11. **For the following engineering design activities, please indicate how well you think your courses are preparing you to engage in the activity. For example, if you think they are not preparing you at all, then mark poor. If you think they are preparing you extremely well, then mark excellent.**

	Poor	Fair	Well	Very well	Excellent
Defining what the problem really is	○	○	○	○	○
Searching for and collecting information needed to solve the problem	○	○	○	○	○
Thinking up potential solutions to the problem	○	○	○	○	○
Detailing how to build the solution to the problem	○	○	○	○	○
Assessing and passing judgment on a possible or planned solution to the problem	○	○	○	○	○
Comparing and contrasting two solutions to the problem on a particular dimension such as cost	○	○	○	○	○
Selecting one idea or solution to the problem from among those considered	○	○	○	○	○
Communicating elements of the design in sketches, diagrams, lists, and written or oral reports	○	○	○	○	○

12. **You have been asked to design a playground. You have a limited amount of time and resources to gather information for your design. From the following list, please put a check mark next to the FIVE kinds of information you would MOST LIKELY NEED as you work on your design:**

- ☐ Availability of materials
- ☐ Body proportions
- ☐ Budget
- ☐ Handicapped accessibility
- ☐ Information about the area
- ☐ Labor availability and cost
- ☐ Legal liability
- ☐ Maintenance concerns
- ☐ Material costs
- ☐ Material specifications
- ☐ Neighborhood demographics
- ☐ Neighborhood opinions
- ☐ Safety
- ☐ Supervision concerns
- ☐ Technical references
- ☐ Utilities

13. **You have been asked to design a playground. You have a limited amount of time and resources to gather information for your design. From the following list, please put a check mark next to the FIVE kinds of information you would LEAST LIKELY NEED as you work on your design:**

- [ ] Availability of materials
- [ ] Body proportions
- [ ] Budget
- [ ] Handicapped accessibility
- [ ] Information about the area
- [ ] Labor availability and cost
- [ ] Legal liability
- [ ] Maintenance concerns
- [ ] Material costs
- [ ] Material specifications
- [ ] Neighborhood demographics
- [ ] Neighborhood opinions
- [ ] Safety
- [ ] Supervision concerns
- [ ] Technical references
- [ ] Utilities

14. **Of the 20 items below, please put a check mark next to the FIVE you think are MOST IMPORTANT to practicing engineers.**

- [ ] Business knowledge
- [ ] Communication
- [ ] Conducting experiments
- [ ] Contemporary issues
- [ ] Creativity
- [ ] Data analysis
- [ ] Design
- [ ] Engineering analysis
- [ ] Engineering tools
- [ ] Ethics
- [ ] Global context
- [ ] Leadership
- [ ] Life-long learning
- [ ] Management skills
- [ ] Math
- [ ] Problem solving
- [ ] Professionalism
- [ ] Science
- [ ] Societal context
- [ ] Teamwork

15. **Please rate how well prepared you are to incorporate each of the following items while practicing as an engineer:**

	Not at all prepared	...	Somewhat prepared	...	Very well prepared
Business knowledge	○	○	○	○	○
Communication	○	○	○	○	○
Conducting experiments	○	○	○	○	○
Contemporary issues	○	○	○	○	○

Creativity	○	○	○	○	○
Data analysis	○	○	○	○	○
Design	○	○	○	○	○
Engineering analysis	○	○	○	○	○
Engineering tools	○	○	○	○	○
Ethics	○	○	○	○	○
Global context	○	○	○	○	○
Leadership	○	○	○	○	○
Life-long learning	○	○	○	○	○
Management skills	○	○	○	○	○
Math	○	○	○	○	○
Problem solving	○	○	○	○	○
Professionalism	○	○	○	○	○
Science	○	○	○	○	○
Societal context	○	○	○	○	○
Teamwork	○	○	○	○	○

16. **You are an engineer working for a silicon chip manufacturing company. Your company's current facilities in California are close to maximum capacity and the company is out of land to expand at the current site. The company needs to build a new factory in a new location. There are three potential sites: in the U.S. in Alabama or Illinois; or in Asia in Thailand. You have been asked to evaluate the sites for locating the plant.**

Please list FIVE factors you think would be important in your evaluation of the sites.

17. **Please rate how well prepared you are to consider each of the following items as a practicing engineer:**

	Not at all prepared	...	Somewhat prepared	...	Very well prepared
Economic context	○	○	○	○	○
Global context	○	○	○	○	○
Natural context	○	○	○	○	○
Societal context	○	○	○	○	○
Technological context	○	○	○	○	○

18. **During your undergraduate years, how many months of experience have you had with academic research or professional engineering?**

	None	1-2 months	3-4 months	5-6 months	7-8 months	9-10 months	more than 10 months
Part-time, academic research work on campus	○	○	○	○	○	○	○
Full-time, academic research work on campus	○	○	○	○	○	○	○

Part-time engineering work (e.g., internship, coop, summer job)	○	○	○	○	○	○	○
Full-time engineering work (e.g., internship, coop, summer job)	○	○	○	○	○	○	○

19. **Please provide a short description of your experience(s) with academic research and/or professional engineering.**

Save | Submit Survey

The survey title and other general fields are on the **General** tab. Individual survey questions are added and modified on the **Questions** tab. Questions may be re-ordered or deleted from the **Order** tab. You may see a preview of your survey at any time, by going to the **Preview** tab. If you have no further changes click **Finish** to go back to the Management Interface.
Click here to open the Help window.

General | Questions | Order | Preview | Finish

Variable and Item Content	SURV-1: C1Y1A Winter 04	SURV 2: C1Y1B Spring 04	SURV 3: C1Y2A Fall 04
1a: Academic Persistence	23. Do see yourself studying or practicing e	25. Do see yourself studying or p	2. Do you intend to complete a maj
	2. What do you intend to major in?	2. What do you intend to major ir	3. What do you intend to major in?
	3. What do you intend to major in (currently	3. What do you intend to major ir	4. If you intend to double major, wh
	4. What is the highest academic degree tha	4. What is the highest academic degree that you intend to obtain in e	
1b: Professional Persistence	Not asked	Not asked	5. Do you intend to practice, condu
2a: Motivation (Financial)	7c. Engineers make more money than most	8c. Engineers make more money	7c. Engineers make more money tl
	7g. Engineers are well paid	8g. Engineers are well paid	7f. Engineers are well paid
	7j. An engineering degree will guarantee me	8j. An engineering degree will gu	7i. An engineering degree will guar
	7h. Engineering is an occupation that is res	8h. Engineering is an occupation	7g. Engineering is an occupation tl
2b: Motivation (Family Influence)			7d. My parents would disapprove if

	7i. My parents want me to be an engineer	8i. My parents want me to be an	7h. My parents want me to be an e
	7d. My parent(s) are making me study engir	8d. My parent(s) are making me study engineering	
2c: Motivation (Social Good)	7b. Technology plays an important role in sc	8b. Technology plays an importa	7b. Technology plays an important
	7f. Engineers have contributed greatly to fixi	8f. Engineers have contributed gi	7e. Engineers have contributed gre
2d: Motivation (High School Mentor Influence)	Not asked	8l. High school teachers/advisors	Not asked
	Not asked	9k. I had one or more high school math/science teachers who seeme	
	Not asked	9n. One or more of my favorite high school teachers were math/scier	
2e: Motivation (Mentor Influence)	Not asked	Not asked	7k. A faculty member, academic ac
	Not asked	Not asked	7l. A non-university affiliated mentc
3a: Confidence in Math & Science Skills	19f. Math ability	21f. Math ability	10e. Math ability
	19g. Science ability	21g. Science ability	10f. Science ability
			10j. Ability to apply math & science
3b: Confidence in Professional and Interpersonal Skills	19b. Self confidence (social)	21b. Self confidence (social)	10a. Self confidence (social)
	19d. Leadership ability	21d. Leadership ability	10c. Leadership ability
	19e. Public speaking ability	21e. Public speaking ability	10d. Public speaking ability
	19i. (Written) Communication skills	21i. (Written) Communication ski	10h. Communication skills
	19j. Business ability	21j. Business ability	10k. Business ability
			10l. Ability to perform in teams
	19c. Self understanding	21c. Self understanding	10b. Self understanding
3c: Confidence in Solving Open-ended Problems			9a. Creative thinking is one of my s
	8g. I enjoy problems that can be solved in d	9h. I enjoy problems that can be	9d. I am skilled at solving problems

	10b. Confidence: Critical thinking skills	11b. Confidence: Critical thinking	10i. Critical thinking skills
			7j. Engineers are creative problem
			14b. Since the beginning of fall terr
4a: Perceived Importance in Math & Science Skills	20b. Math ability	22b. Math ability	11a. Math ability
	20c. Science ability	22c. Science ability	11b. Science ability
			11f. Ability to apply math & science
4b: Perceived Importance in Professional & Interpersonal Skills			
	20a. Public speaking ability	22a. Public speaking ability	
	20e. (Written) Communication skills	22e. (Written) Communication sk	11d. Communication skills
	20f. Business ability	22f. Business ability	11g. Business ability
			11h. Ability to perform in teams
5: Knowledge of the Engineering Profession		9q. I am familiar with what a prac	9c. I am familiar with what a practic
	33. Did any of your immediate family memb	26. How many of your friends and family members are practicing en	
	27. What portion of your friends in college (c	27. What portion of your friends in college (on this campus or other c	

6a: Exposure to Project-Based Learning Methods: Individual	22b. Teaching methods - Individual projects	24b. Teaching methods - Individu	19b. Teaching methods - Individua
6b: Exposure to Project-Based Learning Methods: Team	22c. Teaching methods - Team projects	24c. Teaching methods - Team p	19c. Teaching methods - Team pro
7: Collaborative Work Style	8a. I prefer working/studying alone (reverse)	9a. I prefer working/studying alor	8a. I prefer studying in a group to s
			8c. I prefer working as part of a tea
			8d. I get along well with others in s
8: Extracurricular Fulfillment (Non-engineering)			21. Importance of non-engineering
			22. Frequency of involvement in nc
8b: Extracurricular Involvement (Engineering)			
8c: Research Experience			
9: Curriculum Overload			23a. Pressure - course load
			23b. Pressure - course pace
			23c. Pressure - Balance between s
			24. How well are you meeting work
			25. How stressed do you feel in yo
10: Financial Difficulties	38. Do you have any concerns about your ability to finance your college educ		26. Do you have any concerns abo
	13e. Frequency: Worried about how you would pay for school		
11a: Academic Disengagement - Liberal Arts courses	17a. Came late to liberal arts class	18a. Came late to liberal arts cla	16a. Came late to non-engineering
	17b. Skipped liberal arts class	18b. Skipped liberal arts class	16b. Skipped non-engineering clas
	17c. Turned in liberal arts assignments that	18c. Turned in liberal arts assign	16c. Turned in non-engineering as
	17d. Turned in liberal arts assignments late	18d. Turned in liberal arts assign	16d. Turned in non-engineering as
	17e. Thought liberal arts classes were borin	18e. Thought liberal arts classes	16e. Thought non-engineering clas
11b: Academic Disengagement - Engineering-Related courses	16a. Came late to engineering class	17a. Came late to engineering cl	15a. Came late to engineering clas
	16b. Skipped engineering class	17b. Skipped engineering class	15b. Skipped engineering class
	16c. Turned in engineering assignments tha	17c. Turned in engineering assig	15c. Turned in engineering assignr
	16d. Turned in engineering assignments lat	17d. Turned in engineering assig	15d. Turned in engineering assignr

	16e. Thought engineering classes were bori	17e. Thought engineering classe	15e. Thought engineering classes
11c: Academic Disengagement - Overall	Constructs 11a + 11b	Constructs 11a + 11b	Constructs 11a + 11b
12a: Frequency of Interaction with Faculty	18a. Faculty during office hours	20a. Faculty during office hours	17a. Faculty during office hours
	18b. Faculty outside of class or office hours	20b. Faculty outside of class or c	17b. Faculty outside of class or offi
12b: Frequency of Interaction with Teaching Assistants			
	18c. TAs during office hours	20c. TAs during office hours	17c. TAs during office hours
	18d. TAs outside of class or office hours	20d. TAs outside of class or offic	17d. TAs outside of class or office
12c: Frequency of Interaction with Instructors	Constructs 12a + 12b	Constructs 12a + 12b	Constructs 12a + 12b
13a: Satisfaction with Faculty	11b. Quality of instruction by faculty	12b. Quality of instruction by facu	12a. Quality of instruction by facult
	11c. Availability of faculty	12c. Availability of faculty	12b. Availability of faculty
13b: Satisfaction with Teaching Assistants	11d. Quality of instruction by TAs	12d. Quality of instruction by TAs	12c. Quality of instruction by TAs
	11e. Availability of TAs	12e. Availability of TAs	12d. Availability of TAs
13c: Satisfaction with Instructors	Constructs 13a + 13b	Constructs 13a + 13b	Constructs 13a + 13b
13d. Satisfaction with advising			
14: Satisfaction with Academic Facilities	12a. Computer facilities	13a. Computer facilities	13a. Computer facilities
	12b. Libraries	13b. Libraries	13b. Libraries
	12c. Classrooms	13c. Classrooms	13c. Classrooms
	12f. Laboratories	13f. Laboratories	13f. Laboratories
15: Overall Satisfaction with Collegiate Experience		6. Overall quality of collegiate ex	35. Overall quality of collegiate exp
16: Intrinsic Motivation (Psychological)		29. I feel good when I am doing engineering activities 29. Majoring in engineering is fun 29. I think engineering is interesting	
16: Intrinsic Motivation (Behavioral)			

Demographic Variables

Expected Graduation Date	1. Expected year of graduation	1. Expected year of graduation	1. Expected year of graduation
Expected GPA academic term			
Expected GPA overall			
Sex	24. Sex		
Age	25. How old will you be on December 31st of this year?		
Ethnicity	26. Ethnic background		
Marital status	28. Marital status		
Dependents	29. Number of dependents		
Citzenship	27. Citizenship		
Current academic standing			
Traditional/nontraditional student			
Preliminary area of interest			
Full time/part-time student			
Year graduated from high school	30. What year did you graduate from high school?		
High school community	31. How would you describe the community where you attended high school?		
Average grade in high school	32. What was your average grade in high school?		
Residence in college	33. Where are you living now while attending college?		
Roommates in college	34. With whom do you live during the school year?		
Disabilities	41. Do you have any of the following physical, learning, or health disabilities?		
Assistive technologies	42. Do you receive any of the following assistive technology or other accommodations?		
Cultural Background			
Cultural Background			
Cultural Background			
Cultural Background			
SES	37a. How well do you meet your college expenses - self (income)		27a. How well do you meet your cc
SES	37b. College expenses - self (savings)		27b. College expenses - self (savir
SES	37c. College expenses - parents and family		27c. College expenses - parents ar
SES	37d. College expense - employer support		27d. College expense - employer s
SES	37e. College expenses - scholarships and grants		27e. College expenses - scholarsh
SES	37f. College expenses - loans		27f. College expenses - loans
SES	37g. College expenses - other sources		

SES	34. Highest level of education of mother		
SES	35. Highest level education of father		
SES	36. Best estimate of parents' total income		
SES			
Unofficial item groupings			
Research			34b. Did you participate in enginee
Research			
Research			
Engineering Extra-curricular			34a. Did you participate in an engir
Engineering Extra-curricular			34c. Did you participate in engineer
Engineering Extra-curricular		52. What are your summer plans	32. What did you do this summer tl
Engineering Extra-curricular			33. Did your experience advance y
Engineering Extra-curricular			
Engineering Extra-curricular			
Engineering Extra-curricular			
Engineering Extra-curricular	50. Some students participate in design competitions, internships, and clubs. In the space provided identify engir		
NSSE	6a. Hours spent - preparing for class	7a. Hours spent - preparing for cl	31a. Hours spent - preparing for cla
NSSE	6b. Hours spent - working for pay	7b. Hours spent - working for pay	31b. Hours spent - working for pay
NSSE	6c. Hours spent - participating in co-curricul	7c. Hours spent - participating in	31c. Hours spent - participating in c
NSSE	6d. Hours spent - relaxing and socializing	7d. Hours spent - relaxing and sc	31d. Hours spent - relaxing and so
NSSE	6e. Hours spent - providing care	7e. Hours spent - providing care	31e. Hours spent - providing care
NSSE	6f. Hours spent - commuting to class	7f. Hours spent - commuting to c	31f. Hours spent - commuting to cla
Confirm/Doubt			
Confirm/Doubt			
Confirm/Doubt			
Confirm/Doubt	54. Identify any classes (in high school or cc	43. Identify any classes this year that have STRONGLY REINFORC	
Confirm/Doubt	55. Identify any classes (in high school or cc	44. Identify any classes this year that have STRONGLY WEAKENEI	

Survey verification			
Survey process information			
Survey process information			
Open-ended question			
Items not assigned to a construct and Deleted items/constructs			
Grad school not in engineering	5. If you are thinking of going to graduate sc	5. If you are thinking of going to g	6. If you are thinking of going to gra
Course taught by grad students	21. What portion of the courses you have ta	23. What portion of the courses y	18. What portion of the courses you
Teaching methods - lectures	22a. During the current school year, what p	24a. During the current school ye	19a. During the current school year
Teaching methods - labs	22d. Teaching methods - Labs	24d. Teaching methods - Labs	19d. Teaching methods - Labs
Teaching methods - seminars	22e. Teaching methods - Seminars	24e. Teaching methods - Semina	19e. Teaching methods - Seminars
Competitive work style (personal)			8b. I am a competitive person
Competitive work style (personal)			8e. I strive to get higher grades tha
Competitive work style (institutional)			8g. The educational institution I am
Competitive work style (institutional)	8h. My instructors often remind students tha	9i. My instructors often remind st	8h. My instructors often remind stu
Competitive work style (institutional)			8f. I prefer keeping good ideas to m
Competitive work style (institutional)	8k. My instructors grade on a curve	9m. My instructors grade on a cu	8k. My instructors grade on a curve
Collaborative work style (institutional)	8i. I have easy access to work spaces wher	9j. I have easy access to work sp	8i. I have easy access to work spa
Collaborative work style (institutional)	8j. I am encouraged by my instructors to init	9l. I am encouraged by my instru	8j. I am encouraged by my instruct
Collaborative work style (institutional)			8l. The educational institution I am
Collaborative work style (institutional)			14a. Since the beginning of fall terr
Satisfaction with academic services	12d. Satisfaction with tutoring	13d. Satisfaction with tutoring	13d. Satisfaction with tutoring
Satisfaction with academic services	12e. Satisfaction with academic advising	13e. Satisfaction with academic a	13e. Satisfaction with academic ad
Exposure to PBL Methods			14c. Since the beginning of fall terr
Exposure to PBL Methods			20. To what extent have your cours
Exposure to PBL Methods	8e. I have strong problem solving skills	9e. I have strong problem solving	9b. I have strong problem solving s
Who Am I questions		45.-51. Who am I questions	
Confidence in computer skills	19h. Confidence: Computer and programmi	21h. Confidence: Computer and	10g. Confidence: Computer skills
Perceived importance of computer skills	20d. Perceived importance: Computer and p	22d. Perceived importance: Com	11c. Perceived importance: Compu
Perceived importance of critical thinking skills			11e. Perceived importance: Critical

UPri questions - Motivation, Self-Esteem, Ethnic identity		29.-32. UPri questions	
Motivation (Belief That Engineers Improve Welfare of Society Through Creative Work)	7a. I enjoy figuring out how things work	8a. I enjoy figuring out how thing:	7a. I enjoy figuring out how things v
Motivation (Belief That Engineers Improve Welfare of Society Through Creative Work)	7e. Engineers are innovative	8e. Engineers are innovative	
Motivation (Belief That Engineers Improve Welfare of Society Through Creative Work)	7k. Engineers are creative	8k. Engineers are creative	
	8b. I enjoy the subjects of science and math	9b. I enjoy the subjects of science and math the most	
	8c. Creative thinking is one of my strengths	9c. Creative thinking is one of my strengths	
	8d. Studying in a group is better than studyi	9d. Studying in a group is better than studying by myself	
	8f. I enjoy taking liberal arts courses more tl	9f. I enjoy taking liberal arts courses more than science and math co	
		9g. My friends are supportive of me when I am academically success	
		9o. I can count on my friends at school for emotional support when I	
		9p. I can count on my friends at school for emotional support when I	
	9a. Importance: Getting higher grades than	10a. Importance: Getting higher grades than my classmates	
	9b. Importance: Influencing social values	10b. Importance: Influencing social values	
	9c. Importance: Becoming an authority in m	10c. Importance: Becoming an authority in my field	
	9d. Importance: Keeping goood ideas to my	10d. Importance: Keeping goood ideas to myself unless it is to my ac	
	9e. Importance: Helping to promote racial ui	10e. Importance: Helping to promote racial understanding	
	9f. Importance: Becoming a community leac	10f. Importance: Becoming a community leader	
	9g. Importance: Helping others who are in d	10g. Importance: Helping others who are in difficulty	
	9h. Importance: When playing any game, pl	10h. Importance: When playing any game, playing to win	
	9i. Importance: Developing a meaningful ph	10i. Importance: Developing a meaningful philosophy of life	
	9j. Importance: Becoming a practicing engin	10j. Importance: Becoming a practicing engineer	
	9k. Importance: Getting along with others	10k. Importance: Getting along with others	
	9l. Importance: Working as part of a team	10l. Importance: Working as part of a team	
	9m. Importance: Becoming a student goverı	10m. Importance: Becoming a student government official	
	9n. Importance: Establishing relationships w	10n. Importance: Establishing relationships with engineering student	
	9o. Importance: Establishing relationships w	10o. Importance: Establishing relationships with non-engineering stu	
	10a. Confidence: Analytical and problem so	11a. Confidence: Analytical and problem solving skills	
	10c. Confidence: General knowledge	11c. Confidence: General knowledge	
	10d. Confidence: Knowledge of a particular	11d. Confidence: Knowledge of a particular field or discipline	
	10e. Confidence: Interest in studying engine	11e. Confidence: Interest in studying engineering	
	11a. Satisfaction: Opportunities for commun	12a. Satisfaction: Opportunities for community service	
	13a. Frequency: Felt that your courses inspi	14a. Frequency: Felt that your courses inspired you to think in new w	
	13b. Frequency: Felt you did not have enou	14b. Frequency: Felt you did not have enough time to pursue nonaca	
	13c. Frequency: Worried about keeping up \	14c. Frequency: Worried about keeping up with your schoolwork	
	13d. Frequency: Felt you did not have a "so	14d. Frequency: Felt you did not have a "social life"	
	13f. Frequency: Felt stressed	14e. Frequency: Felt stressed	

13g. Frequency: Participated in a peer study	14f. Frequency: Participated in a peer study group
	14g. Frequency: Visited or worked in a commercial engineering envi
	14h. Frequency: Socialized with someone of another racial/ethnic gr
	14i. Frequency: Discussed racial issues
	14j. Frequency: Attended a racial/cultural awareness workshop/even
14a. Came late to math class	15a. Came late to math class
14b. Skipped math class	15b. Skipped math class
14c. Turned in math assignments that did n	15c. Turned in math assignments that did not reflect your best work
14d. Turned in math assignments late	15d. Turned in math assignments late
14e. Thought math classes were boring	15e. Thought math classes were boring
15a. Came late to science class	16a. Came late to science class
15b. Skipped science class	16b. Skipped science class
15c. Turned in science assignments that did	16c. Turned in science assignments that did not reflect your best wo
15d. Turned in science assignments late	16d. Turned in science assignments late
15e. Thought science classes were boring	16e. Thought science classes were boring
	19a. Frequency: Asked for advice about managing your coursework
	19b. Frequency: Worked with people who have diverse backgrounds
	19c. Frequency: Spent time in a non-academic role
	19d. Frequency: Requested feedback on course assignments from a
	19e. Frequency: "Crammed" all night studying for an exam or comple
	19f. Frequency: Worked collaboratively on an assignment that was p
	19g. Frequency: Decided to turn in "C" quality work over spending co
	19h. Frequency: Had a research experience on a faculty or graduate
	19i. Frequency: Prioritized a good grade in a general education cour
	19j. Frequency: Prioritized a good grade in a math, science, or engin
	19k. Frequency: Studied regularly in blocks of 2 hours or more
	19l. Frequency: Took a seminar course to discuss and argue ideas w
	19m. Frequency: Reduced time spent on course work to have more
	19n. Frequency: Asked for advice about managing your college expe
	19o. Frequency: Created a project outside of your academic work wi
	19p. Frequency: Monitored how you spent your time on your course
	19q. Frequency: Asked for help to strengthen a particular skill (e.g.,
	10r. Frequency: Reduced your course load to improve your grades
19a. Confidence: Self-confidence (intellectu	21a. Confidence: Self-confidence (intellectual)
52a. Frequency: Worked on class projects	28a. Frequency: Worked on class projects
52b. Frequency: Held a study group	28b. Frequency: Held a study group
52c. Frequency: Took a specific lecture-type	28c. Frequency: Took a specific lecture-type class
52d. Frequency: Took a specific laboratory	28d. Frequency: Took a specific laboratory class
52e. Frequency: Worked on homework	28e. Frequency: Worked on homework
52f. Frequency: Reviewed class material	28f. Frequency: Reviewed class material

52g. Frequency: Prepared for class exams	28g. Frequency: Prepared for class exams
52h. Frequency: Wrote class reports	28h. Frequency: Wrote class reports
53. In what ways do you interact with other	39. In what ways do you interact with other engineering students out
	40. When and under what circumstances (if any) do you rely on you
	41. Do you feel uncomfortable seeking emotional support from your
	42. What is the race/ethnicity of your six closest friends at school? (c
43-46. Phil Bell's technology questions	
48. What is the first word or phrase you think of to describe your favorite professor?	
49. Do you believe your peers would agree with this description?	
56. What intellectual, personal, financial, and other challenges do you feel you may need to overcome ito gradua	

SURV 4: C1Y2B Spring 05	SURV 5: C1Y3A Fall 05	SURV 6: C1Y3B Spring 06
2. Do you intend to complete a m	2. Do you intend to complete a major i	2. Do you intend to complete a major in engineering?
3. What do you intend to major ir	3. What do you intend to major in?	3. What do you intend to major in?
4. If you intend to double major, \	4. If you intend to double major, what i	4. If you intend to double major, what is the second maj
engineering?		
5. Do you intend to practice, con	5. Do you intend to practice, conduct r	5. Do you intend to practice, conduct research in, or tea
7b. Engineers make more money	7b. Engineers make more money than	7b. Engineers make more money than most other profe
7e. Engineers are well paid	7e. Engineers are well paid	7e. Engineers are well paid
7h. An engineering degree will gu	7h. An engineering degree will guarant	7h. An engineering degree will guarantee me a job whe
7f. Engineering is an occupation	7f. Engineering is an occupation that is	7f. Engineering is an occupation that is respected by oth
7c. My parents would disapprove	7c. My parents would disapprove if I cl	7c. My parents would disapprove if I chose a major othe

7g. My parents want me to be an	7g. My parents want me to be an engi	7g. My parents want me to be an engineer
7a. Technology plays an importa	7a. Technology plays an important rol	7a. Technology plays an important role in solving socie
7d. Engineers have contributed	7d. Engineers have contributed greatl	7d. Engineers have contributed greatly to fixing problem
Not asked	Not asked	Not asked
ed genuinely excited about math/science		
nce teachers		
7j. A faculty member, academic	7j. A faculty member, academic advsi	7j. A faculty member, academic advsior, teaching assis
7k. A non-university affiliated me	7k. A non-university affiliated mentor h	7k. A non-university affiliated mentor has encouraged a
10d. Math ability	9d. Math ability	10d. Math ability
10e. Science ability	9e. Science ability	10e. Science ability
10h. Ability to apply math & scier	9h. Ability to apply math & science pri	10g. Ability to apply math & science principles in solvin
10a. Self confidence (social)	9a. Self confidence (social)	10a. Self confidence (social)
10b. Leadership ability	9b. Leadership ability	10b. Leadership ability
10c. Public speaking ability	9c. Public speaking ability	10c. Public speaking ability
10g. Communication skills	9g. Communication skills	10f. Communication skills
10i. Business ability	9i. Business ability	10h. Business ability
10j. Ability to perform in teams	9j. Ability to perform in teams	10i. Ability to perform in teams
9a. Creative thinking is one of m	8e. Creative thinking is one of my stre	9a. Creative thinking is one of my strengths
9c. I am skilled at solving probler	8g. I am skilled at solving problems th	9c. I am skilled at solving problems that can have multi

10k. Critical thinking skills	10k. Critical thinking skills	10j. Critical thinking skills
7i. Engineers are creative proble	7i. Engineers are creative problem sol	7i. Engineers are creative problem solvers.

n, how often you felt challenged to solve open-ended problems that might have multiple solutions

11d. Math ability	10d. Math ability	11d. Math ability
11e. Science ability	10e. Science ability	11e. Science ability
11g. Ability to apply math & scier	10h. Ability to apply math & science pr	11g. Ability to apply math & science principles in solving
11a. Self confidence (social)	10a. Self confidence (social)	11a. Self confidence (social)
11b. Leadership ability	10b. Leadership ability	11b. Leadership ability
11c. Public speaking ability	10c. Public speaking ability	11c. Public speaking ability
11g. Communication skills	10g. Communication skills	11f. Communication skills
11i. Business ability	10i. Business ability	11h. Business ability
11j. Ability to perform in teams	10j. Ability to perform in teams	11i. Ability to perform in teams
9b. I am familiar with what a prac	8f. I am familiar with what a practicing	9b. I am familiar with what a practicing engineer does
30. How much exposure have yo	29. How much exposure have you had	30. How much exposure have you had to a professiona
28. Do you have any family mem	27. Do you have any family members w	28. Do you have any family members who are practicing
29. Do you have any close friend	28. Do you have any close friends who	29. Do you have any close friends who are practicing er

19b. Teaching methods - Individu	18b. Teaching methods - Individual pro	19b. Teaching methods - Individual projects
19c. Teaching methods - Team p	18c. Teaching methods - Team project	19c. Teaching methods - Team projects
8a. I prefer studying in a group to	8a. I prefer studying in a group to study	8a. I prefer studying in a group to studying by myself
8c. I prefer working as part of a te	8b. I prefer working as part of a team t	8c. I prefer working as part of a team to working alone
8d. I get along well with others in	8c. I get along well with others in study	8d. I get along well with others in study situations
8j. I am a collaborative person	8d. I am a collaborative person	8j. I am a collaborative person
21. Importance of non-engineerir	20. Importance of non-engineering act	21. Importance of non-engineering activities
22. Frequency of involvement in	21. Frequency of involvement in non-e	22. Frequency of involvement in non-engineering activit
		36. Research experiences since coming to college
23a. Pressure - course load	22a. Pressure - course load	23a. Pressure - course load
23b. Pressure - course pace	22b. Pressure - course pace	23b. Pressure - course pace
23c. Pressure - Balance between	22c. Pressure - Balance between soci	23c. Pressure - Balance between social and academic l
24. How well are you meeting wc	23. How well are you meeting workloa	24. How well are you meeting workload demands of you
25. How stressed do you feel in y	24. How stressed do you feel in your c	25. How stressed do you feel in your coursework right n
26. Do you have any concerns al	25. Do you have any concerns about y	26. Do you have any concerns about your ability to finar
16a. Came late to liberal arts clas	15a. Came late to liberal arts class	16a. Came late to liberal arts class
16b. Skipped liberal arts class	15b. Skipped liberal arts class	16b. Skipped liberal arts class
16c. Turned in liberal arts assign	15c. Turned in liberal arts assignments	16c. Turned in liberal arts assignments that did not refle
16d. Turned in liberal arts assign	15d. Turned in liberal arts assignments	16d. Turned in liberal arts assignments late
16e. Thought liberal arts classes	15e. Thought liberal arts classes were	16e. Thought liberal arts classes were boring
15a. Came late to engineering cl	14a. Came late to engineering class	15a. Came late to engineering class
15b. Skipped engineering class	14b. Skipped engineering class	15b. Skipped engineering class
15c. Turned in engineering assig	14c. Turned in engineering assignmen	15c. Turned in engineering assignments that did not ref
15d. Turned in engineering assig	14d. Turned in engineering assignmen	15d. Turned in engineering assignments late

15e. Thought engineering classe	14e. Thought engineering classes wer	15e. Thought engineering classes were boring
Constructs 11a + 11b	Constructs 11a + 11b	Constructs 11a + 11b
17a. Faculty during class	16a. Faculty during class	17a. Faculty during class
17b. Faculty during office hours	16b. Faculty during office hours	17b. Faculty during office hours
17c. Faculty outside of class or o	16c. Faculty outside of class or office I	17c. Faculty outside of class or office hours
17d. TAs during class	16d. TAs during class	17d. TAs during class
17e. TAs during office hours	16e. TAs during office hours	17e. TAs during office hours
17f. TAs outside of class or office	16f. TAs outside of class or office hour	17f. TAs outside of class or office hours
Constructs 12a + 12b	Constructs 12a + 12b	Constructs 12a + 12b
12a. Quality of instruction by facu	11a. Quality of instruction by faculty	12a. Quality of instruction by faculty
12b.Quality of advising by faculty	11b.Quality of advising by faculty	12b.Quality of advising by faculty
12c. Availability of faculty	11c. Availability of faculty	12c. Availability of faculty
12d. Quality of instruction by TAs	11d. Quality of instruction by TAs	12d. Quality of instruction by TAs
12e. Quality of advising by TAs	11e. Quality of advising by TAs	12e. Quality of advising by TAs
12f. Availability of TAs	11f. Availability of TAs	12f. Availability of TAs
Constructs 13a + 13b	Constructs 13a + 13b	Constructs 13a + 13b
13a. Computer facilities	12a. Computer facilities	13a. Computer facilities
13b. Libraries	12b. Libraries	13b. Libraries
13c. Classrooms	12c. Classrooms	13c. Classrooms
13f. Laboratories	12f. Laboratories	13f. Laboratories
32. Overall quality of collegiate e	31. Overall quality of collegiate experie	32. Overall quality of collegiate experience
38. I feel good when I am doing engineering activities		
38. Majoring in engineering is fun		
29. I think engineering is interesting		

1. Expected year of graduation	1. Expected year of graduation	1. Expected year of graduation
		51. What is your expected GPA this academic term
33. Sex		
34. Ethnic background		
35. Citizenship		
36. Average grade in H.S.		
27a. How well do you meet your	26a. How well do you meet your colleg	27a. How well do you meet your college expenses - sel
27b. College expenses - self (sa	26b. College expenses - self (savings)	27b. College expenses - self (savings)
27c. College expenses - parents	26c. College expenses - parents and f	27c. College expenses - parents and family
27d. College expense - employe	26d. College expense - employer supp	27d. College expense - employer support
27e. College expenses - scholar	26e. College expenses - scholarships	27e. College expenses - scholarships and grants
27f. College expenses - loans	26f. College expenses - loans	27f. College expenses - loans

37. Highest level of education of mother		
	32. Best estimate of parents' total income	
ring-related research last summe	38b. Did you participate in engineering-related research last summer?	
neering related internship/job last	38a. Did you participate in an engineering related internship/job last summer?	
ring-related coursework last sumr	38c. Did you participate in engineering-related coursework last summer?	
53. What are your summer plans	36. What did you do this summer that	52. What are your summer plans? (open)
our interest in studying engineerir	37. Did your experience advance your interest in studying engineering? (Y/N)	
neering-related activities you have	33. Reasons for a leave of absence during fall term	
31a. Hours spent - preparing for	30a. Hours spent - preparing for class	31a. Hours spent - preparing for class
31b. Hours spent - working for pa	30b. Hours spent - working for pay	31b. Hours spent - working for pay
31c. Hours spent - participating i	30c. Hours spent - participating in co-c	31c. Hours spent - participating in co-curricular activitie
31d. Hours spent - relaxing and s	30d. Hours spent - relaxing and sociali	31d. Hours spent - relaxing and socializing
31e. Hours spent - providing care	30e. Hours spent - providing care	31e. Hours spent - providing care
31f. Hours spent - commuting to	30f. Hours spent - commuting to class	31f. Hours spent - commuting to class
		33. Some students during their academic career have a
		34. Doubting experiences
		35. Confirming experiences
ED your interest in studying engineering. (open)		
D your interest in studying engineering. (open)		

6. If you are thinking of going to g	6. If you are thinking of going to gradu	6. If you are thinking of going to graduate school in a fie
18. What portion of the courses y	17. What portion of the courses you ha	18. What portion of the courses you have taken during t
19a. During the current school ye	18a. During the current school year, w	19a. During the current school year, what portion of you
19d. Teaching methods - Labs	18d. Teaching methods - Labs	19d. Teaching methods - Labs
19e. Teaching methods - Semina	18e. Teaching methods - Seminars	19e. Teaching methods - Seminars
8b. I am a competitive person		8b. I am a competitive person
8e. I strive to get higher grades than my classmates		8e. I strive to get higher grades than my classmates
8f. The educational institution I am attending promotes competitive work		8f. The educational institution I am attending promotes c
8g. My instructors often remind students that they need to do better than		8g. My instructors often remind students that they need
ıyself		
8h. I have easy access to work spaces where I can participate in peer s		8h. I have easy access to work spaces where I can part
8i. I am encouraged by my instructors to initiate or participate in peer stu		8i. I am encouraged by my instructors to initiate or partic
8k. The educational institution I am attending promotes collaborative wo		8k. The educational institution I am attending promotes
n, how often you participated in a peer study group		
13d. Satisfaction with tutoring	12d. Satisfaction with tutoring	13d. Satisfaction with tutoring
13e. Satisfaction with academic a	12e. Satisfaction with academic advisi	13e. Satisfaction with academic advising
14. Since January, how often hav	13. Since January, how often have you	14. Since January, how often have you taken courses w
20. To what extent have your cou	19. To what extent have your courses	20. To what extent have your courses required your eng
kills		
44.-49. Who am I questions		45.-50. Who am I questions
10f. Confidence: Computer skills	9f. Confidence: Computer skills	
11f. Perceived importance: Comp	10f. Perceived importance: Computer skills	
thinking skills		

38.-41. UPri questions

work

urses
sful
experience academic difficulties
experience personal difficulties

dvantage to share them

s
dents

ways
ademic activities

ronment
oup

it

rk

s

in instructor
eting an assignment due the next day
particularly challenging or complex
onsiderably more time to turn in "A" quality work
student project
se over a passing grade in a math, science, engineering course
neering course over a passing grade in a general education course

with other students
time for recreation
erience
th the supervision of a professor
work
writing, math)

side the classroom? (open)
friends at school for emotional support? (open)
friends at school? If you do, under what circumstances? (open)
pen)

te with an engineering degree?

SURV 7: C1Y4A Spring 07	APPLES1
2. Do you intend to complete a major in engineering?	7. Do you intend to complete a major in engineering?
3. What do you intend to major in?	6. What is/are your current major(s) or intended major(s)? (Mark all that apply)
4. If you intend to double major, what is the second major you intend to complete?	
	48. Double check: responses for “Not applicable – I am not continuing in an engineering major”
5. Do you intend to practice, conduct research in, or teach engineering for at least 3 years after graduation?	
	34. Do you see yourself pursuing a career in engineering?
49. Post-graduation plans (open)	33. How sure are you about your plans after graduation?
	32a. What do you see yourself doing in the first 3 years after graduation: Job working in engineering profession
	32b. What do you see yourself doing in the first 3 years after graduation: Job working in non-engineering profession
	32c. What do you see yourself doing in the first 3 years after graduation: Go to graduate school in engineering (Masters/PhD)
	32d. What do you see yourself doing in the first 3 years after graduation: Go to professional school (business, law, medicine, etc.)
	32e. What do you see yourself doing in the first 3 years after graduation: Go to graduate school NOT in engineering (Masters/PhD)
	32f. What do you see yourself doing in the first 3 years after graduation: Other
7b. Engineers make more money than most other professionals	8b. Engineers make more money than most other professionals
7e. Engineers are well paid	8e. Engineers are well paid
7g. An engineering degree will guarantee me a job when I graduate	8g. An engineering degree will guarantee me a job when I graduate
ıer people	
7c. My parents would disapprove if I chose a major other than engineering	8c. My parents would disapprove if I chose a major other than engineering

7f. My parents want me to be an engineer	8f. My parents want me to be an engineer
7a. Technology plays an important role in solving society's problems 7d. Engineers have contributed greatly to fixing problems in the world	8a. Technology plays an important role in solving society's problems 8d. Engineers have contributed greatly to fixing problems in the world
Not asked	Not asked
7h. A faculty member, academic advsior, teaching assistant or other university affiliated person has encouraged and/or inspired me to study engineering 7i. A non-university affiliated mentor has encouraged and/or inspired me to study engineering.	8h. A faculty member, academic advsior, teaching assistant or other university affiliated person has encouraged and/or inspired me to study engineering 8i. A non-university affiliated mentor has encouraged and/or inspired me to study engineering.
9d. Math ability 9e. Science ability 9g. Ability to apply math & science principles in solving real world problems 9a. Self confidence (social) 9b. Leadership ability 9c. Public speaking ability 9f. Communication skills 9h. Business ability 9i. Ability to perform in teams	10d. Math ability 10e. Science ability 10g. Ability to apply math & science principles in solving real world problems 10a. Self confidence (social) 10b. Leadership ability 10c. Public speaking ability 10f. Communication skills 10h. Business ability 10i. Ability to perform in teams
8a. Creative thinking is one of my strengths 8c. I am skilled at solving problems that can have multiple solutions	9a. Creative thinking is one of my strengths (4 pt scale) 9b. I am skilled at solving problems that can have multiple solutions (4 pt scale)

9j. Critical thinking skills	10j. Critical thinking skills (5 pt scale)
10d. Math ability	11d. Math ability
10e. Science ability	11e. Science ability
10g. Ability to apply math & science principles in solving real world problems	11g. Ability to apply math & science principles in solving real world problems
10a. Self confidence (social)	11a. Self confidence (social)
10b. Leadership ability	11b. Leadership ability
10c. Public speaking ability	11c. Public speaking ability
10f. Communication skills	11f. Communication skills
10h. Business ability	11h. Business ability
10i. Ability to perform in teams	11i. Ability to perform in teams

8b. I am familiar with what a practicing engineer does

25. How much exposure have you had to a professional engineering environment as a visitor, intern, or employee

g engineers?
ngineers?

How did you gain your knowledge about the engineering profession?
26a. From being a visitor
26b. From being a co-op student
26c. From being an intern
26d. From being an employee
26e. From a family member
26f. From a close friend
26g. From other

27. Yes/No: Do any of your immediate family members (parents, siblings) hold an engineering degree?

24. Before college, how much knowledge did you have about the engineering profession?
25. Since entering college, how much knowledge have you gained about the engineering profession?

17b. Teaching methods - Individual projects	
17c. Teaching methods - Team projects	
Deleted	
Deleted	
Deleted	
Deleted	
18. Importance of non-engineering activities	20. Importance of non-engineering activities
19. Frequency of involvement in non-engineering activities	21. Frequency of involvement in non-engineering activities
	22. Level of involvement in student engineering activities such as engineering societies
31. Research experiences since coming to college	23. Since coming to college, have you had any research experiences?
20a. Pressure - course load	18a. Pressure - course load
20b. Pressure - course pace	18b. Pressure - course pace
20c. Pressure - Balance between social and academic life	18c. Pressure - Balance between social and academic life
21. How well are you meeting workload demands of your coursework?	16. How well are you meeting workload demands of your coursework?
22. How stressed do you feel in your coursework right now?	17. How stressed do you feel in your coursework right now?
23. Do you have any concerns about your ability to finance your college education?	28. Do you have any concerns about your ability to finance your college education?
14a. Came late to liberal arts class	15a. Came late to liberal arts class
14b. Skipped liberal arts class	15b. Skipped liberal arts class
14c. Turned in liberal arts assignments that did not reflect your best work	15c. Turned in liberal arts assignments that did not reflect your best work
14d. Turned in liberal arts assignments late	15d. Turned in liberal arts assignments late
13a. Came late to engineering class	14a. Came late to engineering class
13b. Skipped engineering class	14b. Skipped engineering class
13c. Turned in engineering assignments that did not reflect your best work	14c. Turned in engineering assignments that did not reflect your best work
13d. Turned in engineering assignments late	14d. Turned in engineering assignments late

Constructs 11a + 11b	Constructs 11a + 11b
15a. Faculty during class	
15b. Faculty during office hours	
15c. Faculty outside of class or office hours	
15d. TAs during class	
15e. TAs during office hours	
15f. TAs outside of class or office hours	
Constructs 12a + 12b	19a. Instructors during class
	19b. Instructors during office hours
	19c. Instructors outside of class or office hours
11a. Quality of instruction by faculty	
11b.Quality of advising by faculty	
11c. Availability of faculty	
11d. Quality of instruction by TAs	
11e. Quality of advising by TAs	
11f. Availability of TAs	
Constructs 13a + 13b	12a. Quality of instruction by instructors
	12b.Quality of advising by instructors
	12c. Availability of instructors
	12d: Satisfaction: Academic advising
12a. Computer facilities	
12b. Libraries	
12c. Classrooms	
12d. Laboratories	
27. Overall quality of collegiate experience	13. Overall quality of collegiate experience

1. What is your expected year of graduation from college?	4. What year do you expect to complete your undergraduate degree?
32. What is your expected GPA this academic term	30. What is your expected GPA this academic term
	31. What is your expected GPA overall
33. Sex	35. Sex
34. Age on 12/31 this year	
35. Ethnic background	36. Racial or ethnic identification
36. Marital status	
37. Number of dependents	
38. Citizenship	37. Citizenship status
	2. What is your current academic standing? (freshman, sophomore, junior, senior, 5th year senior, graduate student, other) 3. When you entered this institution, were you: (first-time, returning, transfer student) 5. What were you most interested in majoring in when you first came to university? 42. Full-time/part-time student
39. Born in U.S.	38. Born in U.S.
40. Did one or more of your parents/guardians immigrate?	39. Did one or more of your parents/guardians immigrate?
41. Is English your first language	40. Is English your first language
	41. Are you a first-generation college student?
24a. How well do you meet your college expenses - self (income)	
24b. College expenses - self (savings)	
24c. College expenses - parents and family	
24d. College expense - employer support	
24e. College expenses - scholarships and grants	
24f. College expenses - loans	

42. Highest level of education of mother	44. Highest level of education of mother
43. Highest level education of father	45. Highest level education of father
44. Best estimate of parents' total income	
45. Description of family	43. Description of family
48b. Did you participate in engineering-related research last summer?	
ETD18a. During your undergraduate years, how many months of experience with part-time academic research work on campus	
ETD18b. During your undergraduate years, how many months of experience with full-time academic research work on campus	
48a. Did you participate in an engineering related internship/job last summer?	
48c. Did you participate in engineering-related coursework last summer?	
46. What did you do last summer (2006) that was particularly important to you? (open)	
47. Did your experience advance your interest in studying engineering? (open)	
ETD18c. During your undergraduate years, how many months of experience with part-time engineering work (internship, co-op, summer job)	
ETD18d. During your undergraduate years, how many months of experience with full-time engineering work (internship, co-op, summer job)	
ETD19. Short description of your experience(s) with academic research and/or professional engineering (open)	
26a. Hours spent - preparing for class	29a. Hours spent - preparing for class
26b. Hours spent - working for pay	29b. Hours spent - working for pay
26c. Hours spent - participating in co-curricular activities	29c. Hours spent - participating in co-curricular activities
26d. Hours spent - relaxing and socializing	29d. Hours spent - relaxing and socializing
26e. Hours spent - providing care	29e. Hours spent - providing care
26f. Hours spent - commuting to class	29f. Hours spent - commuting to class
28. I started at this institution…	47. I started at this institution…
29. Decision to continue engineering - reasons	48. Decisions to continue engineering - reasons
30. Doubts - reasons	49. Doubts - reasons

1. What school are you currently attending?
51. How did you learn about the survey
52. Would you have been willing to take the survey if the compensation was…

50. Is there anything you want to tell us about your experiences in engineering that we haven’t already asked you about?

6. If you are thinking of going to graduate school in a field OTHER THAN engineering, please mark your most probable area of study.
16. What portion of the courses you have taken during the current school year have been taught primarily by graduate students?
17a. During the current school year, what portion of your classes have used the following teaching methods - Lectures
17d. Teaching methods - Labs
17e. Teaching methods - Seminars

competitive work
to do better than other students to obtain high grades

icipate in peer study/discussion sessions with my fellow students
cipate in peer study sessions with my fellow students
collaborative work

hich required your enagement in individual or group projects
gagement in individual and/or group projects

APPLES2

7. Do you intend to complete a major in engineering?

5. What is your current major or first choice of major (Mark one)

6. What is your second choice of major or second major/minor (if applicable)?

31. Do you see yourself continuing in an engineering major?

8. Do you intend to practice, conduct research in, or teach engineering for at least 3 years after graduation?

32. Do you see yourself pursuing a career in engineering?

33a. How likely is it that you would do each of the following after graduation?: Work in an engineering job

33b. How likely is it that you would do each of the following after graduation?: Work in a non-engineering job

33c. How likely is it that you would do each of the following after graduation?: Go to graduate school in an engineering discipline

33d. How likely is it that you would do each of the following after graduation?: Go to graduate school in a non-engineering discipline

9b. Engineers make more money than most other professionals

9e. Engineers are well paid

9g. An engineering degree will guarantee me a job when I graduate

9c. My parents would disapprove if I chose a major other than engineering

9f. My parents want me to be an engineer

9a. Technology plays an important role in solving society's problems

9d. Engineers have contributed greatly to fixing problems in the world

9n. Engineering skills can be used for the good of society

Not asked

9h. A faculty member, academic advsior, teaching assistant or other university affiliated person has encouraged and/or inspired me to study engineering

9i. A non-university affiliated mentor has encouraged and/or inspired me to study engineering.

9j. A mentor has introduced me to people and opportunities in engineering

10c. Agree/disagree: A mentor has supported my decision to major in engineering.

11d. Math ability
11e. Science ability
11g. Ability to apply math & science principles in solving real world problems

11a. Self confidence (social)
11b. Leadership ability
11c. Public speaking ability
11f. Communication skills
11h. Business ability
11i. Ability to perform in teams

10a. Creative thinking is one of my strengths (4 pt scale)
10b. I am skilled at solving problems that can have multiple solutions (4 pt scale)

11j. Critical thinking skills (5 pt scale)

12d. Math ability
12e. Science ability
12g. Ability to apply math & science principles in solving real world problems

12a. Self confidence (social)
12b. Leadership ability
12c. Public speaking ability
12f. Communication skills
12h. Business ability
12i. Ability to perform in teams

28. How much exposure have you had to a professional engineering environment as a visitor, intern, or employee

How did you gain your knowledge about the engineering profession?
29a. From being a visitor
29b. From being a co-op student or intern

29c. From being an employee
29d. From a family member
29e From a close friend
29g. From other

29f. From school-related experiences (professor, class)

30. Yes/No: Do any of your immediate family members (parents, siblings) hold an engineering degree?

26. Before college, how much knowledge did you have about the engineering profession?
27. Since entering college, how much knowledge have you gained about the engineering profession?

14a. Teaching methods - individual projects

14b. Teaching methods - team projects

22. Importance of non-engineering activities
23. Frequency of involvement in non-engineering activities
24. Level of involvement in student engineering activities such as engineering societies
25. Since coming to college, have you had any research experiences?
20a. Pressure - course load
20b. Pressure - course pace
20c. Pressure - Balance between social and academic life
18. How well are you meeting workload demands of your coursework?
19. How stressed do you feel in your coursework right now?
34. Do you have any concerns about your ability to finance your college education?

17a. Came late to liberal arts class
17b. Skipped liberal arts class
17c. Turned in liberal arts assignments that did not reflect your best work
17d. Turned in liberal arts assignments late

16a. Came late to engineering class
16b. Skipped engineering class
16c. Turned in engineering assignments that did not reflect your best work
16d. Turned in engineering assignments late

21a. Instructors during class
21b. Instructors during office hours
21c. Instructors outside of class or office hours

13a. Quality of instruction by instructors
13b.Quality of advising by instructors
13c. Availability of instructors
13d: Satisfaction: Academic advising

15. Overall quality of collegiate experience

9k. I feel good when I am doing engineering
9m. I think engineering is fun

9o. I think engineering is interesting

9l. I like to build stuff
9p. I like to figure out how things work

35. What is your cumulative GPA?
36. Sex
38. How old are you?
37. Racial or ethnic identification

39. Citizenship status
2. What is your current academic standing? (freshman, sophomore, junior, senior, 5th year senior, graduate student, other)
3. When you entered this institution, were you: (first-time, returning, transfer student)
4. What were you most interested in majoring in when you first came to university?
44. Full-time/part-time student

45. Which of the following best describes where you are living now while attending college?

40. Born in U.S.
41. Did one or more of your parents/guardians immigrate?
42. Is English your first language
43. Are you a first-generation college student?

47. Highest level of education of mother
48. Highest level education of father

46. Description of family

1. What school are you currently attending?

50. Is there anything you want to tell us about your experiences in engineering that we haven’t already asked you about?

	Selected Variables and Items from PIE to APPLES1 to APPLES2	SURV-1: C1Y1A Winter 04
	OFFICIAL VARIABLES/CONSTRUCTS	
1	**1a: Academic Persistence**	Y
2	**1b: Professional Persistence**	Not Asked
3	**2a: Motivation (Financial)**	Different
4	**2b: Motivation (Family Influence)**	Different
5	**2c: Motivation (Social Good)**	Different
6	**2d: Motivation (High School Mentor Influence)**	Not Asked
7	**2e: Motivation (Mentor Influence)**	Not Asked
8	**3a: Confidence in Math & Science Skills**	Different
9	**3b: Confidence in Professional and Interpersonal Skills**	Different
10	**3c: Confidence in Solving Open-ended Problems**	Different
11	**4a: Perceived Importance in Math & Science Skills**	Different
12	**4b: Perceived Importance in Professional & Interpersonal Skills**	Different
13	**5: Knowledge of the Engineering Profession**	Not Asked
14	**5a. Knowledge of the Engineering Profession (Change over time)**	Not Asked
15	**5b. Knowledge of the Engineering Profession (Sources)**	Not Asked
16	**6a: Exposure to Project-Based Learning Methods: Individual**	Y
17	**6b: Exposure to Project-Based Learning Methods: Team**	Y
18	**7: Collaborative Work Style**	Different
19	**8: Extracurricular Fulfillment (Non-engineering)**	Not Asked
20	**8b: Extracurricular Involvement (Engineering)**	Not Asked
21	**8c: Research Experience**	Not Asked
22	**9: Curriculum Overload**	Not Asked
23	**10: Financial Difficulties**	Not Asked
24	**11a: Academic Disengagement - Liberal Arts courses**	Not Asked
25	**11b: Academic Disengagement - Engineering-Related courses**	Y
26	**11c: Academic Disengagement - Overall**	Not Complete
27	**12: Frequency of Interaction with Instructors**	Different
28	**13a: Satisfaction with Instructors**	Different
29	**13d. Satisfaction with academic advising**	Y
30	**13b: Satisfaction with Academic Facilities**	Different
31	**13c: Overall Satisfaction with Collegiate Experience**	Not Asked
32	**Intrinsic Motivation (Psychological)**	Not Asked
33	**Intrinsic Motivation (Behavioral)**	Not Asked
	DEMOGRAPHIC VARIABLES	
	Survey verification: What school are you currently attending?	Not Asked
	Expected Graduation Date	Y
	Expected GPA academic term	Not Asked
	Expected GPA overall	Not Asked
	Sex	Y
	Age	Y
	Ethnicity	Y
	Marital status	Y
	Dependents	Y

Citzenship	Y
Current academic standing	Not Asked
Traditional/nontraditional student	Not Asked
Preliminary area of interest	Not Asked
Full time/part-time student	Not Asked
Year graduated from high school	Y
High school community	Y
Average grade in high school	Y
Residence in college	Y
Roommates in college	Y
Disabilities	Y
Assistive technologies	Y
Born in U.S.	Not Asked
Parents/guardians immigrate?	Not Asked
English first language	Not Asked
First Generation College Student	Not Asked
How well do you meet your college expenses - self (income)	Y
College expenses - self (savings)	Y
College expenses - parents and family	Y
College expense - employer support	Y
College expenses - scholarships and grants	Y
College expenses - loans	Y
College expenses - other sources	Y
Highest level of education of mother	Y
Highest level education of father	Y
Best estimate parents' income	Y
Description of Family Income	Not Asked

UNOFFICIAL VARIABLES

Research: Did you participate in engineering-related research last summer?	Not Asked
Research: ETD18a. During your undergraduate years, how many months of experience with part-time academic research work on campus	Not Asked
Research: ETD18b. During your undergraduate years, how many months of experience with full-time academic research work on campus	Not Asked
Research: Did you participate in engineering-related coursework last summer?	Not Asked
Extra-curricular: Did your experience advance your interest in studying engineering? (open)	Not Asked
Extra-curricular: What did you do last summer that was particularly important to you? (open)	Not Asked
Extra-curricular: Short description of your experience(s) with academic research and/or professional engineering (open)	Not Asked
Engineering Extra-curricular: Some students participate in design competitions, internships, and clubs. In the space provided identify engineering-related activities you have participated in outside of class.(open)	Y
Engineering Profession: During your undergraduate years, how many months of experience with part-time engineering work (internship, co-op, summer job)	Not Asked

Engineering Profession: During your undergraduate years, how many months of experience with full-time engineering work (internship, co-op, summer job)	Not Asked
Engineering Profession: Did you participate in an engineering related internship/job last summer?	Not Asked
NSSE: Hours spent - preparing for class	Y
NSSE: Hours spent - working for pay	Y
NSSE: Hours spent - participating in co-curricular activities	Y
NSSE: Hours spent - relaxing and socializing	Y
NSSE: Hours spent - providing care	Y
NSSE: Hours spent - commuting to class	Y
Confirm/Doubt: I started at this institution…	Not Asked
Confirm/Doubt: Decision to continue engineering - reasons	Not Asked
Confirm/Doubt: Doubts - reasons	Not Asked
Confirm/Doubt: Identify any classes (in high school or college so far) this year that have STRONGLY REINFORCED your interest in studying engineering. (open)	Y
Confirm/Doubt: Identify any classes (in high school or college so far) this year that have STRONGLY WEAKENED your interest in studying engineering. (open)	Y

MISCELLANEOUS ITEMS NOT ASSIGNED TO A CONSTRUCT OR DELETED OVER TIME

Open-ended question: Is there anything you want to tell us about your experiences in engineering that we haven't already asked you about?	Not Asked
Grad School: If you are thinking of going to graduate school in a field OTHER THAN engineering, please mark your most probable area of study.	Y
Course taught by grad students: What portion of the courses you have taken during the current school year have been taught primarily by graduate students?	Y
Teaching methods - lectures	Y
Teaching methods - labs	Y
Teaching methods - seminars	Y
Competitive work style (personal): I am a competitive person	Not Asked
Competitive work style (personal): I strive to get higher grades than my classmates	Not Asked
Competitive work style (institutional): The educational institution I am attending promotes competitive work	Not Asked
Competitive work style (institutional): My instructors often remind students that they need to do better than other students to obtain high grades	Y
Competitive work style (institutional): I prefer keeping good ideas to myself	Not Asked
Competitive work style (institutional): My instructors grade on a curve	Y
Collaborative work style (institutional): I have easy access to work spaces where I can participate in peer study/discussion sessions with my fellow students	Y

Collaborative work style (institutional): I am encouraged by my instructors to initiate or participate in peer study sessions with my fellow students	Y
Collaborative work style (institutional): The educational institution I am attending promotes collaborative work	Not Asked
Collaborative work style (institutional): Since the beginning of fall term, how often you participated in a peer study group	Not Asked
Satisfaction with academic services: Satisfaction with tutoring	Y
Exposure to PBL Methods: Since this term, how often have you taken courses which required your enagement in individual or group projects	Not Asked
Exposure to PBL Methods: To what extent have your courses required your engagement in individual and/or group projects	Not Asked
Exposure to PBL Methods:: I have strong problem solving skills	Y
Who Am I questions	Not Asked
Confidence in computer/programming skills	Y
Perceived importance of computer skills	Y
Perceived importance of critical thinking skills	Not Asked
UPri questions - Motivation, Self-Esteem, Ethnic identity	Not Asked
Motivation (Belief That Engineers Improve Welfare of Society Through Creative Work): I enjoy figuring out how things work	Y
Motivation (Belief That Engineers Improve Welfare of Society Through Creative Work): Engineers are innovative	Y
Motivation (Belief That Engineers Improve Welfare of Society Through Creative Work): Engineers are creative	Y
I enjoy the subjects of science and math the most	Y
Creative thinking is one of my strengths	Y
Peers: Studying in a group is better than studying by myself	Y
I enjoy taking liberal arts courses more than science and math courses	Y
Peers: My friends are supportive of me when I am academically successful	Not Asked
Peers: I can count on my friends at school for emotional support when I experience academic difficulties	Not Asked
Peers: I can count on my friends at school for emotional support when I experience personal difficulties	Not Asked
Importance: Getting higher grades than my classmates	Y
Importance: Influencing social values	Y
Importance: Becoming an authority in my field	Y
Importance: Keeping goood ideas to myself unless it is to my advantage to share them	Y
Importance: Helping to promote racial understanding	Y
Importance: Becoming a community leader	Y
Importance: Helping others who are in difficulty	Y
Importance: When playing any game, playing to win	Y
Importance: Developing a meaningful philosophy of life	Y
Importance: Becoming a practicing engineer	Y
Importance: Getting along with others	Y
Importance: Working as part of a team	Y
Importance: Becoming a student government official	Y
Importance: Establishing relationships with engineering students	Y

Importance: Establishing relationships with non-engineering students	Y
Confidence: Analytical and problem solving skills	Y
Confidence: General knowledge	Y
Confidence: Knowledge of a particular field or discipline	Y
Confidence: Interest in studying engineering	Y
Satisfaction: Opportunities for community service	Y
Frequency: Felt that your courses inspired you to think in new ways	Y
Frequency: Felt you did not have enough time to pursue nonacademic activities	Y
Frequency: Worried about keeping up with your schoolwork	Y
Frequency: Felt you did not have a "social life"	Y
Frequency: Felt stressed	Y
Peers: Frequency: Participated in a peer study group	Y
Frequency: Visited or worked in a commercial engineering environment	Not Asked
Frequency: Socialized with someone of another racial/ethnic group	Not Asked
Frequency: Discussed racial issues	Not Asked
Frequency: Attended a racial/cultural awareness workshop/event	Not Asked
Came late to math class	Y
Skipped math class	Y
Turned in math assignments that did not reflect your best work	Y
Turned in math assignments late	Y
Thought math classes were boring	Y
Came late to science class	Y
Skipped science class	Y
Turned in science assignments that did not reflect your best work	Y
Turned in science assignments late	Y
Thought science classes were boring	Y
Frequency: Asked for advice about managing your coursework	Not Asked
Frequency: Worked with people who have diverse backgrounds	Not Asked
Frequency: Spent time in a non-academic role	Not Asked
Frequency: Requested feedback on course assignments from an instructor	Not Asked
Frequency: "Crammed" all night studying for an exam or completing an assignment due the next day	Not Asked
Frequency: Worked collaboratively on an assignment that was particularly challenging or complex	Not Asked
Frequency: Decided to turn in "C" quality work over spending considerably more time to turn in "A" quality work	Not Asked
Frequency: Had a research experience on a faculty or graduate student project	Not Asked
Frequency: Prioritized a good grade in a general education course over a passing grade in a math, science, engineering course	Not Asked
Frequency: Prioritized a good grade in a math, science, or engineering course over a passing grade in a general education course	Not Asked
Frequency: Studied regularly in blocks of 2 hours or more	Not Asked
Frequency: Took a seminar course to discuss and argue ideas with other students	Not Asked
Frequency: Reduced time spent on course work to have more time for recreation	Not Asked

Frequency: Asked for advice about managing your college experience	Not Asked
Frequency: Created a project outside of your academic work with the supervision of a professor	Not Asked
Frequency: Monitored how you spent your time on your course work	Not Asked
Frequency: Asked for help to strengthen a particular skill (e.g., writing, math)	Not Asked
Frequency: Reduced your course load to improve your grades	Not Asked
Confidence: Self-confidence (intellectual)	Y
Frequency: Worked on class projects	Y
Frequency: Held a study group	Y
Frequency: Took a specific lecture-type class	Y
Frequency: Took a specific laboratory class	Y
Frequency: Worked on homework	Y
Frequency: Reviewed class material	Y
Frequency: Prepared for class exams	Y
Frequency: Wrote class reports	Y
In what ways do you interact with other engineering students outside the classroom? (open)	Y
When and under what circumstances (if any) do you rely on you friends at school for emotional support? (open)	Not Asked
Do you feel uncomfortable seeking emotional support from your friends at school? If you do, under what circumstances? (open)	Not Asked
What is the race/ethnicity of your six closest friends at school? (open)	Not Asked
43-46. Phil Bell's technology questions: How often do you use the following technologies in your personal life outside of school/school-related activities?	Y
What is the first word or phrase you think of to describe your favorite professor?	Y
Do you believe your peers would agree with this description?	Y
What intellectual, personal, financial, and other challenges do you feel you may need to overcome ito graduate with an engineering degree?	Y
UPri QUESTIONS	
Group Identification Scale: I identify with engineering students	Not Asked
Group Identification Scale: I am glad to belong to a group of engineering students	Not Asked
Group Identification Scale: I feel held back by engineering students	Not Asked
Group Identification Scale: I think engineering students work well together	Not Asked
Group Identification Scale: I see myself as an important part of engineering students on campus	Not Asked
Group Identification Scale: I fit in well with the other engineering students	Not Asked
Group Identification Scale: I consider engineering students to not be important	Not Asked
Group Identification Scale: I feel uneasy with other engineering students	Not Asked
Group Identification Scale: I feel strong ties to engineering students	Not Asked
SIMS: Intrinsic Motivation: I think engineering is interesting	Not Asked
SIMS: Intrinsic Motivation: I think engineering is pleasant	Not Asked

SIMS: Intrinsic Motivation: Majoring in engineering is fun	Not Asked
SIMS: Intrinsic Motivation: I feel good when I am doing engineering activities	Not Asked
SIMS: Identified Regulation: I am majoring in engineering for my own good	Not Asked
SIMS: Identified Regulation: I think engineering is good for me	Not Asked
SIMS: Identified Regulation: It is my personal decision	Not Asked
SIMS: Identified Regulation: I believe engineering is important for me	Not Asked
SIMS: Amotivation: There may be good reasons to major in engineering, but personally, I don't see any	Not Asked
SIMS: Amotivation: I am majoring in (considering majoring in) engineering, but I am not sure if it is worth it	Not Asked
SIMS: Amotivation: I don't know. I don't see what the activity brings me	Not Asked
SIMS: Amotivation: I am doing it, but am not sure it is a good thing to pursue	Not Asked
SIMS: External Regulation: I am supposed to major in engineering	Not Asked
SIMS: External Regulation: Majoring in engineering is something that I have to do	Not Asked
SIMS: External Regulation: I don't have any choice	Not Asked
SIMS: External Regulation: I feel that I have to do it	Not Asked
Self-Esteem: On the whole, I am satisfied with myself	Not Asked
Self-Esteem: At times, I think I am no good at all	Not Asked
Self-Esteem: I feel that I have a number of good qualities	Not Asked
Self-Esteem: I am able to do things as well as most other people	Not Asked
Self-Esteem: I feel I do not have much to be proud of	Not Asked
Self-Esteem: I certainly feel useless at times	Not Asked
Self-Esteem: I feel that I'm a person of worth, at least on an equal plane with others	Not Asked
Self-Esteem: I wish I could have more respect for myself	Not Asked
Self-Esteem: All in all, I am inclined to feel that I am a failure	Not Asked
Self-Esteem: I take a positive attitude toward myself	Not Asked
MIBI Centrality Engineering: Overall, being an engineering student has very little to do with how I feel about myself	Not Asked
MIBI Centrality Engineering: In general, being an engineering student is an important part of my self image	Not Asked
MIBI Centrality Engineering: My destiny is tied to the destiny of other engineering students	Not Asked
MIBI Centrality Engineering: Being an engineering student is unimportant to my sense of what kind of person I am	Not Asked
MIBI Centrality Engineering: I have a strong sense of belonging to the engineering student community	Not Asked
MIBI Centrality Engineering: I have a strong attachment to other engineering students	Not Asked
MIBI Centrality Engineering: Being an engineering student is an important reflection of who I am	Not Asked
MIBI Centrality Engineering: Being an engineering student is not a major factor in my social relationships	Not Asked
MIBI Private Regard Engineering: I feel good about engineers	Not Asked
MIBI Private Regard Engineering: I am happy that I am going to be an engineer	Not Asked

MIBI Private Regard Engineering: I feel that engineers have made major accomplishments and advancements	Not Asked
MIBI Private Regard Engineering: I often regret that I am going to become an engineer	Not Asked
MIBI Private Regard Engineering: I am proud to be an engineer	Not Asked
MIBI Private Regard Engineering: I feel that the engineering community has made valuable contributions to this society	Not Asked
MIBI Public Regard Engineering: Overall, engineers are considered good by others	Not Asked
MIBI Public Regard Engineering: In general, others respect engineers	Not Asked
MIBI Public Regard Engineering: Most people consider engineers, on the average, to be more ineffective than other professionals	Not Asked
MIBI Public Regard Engineering: Engineers are not respected by the broader society	Not Asked
MIBI Public Regard Engineering: In general, other professionals view engineers in a positive manner	Not Asked
MIBI Public Regard Engineering: Society views engineers as an asset+B283	Not Asked
MIBI Centrality Ethnicity: Overall, being a member of my ethnic group has very little to do with how I feel about myself	Not Asked
MIBI Centrality Ethnicity: In general, being a member of my ethnic group is an important part of my self image	Not Asked
MIBI Centrality Ethnicity: My destiny is tied to the destiny of other members of my ethnic group	Not Asked
MIBI Centrality Ethnicity: Being a member of my ethnic group is unimportant to my sense of what kind of person I am	Not Asked
MIBI Centrality Ethnicity: I have a strong sense of belonging to my ethnic group community	Not Asked
MIBI Centrality Ethnicity: I have a strong attachment to other members of my ethnic group	Not Asked
MIBI Centrality Ethnicity: Being a member of my ethnic group is an important reflection of who I am	Not Asked
MIBI Centrality Ethnicity: Being a member of my ethnic group is not a major factor in my social relationships	Not Asked
MIBI Centrality Gender: Overall, being a member of my gender has very little to do with how I feel about myself	Not Asked
MIBI Centrality Gender: In general, being a member of my gender is an important part of my self-image	Not Asked
MIBI Centrality Gender: My destiny is tied to the destiny of other members of my gender	Not Asked
MIBI Centrality Gender: Being a member of my gender is unimportant to my sense of what kind of person I am	Not Asked
MIBI Centrality Gender: I have a strong sense of belonging to my gender community	Not Asked
MIBI Centrality Gender: I have a strong attachment to other members of my gender	Not Asked
MIBI Centrality Gender: Being a member of my gender is an important reflection of who I am	Not Asked
MIBI Centrality Gender: Being a member of my gender is not a major factor in my social relationships	Not Asked

KEY

Different

SURV 2: C1Y1B Spring 04	SURV 3: C1Y2A Fall 04	SURV 4: C1Y2B Spring 05	SURV 5: C1Y3A Fall 05	SURV 6: C1Y3B Spring 06	SURV 7: C1Y4A Spring 07
Y	Y	Y	Y	Y	Y
Not Asked	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Different	Different	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Different	Y	Y	Y	Y	Not Asked
Not Asked	Y	Y	Y	Y	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Y	Y
Not Asked	Y	Y	Y	Y	Y
Not Asked	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Different	Y	Y	Y	Y	Y
Different	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Not Asked
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Y	Y	Y	Y	Y
Not Asked	Not Asked	Not Asked	Not Asked	Y	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Y	Not Asked	Not Asked	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y
Not Asked	Not Asked	Y	Not Asked	Not Asked	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y

Not Asked	Not Asked	Y	Not Asked	Not Asked	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Y	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Y	Not Asked	Not Asked	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y
Not Asked	Not Asked	Not Asked	Y	Not Asked	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y
Not Asked	Y	Not Asked	Y	Not Asked	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y
Not Asked	Y	Not Asked	Y	Not Asked	Y
Not Asked	Y	Not Asked	Y	Not Asked	Y
Y	Y	Y	Y	Y	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y

Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Y
Not Asked	Y	Not Asked	Y	Not Asked	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Not Asked	Not Asked	Not Asked	Not Asked	Different	Y
Not Asked	Not Asked	Not Asked	Not Asked	Different	Y
Not Asked	Not Asked	Not Asked	Not Asked	Different	Y
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y
Not Asked	Y	Y	Not Asked	Y	Not Asked
Not Asked	Y	Y	Not Asked	Y	Not Asked
Not Asked	Y	Y	Not Asked	Y	Not Asked
Y	Y	Y	Not Asked	Y	Not Asked
Not Asked	Y	Not Asked	Not Asked	Not Asked	Not Asked
Y	Y	Not Asked	Not Asked	Not Asked	Not Asked
Y	Y	Y	Not Asked	Y	Not Asked

Y	Y	Y	Not Asked	Y	Not Asked
Not Asked	Y	Y	Not Asked	Y	Not Asked
Not Asked	Y	Not Asked	Not Asked	Not Asked	Not Asked
Y	Y	Y	Y	Y	Not Asked
Not Asked	Y	Y	Y	Y	Not Asked
Not Asked	Y	Y	Y	Y	Not Asked
Y	Y	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Y	Not Asked
Y	Y	Y	Y	Not Asked	Not Asked
Y	Y	Y	Y	Not Asked	Not Asked
Not Asked	Y	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Y	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked

Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked

Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Not Asked	Not Asked	Not Asked	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked

Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked

Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked
Y	Not Asked	Y	Not Asked	Not Asked	Not Asked

Items comprising this variable were later modified

APPLES1 Spring 07	APPLES2 Winter 08
Y	Y
Y	Y
Y	Y
Y	Y
Y	Y
Not Asked	Not Asked
Y	Y
Y	Y
Y	Y
Y	Y
Y	Y
Y	Y
Not Asked	Y
Y	Y
Y	Y
Not Asked	Y
Not Asked	Y
Not Asked	Not Asked
Y	Y
Y	Y
Y	Y
Y	Y
Y	Y
Y	Y
Y	Y
Y	Y
Y	Y
Y	Y
Y	Y
Not Asked	Not Asked
Y	Y
Not Asked	Y
Not Asked	Y
Y	Y
Y	Not Asked
Y	Not Asked
Y	Y
Y	Y
Not Asked	Y
Y	Y
Not Asked	Not Asked
Not Asked	Not Asked

Y	Y
Y	Y
Y	Y
Y	Y
Y	Y
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Y
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Y	Y
Y	Y
Y	Y
Y	Y
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Y	Y
Y	Y
Not Asked	Not Asked
Y	Y
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked

Not Asked	Not Asked
Not Asked	Not Asked
Y	Not Asked
Y	Not Asked
Y	Not Asked
Y	Not Asked
Y	Not Asked
Y	Not Asked
Y	Not Asked
Y	Not Asked
Y	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Y	Y
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked

Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked

Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked

Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked

Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked

Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked
Not Asked	Not Asked

	Cronbach's Alphas for Multi-item Scales	SURV-1: C1Y1A Winter 04 Frosh	SURV 2: C1Y1B Spring 04 Frosh	SURV 3: C1Y2A Fall 04 Soph
	OFFICIAL VARIABLES/CONSTRUCTS			
1	1a: Academic Persistence	Single Item	Single Item	Single Item
2	1b: Professional Persistence	Single Item	Single Item	Single Item
3	2a: Motivation (Financial)	Different	Y	Y
4	2b: Motivation (Family Influence)	Different	Y	Y
5	2c: Motivation (Social Good)	Different	Y	Y
6	2d: Motivation (High School Mentor Influence)	---	Y	---
7	2e: Motivation (Mentor Influence)	---	---	Y
8	3a: Confidence in Math & Science Skills	Different	Y	Y
9	3b: Confidence in Professional and Interpersonal Skills	Different	Y	Y
10	3c: Confidence in Solving Open-ended Problems	Different	Y	Y
11	4a: Perceived Importance in Math & Science Skills	Different	Y	Y
12	4b: Perceived Importance in Professional & Interpersonal Skills	Different	Different	Different
13	5: Knowledge of the Engineering Profession	---	Y	Y
14	5a. Knowledge of the Engineering Profession (Change over time)	---	---	---
15	5b. Knowledge of the Engineering Profession (Sources)	---	---	---
16	6a: Exposure to Project-Based Learning Methods: Individual	Single Item	Single Item	Single Item
17	6b: Exposure to Project-Based Learning Methods: Team	Single Item	Single Item	Single Item
18	7: Collaborative Work Style	Different	Different	Y
19	8: Extracurricular Fulfillment (Non-engineering)	---	---	Y
20	8b: Extracurricular Involvement (Engineering)	---	---	---
21	8c: Research Experience	---	---	---
22	9: Curriculum Overload	---	---	Y
23	10: Financial Difficulties	---	---	Single Item
24	11a: Academic Disengagement - Liberal Arts courses	---	Y	Y
25	11b: Academic Disengagement - Engineering-Related courses	Y	Y	Y
26	11c: Academic Disengagement - Overall	Not Complete	Y	Y
27	12: Frequency of Interaction with Instructors	Different	Different	Y
28	13a: Satisfaction with Instructors	Different	Different	Y
29	13d. Satisfaction with academic advising	Single Item	Single Item	Single Item
30	13b: Satisfaction with Academic Facilities	Different	Y	Y

31	**13c: Overall Satisfaction with Collegiate Experience**	---	Single Item	Single Item
32	**Intrinsic Motivation (Psychological)**	---	---	---
33	**Intrinsic Motivation (Behavioral)**	---	---	---

KEY

---	Not Asked
N/A	Alpha cannot be calculated bec
Single item	Single item variable; alpha can

SURV 4: C1Y2B Spring 05 Soph	SURV 5: C1Y3A Fall 05 Junior	SURV 6: C1Y3B Spring 06 Junior	SURV 7: C1Y4A Spring 07 Senior	APPLES1 Spring 07 Overall	APPLES1 Spring 07 Frosh	APPLES1 Spring 07 Soph	APPLES1 Spring 07 Junior	APPLES1 Spring 07 Senior
Single Item	Single Item	Single Item	Single Item	Single Item				
Single Item	Single Item	Single Item	Single Item	Single Item				
Y	0.76	Y	Y	0.82				
Y	0.85	Y	Y	0.87				
Y	0.70	Y	Y	0.64				
---	---	---	---	---				
Y	0.65	Y	Y	0.60				
Y	0.83	Y	Y	0.82				
Y	0.84	Y	Y	0.80				
Y	0.69	Y	Y	0.68				
Y	0.79	Y	Y	0.79				
Y	0.79	Y	Y	0.83				
Y	Y	Y	Y	---				
---	---	---	---	N/A				
---	---	---	---	N/A				
Single Item	Single Item	Single Item	Single Item	---				
Single Item	Single Item	Single Item	Single Item	---				
Y	Y	Y	---	---				
Y	0.85	Y	Y	0.82				
---	---	---	---	Single Item				
---	---	Single Item	Single Item	Single Item				
Y	0.81	Y	Y	0.78				
Single Item	Single Item	Single Item	Single Item	Single Item				
Y	0.58	Y	Y	0.88				
Y	0.70	Y	Y	0.86				
Y	Y	Y	Y	Y				
Y	0.69	Y	Y	0.74				
Y	0.84	Y	Y	0.72				
Single Item	Single Item	Single Item	---	Single Item				
Y	Y	Y	Y	---				

Single Item	Single Item	Single Item	Single Item	Single Item				
---	---	---	---	---				
---	---	---	---	---				

cause it's not a scale
not be calculated

APPLES2 Winter 08 Overall	APPLES2 Winter 08 Frosh	APPLES2 Winter 08 Soph	APPLES2 Winter 08 Junior	APPLES2 Winter 08 Senior
Single Item				
Single Item				
Y				
Y				
Y				

Y				
Y				
Y				
Y				
Y				
Y				
Y				
N/A				
N/A				
Single Item				
Single Item				

Y				
Single Item				
Single Item				
Y				
Single Item				
Y				
Y				
Y				
Y				
Y				
Single Item				

Single Item				
Y				
Y				

Appendix 4-C
APPLES1 Instrument

ACADEMIC PATHWAYS OF PEOPLE LEARNING ENGINEERING SURVEY (APPLES)

For best viewing results, please maximize your browser window.

QUESTIONS MARKED WITH A * ARE REQUIRED.

*1. **What school are you currently attending?**

- ○ [NAME OF INSTITUTION]
- ○ Other: [ ]
- ○ *I prefer not to answer*

*2. **What is your current academic standing?**

- ○ Freshman
- ○ Sophomore
- ○ Junior
- ○ Senior
- ○ Fifth year senior or more
- ○ Graduate student
- ○ Other: [ ] _______________
- ○ *I prefer not to answer*

*3. **When you entered this institution were you:**

- ○ A first-time college student
- ○ Returning or non-traditional college student
- ○ A transfer student from a two-year institution
- ○ A transfer student from a four-year institution
- ○ A transfer student from an institution that participates in a 3 + 2 engineering program
- ○ *I prefer not to answer*

*4. **What year do you expect to complete your undergraduate degree?**

- ○ 2007 or earlier
- ○ 2008
- ○ 2009
- ○ 2010
- ○ 2011
- ○ 2012 or later
- ○ *I prefer not to answer*

*5. **What were you most interested in majoring in when you first came to university? (Choose one)**

- ○ Arts and Humanities
- ○ Engineering
- ○ Math and Natural Sciences
- ○ Physical Sciences
- ○ Social Sciences
- ○ Other: ______
- ○ *I prefer not to answer*

*6. **What is/are your current major(s) or intended major(s)? (Mark all that apply)**

- ☐ Aerospace Engineering
- ☐ Chemical Engineering
- ☐ Civil Engineering
- ☐ Computer Science/Engineering
- ☐ Electrical Engineering
- ☐ Industrial Engineering
- ☐ Materials and Metallurgical Engineering
- ☐ Mechanical Engineering

- ☐ Arts and Humanities
- ☐ Math and Natural Sciences
- ☐ Physical Sciences
- ☐ Social Sciences
- ☐ Other
- ☐ *I prefer not to answer*

*7. **Do you intend to complete a major in engineering?**

- ○ Definitely Not
- ○ Probably Not
- ○ Not Sure
- ○ Probably Yes
- ○ Definitely Yes
- ○ *I prefer not to answer*

*8. **We are interested in knowing why you are or were studying engineering. Please indicate below the extent to which the following reasons apply to you:**

	Not a Reason	**Minimal Reason**	**Moderate Reason**	**Major Reason**	***I prefer not to answer***
Technology plays an important role in solving society's problems	○	○	○	○	○
Engineers make more money than most other professionals	○	○	○	○	○
My parent(s) would disapprove if I chose a major other than engineering	○	○	○	○	○
Engineers have contributed greatly to fixing problems in the world	○	○	○	○	○
Engineers are well paid	○	○	○	○	○
My parent(s) want me to be an engineer	○	○	○	○	○
An engineering degree will guarantee me a job when I graduate	○	○	○	○	○
A faculty member, academic advisor, teaching assistant or other university affiliated person has encouraged and/or inspired me to study engineering	○	○	○	○	○
A non-university affiliated mentor has encouraged and/or inspired me to study engineering	○	○	○	○	○

*9. **Please indicate how strongly you disagree or agree with each of the statements:**

	Disagree Strongly	**Disagree**	**Agree**	**Agree Strongly**	***I prefer not to answer***
Creative thinking is one of my strengths	○	○	○	○	○
I am skilled at solving problems that can have multiple solutions	○	○	○	○	○

*10. **Rate yourself on each of the following traits as compared to your classmates. We want the most accurate estimate of how you see yourself.**

	Lowest 10%	Below Average	Average	Above Average	Highest 10%	*I prefer not to answer*
Self confidence (social)	○	○	○	○	○	○
Leadership ability	○	○	○	○	○	○
Public speaking ability	○	○	○	○	○	○
Math ability	○	○	○	○	○	○
Science ability	○	○	○	○	○	○
Communication skills	○	○	○	○	○	○
Ability to apply math and science principles in solving real world problems	○	○	○	○	○	○
Business ability	○	○	○	○	○	○
Ability to perform in teams	○	○	○	○	○	○
Critical thinking skills	○	○	○	○	○	○

*11. **How important do you think each of the following skills and abilities is to becoming a successful engineer?**

	Not Important	Somewhat Important	Very Important	Crucial	*I prefer not to answer*
Self confidence (social)	○	○	○	○	○
Leadership ability	○	○	○	○	○
Public speaking ability	○	○	○	○	○
Math ability	○	○	○	○	○
Science ability	○	○	○	○	○
Communication skills	○	○	○	○	○
Ability to apply math and science principles in solving real world problems	○	○	○	○	○
Business ability	○	○	○	○	○
Ability to perform in teams	○	○	○	○	○
Critical thinking skills	○	○	○	○	○

*12. **Please rate your satisfaction with this institution on each aspect of campus life listed below. If you do not have experience with this aspect, mark N/A.**

	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied	N/A	*I prefer not to answer*
Quality of instruction	○	○	○	○	○	○
Availability of instructors	○	○	○	○	○	○
Quality of advising by instructors	○	○	○	○	○	○
Academic advising	○	○	○	○	○	○

*13. **Please rate the overall quality of your collegiate experience so far:**

- ○ Very dissatisfied
- ○ Dissatisfied
- ○ Satisfied
- ○ Very satisfied
- ○ *I prefer not to answer*

*14. **Think about the engineering, math or science classes you are taking/have taken during the current school year. Indicate how often you: (Mark N/A if you have not taken any engineering related classes.)**

	Never	Rarely	Occasionally	Frequently	N/A	*I prefer not to answer*
Came late to engineering class	○	○	○	○	○	○
Skipped engineering class	○	○	○	○	○	○
Turned in engineering assignments that did not reflect your best work	○	○	○	○	○	○
Turned in engineering assignments late	○	○	○	○	○	○

*15. **Think about the liberal arts classes (not engineering, math, or science classes)you are taking/have taken during the current school year. Indicate how often you: (Mark N/A if you have not taken any liberal arts classes.)**

	Never	Rarely	Occasionally	Frequently	N/A	*I prefer not to answer*
Came late to liberal arts class	○	○	○	○	○	○
Skipped liberal arts class	○	○	○	○	○	○
Turned in liberal arts assignments that did not reflect your best work	○	○	○	○	○	○
Turned in liberal arts assignments late	○	○	○	○	○	○

*16. **How well are you meeting the workload demands of your coursework?**

○ I am meeting all of the demands easily

○ I am meeting all of the demands, but it is hard work

○ I am meeting most of the demands, but cannot meet some

○ I can meet some of the demands, but cannot meet most

○ I cannot meet any of the demands

○ *I prefer not to answer*

*17. **How stressed do you feel in your coursework right now?**

○ No stress

○ Moderately low stress

○ Moderate stress

○ Moderately high stress

○ High stress

○ *I prefer not to answer*

*18. **During the current school year, how much pressure have you felt with each of the following?**

	No Pressure	Moderately Low Pressure	Moderate Pressure	Moderately High Pressure	High Pressure	*I prefer not to answer*
Course load (amount of course material being covered)	○	○	○	○	○	○
Course pace (the rate at which the course material is being covered)	○	○	○	○	○	○
Balance between social and academic life	○	○	○	○	○	○

*19. **During the current school year, how often have you interacted with your instructors (faculty, teaching assistants) in your *engineering, math, or science* classes (e.g. by phone, e-mail, IM, or in person)? Mark N/A if you have not taken any engineering, math, or science classes this year.**

	Never	Rarely	Occasionally	Often	Very Often	N/A	*I prefer not to answer*
Instructors during class	○	○	○	○	○	○	○
Instructors during office hours	○	○	○	○	○	○	○
Instructors outside of class or office hours	○	○	○	○	○	○	○

*20. **Some people are involved in non-engineering activities on or off campus, such as hobbies, civic or church organizations, campus publications, student government, social fraternity or sorority, sports, etc. How important is it for you to be involved in these kind of activities?**

○ Not Important

○ Somewhat Important

○ Very Important

○ Essential

○ *I prefer not to answer*

*21. **How often are you involved in the kinds of non-engineering activities described above?**

- Never
- Rarely
- Occasionally
- Frequently
- *I prefer not to answer*

*22. **What is your level of involvement in student engineering activities such as engineering societies?**

- No involvement
- Limited involvement
- Moderate involvement
- Extensive involvement
- *I prefer not to answer*

*23. **Since coming to college, have you had any research experience(s)?**

- No
- Yes, in engineering related areas
- Yes, in non-engineering related areas
- Yes, in both engineering and non-engineering related areas
- *I prefer not to answer*

*24. **Before college, how much knowledge did you have about the engineering profession?**

- No knowledge
- Limited knowledge
- Moderate knowledge
- Extensive knowledge
- *I prefer not to answer*

*25. **Since entering college, how much knowledge have you gained about the engineering profession?**

- ○ No knowledge
- ○ Limited knowledge
- ○ Moderate knowledge
- ○ Extensive knowledge
- ○ *I prefer not to answer*

*26. **How did you gain your knowledge about the engineering profession? (Mark all that apply)**

- ☐ From being a visitor
- ☐ From being a co-op student
- ☐ From being an intern
- ☐ From being an employee
- ☐ From a family member
- ☐ From a close friend
- ☐ Other: ________
- ☐ *I prefer not to answer*

*27. **Do any of your immediate family members (parents, siblings) hold an engineering degree?**

- ○ No
- ○ Yes
- ○ *I prefer not to answer*

*28. **Do you have any concerns about your ability to finance your college education?**

- ○ None (I am confident that I will have sufficient funds)
- ○ Some (but I probably will have sufficient funds)
- ○ Major (I have funds but will graduate with significant debt)
- ○ Extreme (not sure if I will have sufficient funds to complete college)
- ○ *I prefer not to answer*

*29. **About how many hours do you spend in a typical 7-day week doing each of the following?**

	0	1-5	6-10	11-15	16-20	21-25	26-30	More than 30	*I prefer not to answer*
Preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)	○	○	○	○	○	○	○	○	○
Working for pay	○	○	○	○	○	○	○	○	○
Participating in co-curricular activities (organizations, campus publications, student government, social fraternity or sorority, intercollegiate or intramural sports, etc.)	○	○	○	○	○	○	○	○	○
Relaxing and socializing (watching TV, partying, exercising, etc.)	○	○	○	○	○	○	○	○	○
Providing care for dependents living with you (parents, children, spouse, etc.)	○	○	○	○	○	○	○	○	○
Commuting to class (driving, walking, etc.)	○	○	○	○	○	○	○	○	○

*30. **What is your expected grade point average this academic term?**

○ A or A+ (3.9 or above)

○ (3.5-3.8)

○ B+ (3.2-3.4)

○ B (2.9-3.1)

○ (2.5-2.8)

○ C+ (2.2-2.4)

○ C (1.9-2.1)

○ or lower (less than 1.5)

○ *I prefer not to answer*

*31. **What is your expected grade point average overall?**

- ○ A or A+ (3.9 or above)
- ○ (3.5-3.8)
- ○ B+ (3.2-3.4)
- ○ B (2.9-3.1)
- ○ (2.5-2.8)
- ○ C+ (2.2-2.4)
- ○ C (1.9-2.1)
- ○ or lower (less than 1.5)
- ○ *I prefer not to answer*

*32. **What do you see yourself doing in the first 3 years after graduation? (Mark all that apply)**

- ☐ Find a job working in the engineering profession
- ☐ Find a job working in a non-engineering profession
- ☐ Go to graduate school in engineering (Masters/PhD)
- ☐ Go to professional school (business, law, medicine, etc.)
- ☐ Go to graduate school NOT in engineering (Masters/PhD)
- ☐ Other: (please explain) ____
- ☐ *I prefer not to answer*

*33. **How sure are you about your plans after graduation?**

- ○ Not at all sure
- ○ Somewhat sure
- ○ Pretty sure
- ○ Absolutely sure
- ○ *I prefer not to answer*

*34. **Do you see yourself pursuing a career in engineering?**

- ○ Definitely Not
- ○ Probably Not
- ○ Not Sure
- ○ Probably Yes
- ○ Definitely Yes
- ○ *I prefer not to answer*

*35. **Your sex:**

- ○ Male
- ○ Female
- ○ *I prefer not to answer*

*36. **What is your racial or ethnic identification? (Select only one)**

- ○ American Indian or other native person
- ○ Asian, Asian American, or Pacific Islander
- ○ Black or African American
- ○ White (non-Hispanic)
- ○ Hispanic or Latino/a
- ○ Multiracial
- ○ Other: ____________
- ○ *I prefer not to answer*

*37. **Are you:**

- ○ A U.S. Citizen
- ○ A Permanent Resident of the U.S.
- ○ Other
- ○ *I prefer not to answer*

*38. **Were you born in the United States?**

- ○ Yes
- ○ If no, at what age did you immigrate to the U.S? [ ]
- ○ *I prefer not to answer*

*39. **Did one or more of your parents/guardians immigrate to the United States?**

- ○ Yes
- ○ No
- ○ *I prefer not to answer*

*40. **Is English your first language?**

- ○ Yes
- ○ No
- ○ *I prefer not to answer*

*41. **Are you a first-generation college student (first in your immediate family to attend college)?**

- ○ Yes
- ○ No
- ○ *I prefer not to answer*

*42. **Are you enrolled primarily as a:**

- ○ Full-time student
- ○ Part-time student
- ○ *I prefer not to answer*

*43. **Would you describe your family as: (Mark one)**

- ○ Low income
- ○ Middle income
- ○ Upper-middle income
- ○ High income
- ○ *I prefer not to answer*

*44. **What is the highest level of education that your mother completed? (Mark one)**

- ○ Did not finish high school
- ○ Graduated from high school
- ○ Attended college but did not complete degree
- ○ Completed an Associate degree (AA, AS, etc.)
- ○ Completed a Bachelor degree (BA, BS, etc.)
- ○ Completed a Masters degree (MA, MS, etc.)
- ○ Completed a Doctoral or Professional degree (JD, MD, PhD, etc.)
- ○ Don't know or Not applicable
- ○ *I prefer not to answer*

*45. **What is the highest level of education that your father completed? (Mark one)**

- ○ Did not finish high school
- ○ Graduated from high school
- ○ Attended college but did not complete degree
- ○ Completed an Associate degree (AA, AS, etc.)
- ○ Completed a Bachelor degree (BA, BS, etc.)
- ○ Completed a Masters degree (MA, MS, etc.)
- ○ Completed a Doctoral or Professional degree (JD, MD, PhD, etc.)
- ○ Don't know or Not applicable
- ○ *I prefer not to answer*

*46. **You have been asked to design a playground. You have a limited amount of time and resources to gather information for your design. From the following list, please put a check mark next to the FIVE kinds of information you would MOST LIKELY NEED as you work on your design:**

- ☐ Availability of materials
- ☐ Body proportions
- ☐ Budget
- ☐ Handicapped accessibility
- ☐ Information about the area
- ☐ Labor availability and cost
- ☐ Legal liability
- ☐ Maintenance concerns
- ☐ Material costs
- ☐ Material specifications
- ☐ Neighborhood demographics
- ☐ Neighborhood opinions
- ☐ Safety
- ☐ Supervision concerns
- ☐ Technical references
- ☐ Utilities
- ☐ *I prefer not to answer*

*47. **Which of the following statements best describes your situation with respect to an engineering major? (Mark one)**

I started at this institution...

- ○ Intending to major in engineering and never doubted the decision.
- ○ Intending to major in engineering and have/had doubts.
- ○ Considering engineering, but was open to other majors, too.
- ○ Intending another major, but am now considering engineering.
- ○ Completely undecided about what my major would be.
- ○ *I prefer not to answer*

*48. **My decision to CONTINUE with an engineering major *primarily* came from: (Mark one)**

- ○ Not applicable - I am not continuing in an engineering major.
- ○ Experiences with **PRE-ENGINEERING**-related (math, physics, etc) coursework,
- ○ faculty, and/or research/internship(s)
- ○ Experiences with **ENGINEERING**-related coursework, faculty, and/or
- ○ research/internship(s)
- ○ Experiences with **OTHER** coursework, faculty, and/or research/internship(s)
- ○ *I prefer not to answer*

*49. **My DOUBTS about continuing in an engineering major *primarily* came from: (Mark one)**

- ○ Not applicable - I never doubted continuing in an engineering major.
- ○ Experiences with **PRE-ENGINEERING**-related (math, physics, etc) coursework,
- ○ faculty, and/or research/internship(s)
- ○ Experiences with **ENGINEERING**-related coursework, faculty, and/or
- ○ research/internship(s)
- ○ Experiences with **OTHER** coursework, faculty, and/or research/internship(s)
- ○ *I prefer not to answer*

50. **Is there anything you want to tell us about your experiences in engineering that we haven't already asked you about?**

*51. **How did you learn about this survey? (Mark all that apply)**

- ☐ Advertisement in student newspaper
- ☐ Announcement in class
- ☐ Given time in class to complete the survey
- ☐ Announcement or email from engineering society or other student group
- ☐ Email from a friend
- ☐ Email from school official/dean
- ☐ Poster/flyer
- ☐ Other
- ☐ *I prefer not to answer*

*52. **Would you have been willing to take this survey if the compensation was: (Mark all that apply)**

- ☐ Drawing for $50 (1 chance out of 100)
- ☐ $0 - No compensation
- ☐ *I prefer not to answer*

debug

p h p E S P

Survey Design

Help

General Questions Order Preview Finish

This is a preview of how this survey will look. In the preview the survey navigation buttons are inactive, use the section number buttons to view different sections. Some navigation buttons may not appear on your final survey, depending on what access it is assigned. The survey will use the background color of the document in which it is embedded. If you have no further changes click **Finish** at the bottom of this page.

Section: 1 2 3 4 5 6 7

Academic Pathways Of People Learning Engineering Survey

(APPLES)

Page 1 of 7

For best viewing results, please maximize your browser window.

Questions marked with a * are required.

*1. **What school are you currently attending?**

- ◯ INSERT NAME OF SCHOOL
- ◯ Other: ______
- ◯ *I prefer not to answer*

*2. **What is your current academic standing?**

- Freshman
- Sophomore
- Junior
- Senior
- Fifth year senior or more
- Graduate student
- Other:
- *I prefer not to answer*

*3. **When you entered this institution were you:**

- A first-time college student
- Returning or non-traditional college student
- A transfer student from a two-year institution
- A transfer student from a four-year institution
- A transfer student from an institution that participates in a 3 + 2 engineering program
- *I prefer not to answer*

*4. **What were you most interested in majoring in when you first came to university? (Choose one)**

- Arts and Humanities
- Engineering
- Math and Natural Sciences
- Physical Sciences
- Social Sciences
- Other
- *I prefer not to answer*

*5. **What is your current major or first choice of major? (Mark one)**

- Aerospace Engineering
- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Industrial Engineering
- Materials and Metallurgical Engineering
- Mechanical Engineering
- Computer Science/Engineering (in engineering)

- Computer Science (non-engineering)
- Other Engineering:
- Arts and Humanities
- Math and Natural Sciences
- Physical Sciences
- Social Sciences
- Other Non-Engineering:
- *I prefer not to answer*

*6. **What is your second choice of major or second major/minor? (Mark one or N/A if not applicable)**

- Aerospace Engineering
- Chemical Engineering
- Civil Engineering
- Electrical Engineering
- Industrial Engineering
- Materials and Metallurgical Engineering
- Mechanical Engineering
- Computer Science/Engineering (in engineering)
- Computer Science (non-engineering)
- Other Engineering:
- Arts and Humanities
- Math and Natural Sciences
- Physical Sciences
- Social Sciences
- Other Non-Engineering:
- N/A
- Undecided
- *I prefer not to answer*

*7. **Do you intend to complete a major in engineering?**

- Definitely not
- Probably not
- Not sure
- Probably yes
- Definitely yes
- *I prefer not to answer*

*8. **Do you intend to practice, conduct research in, or teach engineering for at least 3 years after graduation?**

- Definitely not
- Probably not
- Not sure
- Probably yes
- Definitely yes
- *I prefer not to answer*

PAGE 1 OF 7

Save Next Page

The survey title and other general fields are on the **General** tab. Individual survey questions are added and modified on the **Questions** tab. Questions may be re-ordered or deleted from the **Order** tab. You may see a preview of your survey at any time, by going to the **Preview** tab. If you have no further changes click **Finish** to go back to the Management Interface.
Click here to open the Help window.

General Questions Order Preview Finish

debug

p h p E S P

Survey Design

Help

General Questions Order Preview Finish

This is a preview of how this survey will look. In the preview the survey navigation buttons are inactive, use the section number buttons to view different sections. Some navigation buttons may not appear on your final survey, depending on what access it is assigned. The survey will use the background color of the document in which it is embedded. If you have no further changes click **Finish** at the bottom of this page.

Section: 1 2 3 4 5 6 7

ACADEMIC PATHWAYS OF PEOPLE LEARNING ENGINEERING SURVEY

(APPLES)

PAGE 2 OF 7

For best viewing results, please maximize your browser window.

QUESTIONS MARKED WITH A * ARE REQUIRED.

*9. **We are interested in knowing why you are or were studying engineering. Please indicate below the extent to which the following reasons apply to you:**

	Not a Reason	Minimal Reason	Moderate Reason	Major Reason	*I prefer not to answer*
Technology plays an important role in solving society's problems	○	○	○	○	○
Engineers make more money than most other professionals	○	○	○	○	○
My parent(s) would disapprove if I chose a major other than engineering	○	○	○	○	○
Engineers have contributed greatly to fixing problems in the world	○	○	○	○	○
Engineers are well paid	○	○	○	○	○
My parent(s) want me to be an engineer	○	○	○	○	○
An engineering degree will guarantee me a job when I graduate	○	○	○	○	○
A faculty member, academic advisor, teaching assistant or other university affiliated person has encouraged and/or	○	○	○	○	○

inspired me to study engineering					
A non-university affiliated mentor has encouraged and/or inspired me to study engineering	◯	◯	◯	◯	◯
A mentor has introduced me to people and opportunities in engineering	◯	◯	◯	◯	◯
I feel good when I am doing engineering	◯	◯	◯	◯	◯
I like to build stuff	◯	◯	◯	◯	◯
I think engineering is fun	◯	◯	◯	◯	◯
Engineering skills can be used for the good of society	◯	◯	◯	◯	◯
I think engineering is interesting	◯	◯	◯	◯	◯
I like to figure out how things work	◯	◯	◯	◯	◯

*10. **Please indicate how strongly you disagree or agree with each of the statements:**

	Disagree Strongly	Disagree	Agree	Agree Strongly	*I prefer not to answer*
Creative thinking is one of my strengths	◯	◯	◯	◯	◯
I am skilled at solving problems that can have multiple solutions	◯	◯	◯	◯	◯
A mentor has supported my decision to major in engineering	◯	◯	◯	◯	◯

*11. **Rate yourself on each of the following traits as compared to your classmates. We want the most accurate estimate of how you see yourself.**

	Lowest 10%	Below Average	Average	Above Average	Highest 10%	*I prefer not to answer*
Self confidence (social)	◯	◯	◯	◯	◯	◯
Leadership ability	◯	◯	◯	◯	◯	◯
Public speaking ability	◯	◯	◯	◯	◯	◯
Math ability	◯	◯	◯	◯	◯	◯
Science ability	◯	◯	◯	◯	◯	◯
Communication skills	◯	◯	◯	◯	◯	◯
Ability to apply math and science principles in solving real world problems	◯	◯	◯	◯	◯	◯
Business ability	◯	◯	◯	◯	◯	◯
Ability to perform in teams	◯	◯	◯	◯	◯	◯
Critical thinking skills	◯	◯	◯	◯	◯	◯

*12. **How important do you think each of the following skills and abilities is to becoming a successful engineer?**

	Not Important	Somewhat Important	Very Important	Crucial	*I prefer not to answer*
Self confidence (social)	○	○	○	○	○
Leadership ability	○	○	○	○	○
Public speaking ability	○	○	○	○	○
Math ability	○	○	○	○	○
Science ability	○	○	○	○	○
Communication skills	○	○	○	○	○
Ability to apply math and science principles in solving real world problems	○	○	○	○	○
Business ability	○	○	○	○	○
Ability to perform in teams	○	○	○	○	○

*13. **Please rate your satisfaction with this institution on each aspect of campus life listed below. (Mark N/A if you do not have experience with this aspect.)**

	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied	N/A	*I prefer not to answer*
Quality of instruction	○	○	○	○	○	○
Availability of instructors	○	○	○	○	○	○
Quality of advising by instructors	○	○	○	○	○	○
Academic advising	○	○	○	○	○	○

*14. **During the current school year, what portion of your classes have used the following teaching methods?**

	None	Very little	Less than half	About half	More than half	All or nearly all	*I prefer not to answer*
Individual projects	○	○	○	○	○	○	○
Team projects	○	○	○	○	○	○	○

*15. **Please rate the overall quality of your collegiate experience so far:**

- ◯ Very dissatisfied
- ◯ Dissatisfied
- ◯ Satisfied
- ◯ Very satisfied
- ◯ *I prefer not to answer*

PAGE 2 OF 7

Previous Page | Save | Next Page

The survey title and other general fields are on the **General** tab. Individual survey questions are added and modified on the **Questions** tab. Questions may be re-ordered or deleted from the **Order** tab. You may see a preview of your survey at any time, by going to the **Preview** tab. If you have no further changes click **Finish** to go back to the Management Interface.
Click here to open the Help window.

General | Questions | Order | Preview | Finish

debug

p h p E S P

Survey Design

Help

General Questions Order Preview Finish

This is a preview of how this survey will look. In the preview the survey navigation buttons are inactive, use the section number buttons to view different sections. Some navigation buttons may not appear on your final survey, depending on what access it is assigned. The survey will use the background color of the document in which it is embedded. If you have no further changes click **Finish** at the bottom of this page.

Section: 1 2 3 4 5 6 7

ACADEMIC PATHWAYS OF PEOPLE LEARNING ENGINEERING SURVEY

(APPLES)

PAGE 3 OF 7

For best viewing results, please maximize your browser window.

QUESTIONS MARKED WITH A * ARE REQUIRED.

*16. **Think about the engineering, math or science classes you are taking/have taken during the current school year. Indicate how often you:**
(Mark N/A if you have not taken any engineering related classes.)

	Never	Rarely	Occasionally	Frequently	N/A	*I prefer not to answer*
Came late to engineering class	○	○	○	○	○	○
Skipped engineering class	○	○	○	○	○	○
Turned in engineering assignments that did not reflect your best work	○	○	○	○	○	○
Turned in engineering assignments late	○	○	○	○	○	○

*17. **Think about the liberal arts classes (not engineering, math, or science classes)you are taking/have taken during the current school year. Indicate how often you: (Mark N/A if you have not taken any liberal arts classes.)**

	Never	Rarely	Occasionally	Frequently	N/A	*I prefer not to answer*
Came late to liberal arts class	◯	◯	◯	◯	◯	◯
Skipped liberal arts class	◯	◯	◯	◯	◯	◯
Turned in liberal arts assignments that did not reflect your best work	◯	◯	◯	◯	◯	◯
Turned in liberal arts assignments late	◯	◯	◯	◯	◯	◯

*18. **How well are you meeting the workload demands of your coursework?**

◯ I am meeting all of the demands easily
◯ I am meeting all of the demands, but it is hard work
◯ I am meeting most of the demands, but cannot meet some
◯ I can meet some of the demands, but cannot meet most
◯ I cannot meet any of the demands
◯ *I prefer not to answer*

*19. **How stressed do you feel in your coursework right now?**

◯ No stress
◯ Moderately low stress
◯ Moderate stress
◯ Moderately high stress
◯ High stress
◯ *I prefer not to answer*

*20. **During the current school year, how much pressure have you felt with each of the following?**

	No Pressure	Moderately Low Pressure	Moderate Pressure	Moderately High Pressure	High Pressure	*I prefer not to answer*
Course load (amount of course material being covered)	◯	◯	◯	◯	◯	◯

Course pace (the rate at which the course material is being covered)	◯	◯	◯	◯	◯	◯
Balance between social and academic life	◯	◯	◯	◯	◯	◯

*21. **During the current school year, how often have you interacted with your instructors (faculty, teaching assistants) in your *engineering, math, or science* classes (e.g. by phone, e-mail, IM, or in person)?**
(Mark N/A if you have not taken any engineering, math, or science classes this year.)

	Never	Rarely	Occasionally	Often	Very often	N/A	*I prefer not to answer*
Instructors during class	◯	◯	◯	◯	◯	◯	◯
Instructors during office hours	◯	◯	◯	◯	◯	◯	◯
Instructors outside of class or office hours	◯	◯	◯	◯	◯	◯	◯

*22. **Some people are involved in non-engineering activities on or off campus, such as hobbies, civic or church organizations, campus publications, student government, social fraternity or sorority, sports, etc. How important is it for you to be involved in these kind of activities?**

◯ Not important
◯ Somewhat important
◯ Very important
◯ Essential
◯ *I prefer not to answer*

*23. **How often are you involved in the kinds of non-engineering activities described above?**

◯ Never
◯ Rarely
◯ Occasionally
◯ Frequently
◯ *I prefer not to answer*

*24. **What is your level of involvement in student engineering activities such as engineering clubs or societies?**

- No involvement
- Limited involvement
- Moderate involvement
- Extensive involvement
- *I prefer not to answer*

*25. **Since coming to college, have you had any research experience(s)? (Mark one)**

- No
- Yes, in engineering related areas
- Yes, in non-engineering related areas
- Yes, in both engineering and non-engineering related areas
- *I prefer not to answer*

PAGE 3 OF 7

Previous Page | Save | Next Page

The survey title and other general fields are on the **General** tab. Individual survey questions are added and modified on the **Questions** tab. Questions may be re-ordered or deleted from the **Order** tab. You may see a preview of your survey at any time, by going to the **Preview** tab. If you have no further changes click **Finish** to go back to the Management Interface.
Click here to open the Help window.

General | Questions | Order | Preview | Finish

debug

p h p E S P

Survey Design

Help

General Questions Order Preview Finish

This is a preview of how this survey will look. In the preview the survey navigation buttons are inactive, use the section number buttons to view different sections. Some navigation buttons may not appear on your final survey, depending on what access it is assigned. The survey will use the background color of the document in which it is embedded. If you have no further changes click **Finish** at the bottom of this page.

Section: 1 2 3 4 5 6 7

ACADEMIC PATHWAYS OF PEOPLE LEARNING ENGINEERING SURVEY

(APPLES)

PAGE 4 OF 7

For best viewing results, please maximize your browser window.

QUESTIONS MARKED WITH A * ARE REQUIRED.

*26. **Before college, how much knowledge did you have about the engineering profession?**

- No knowledge
- Limited knowledge
- Moderate knowledge
- Extensive knowledge
- *I prefer not to answer*

*27. **Since entering college, how much knowledge have you gained about the engineering profession?**

- No knowledge
- Limited knowledge
- Moderate knowledge
- Extensive knowledge
- *I prefer not to answer*

*28. **How much exposure have you had to a professional engineering environment as a visitor, intern, or employee?**

- No exposure
- Limited exposure
- Moderate exposure
- Extensive exposure
- *I prefer not to answer*

*29. **How did you gain your knowledge about the engineering profession? (Mark all that apply)**

- From being a visitor
- From being a co-op student or intern
- From being an employee
- From a family member
- From a close friend
- From school-related experiences (i.e., a professor or class)
- Other:
- *I prefer not to answer*

*30. **Do any of your immediate family members (parents, siblings) hold an engineering degree?**

- No
- Yes
- *I prefer not to answer*

31. **Do you see yourself continuing in an engineering major?**

- No - I am NOT majoring or planning to major in engineering
- Yes
- *I prefer not to answer*

*32. **Do you see yourself pursuing a career in engineering?**

- Definitely not
- Probably not
- Not sure
- Probably yes
- Definitely yes
- *I prefer not to answer*

*33. **How likely is it that you would do each of the following after graduation?**

	Definitely not	Probably not	Not sure	Probably yes	Definitely yes	*I prefer not to answer*
Work in an engineering job						
Work in a non-engineering job						
Go to graduate school in an engineering discipline						
Go to graduate school outside of engineering						

*34. **Do you have any concerns about your ability to finance your college education?**

- None (I am confident that I will have sufficient funds)
- Some (but I probably will have sufficient funds)
- Major (I have funds but will graduate with significant debt)
- Extreme (not sure if I will have sufficient funds to complete college)
- *I prefer not to answer*

*35. **What is your cumulative grade point average?**

A or A+	(i.e., 3.9 or above on a 4.0 scale)
A-	(3.5-3.8)
B+	(3.2-3.4)
B	(2.9-3.1)
B-	(2.5-2.8)
C+	(2.2-2.4)
C	(1.9-2.1)
C- or lower	(less than 1.5)
I prefer not to answer	

PAGE 4 OF 7

Previous Page | Save | Next Page

The survey title and other general fields are on the **General** tab. Individual survey questions are added and modified on the **Questions** tab. Questions may be re-ordered or deleted from the **Order** tab. You may see a preview of your survey at any time, by going to the **Preview** tab. If you have no further changes click **Finish** to go back to the Management Interface.
Click here to open the Help window.

General | Questions | Order | Preview | Finish

debug

p h p E S P

Survey Design

Help

General Questions Order Preview Finish

This is a preview of how this survey will look. In the preview the survey navigation buttons are inactive, use the section number buttons to view different sections. Some navigation buttons may not appear on your final survey, depending on what access it is assigned. The survey will use the background color of the document in which it is embedded. If you have no further changes click **Finish** at the bottom of this page.

Section: 1 2 3 4 5 6 7

ACADEMIC PATHWAYS OF PEOPLE LEARNING ENGINEERING SURVEY

(APPLES)

PAGE 5 OF 7

For best viewing results, please maximize your browser window.

QUESTIONS MARKED WITH A * ARE REQUIRED.

*36. **Your sex:**

- ◯ Female
- ◯ Male
- ◯ *I prefer not to answer*

*37. **What is your racial or ethnic identification? (Mark all that apply)**

- ☐ American Indian or Alaska Native
- ☐ Asian or Asian American
- ☐ Black or African American
- ☐ Hispanic or Latino/a
- ☐ Native Hawaiian or Pacific Islander
- ☐ White
- ☐ Other: ______

☐ *I prefer not to answer*

*38. **How old are you? (Mark one)**

- 17 or younger
- 18-19
- 20-23
- 24-29
- 30-39
- 40-55
- over 55
- *I prefer not to answer*

*39. **Are you:**

- A U.S. Citizen
- A Permanent Resident of the U.S.
- Other
- *I prefer not to answer*

*40. **Were you born in the United States?**

- Yes
- If no, at what age did you immigrate to the U.S:
- *I prefer not to answer*

*41. **Did one or more of your parents/guardians immigrate to the United States?**

- Yes
- No
- *I prefer not to answer*

*42. **Is English your first language?**

- Yes
- No
- *I prefer not to answer*

*43. **Are you a first-generation college student (first in your immediate family to attend college)?**

- Yes
- No
- *I prefer not to answer*

*44. **Are you enrolled primarily as a:**

- Full-time student
- Part-time student
- *I prefer not to answer*

*45. **Which of the following best describes where you are living now while attending college?**

- Dormitory or other campus housing
- Residence (house, apartment, etc.) within **walking distance** of the institution
- Residence (house, apartment, etc.) within **driving distance** of the institution
- *I prefer not to answer*

*46. **Would you describe your family as: (Mark one)**

- High income
- Upper-middle income
- Middle income
- Lower-middle income
- Low income
- *I prefer not to answer*

*47. **What is the highest level of education that your mother completed? (Mark one)**

- Did not finish high school
- Graduated from high school
- Attended college but did not complete degree
- Completed an Associate degree (AA, AS, etc.)
- Completed a Bachelor degree (BA, BS, etc.)
- Completed a Masters degree (MA, MS, etc.)
- Completed a Doctoral or Professional degree (JD, MD, PhD, etc.)
- Don't know or not applicable
- *I prefer not to answer*

*48. **What is the highest level of education that your father completed? (Mark one)**

- Did not finish high school
- Graduated from high school
- Attended college but did not complete degree
- Completed an Associate degree (AA, AS, etc.)
- Completed a Bachelor degree (BA, BS, etc.)
- Completed a Masters degree (MA, MS, etc.)
- Completed a Doctoral or Professional degree (JD, MD, PhD, etc.)
- Don't know or not applicable
- *I prefer not to answer*

PAGE 5 OF 7

Previous Page | Save | Next Page

The survey title and other general fields are on the **General** tab. Individual survey questions are added and modified on the **Questions** tab. Questions may be re-ordered or deleted from the **Order** tab. You may see a preview of your survey at any time, by going to the **Preview** tab. If you have no further changes click **Finish** to go back to the Management Interface.
Click here to open the Help window.

General | Questions | Order | Preview | Finish

debug

p h p E S P

Survey Design

Help

General Questions Order Preview Finish

This is a preview of how this survey will look. In the preview the survey navigation buttons are inactive, use the section number buttons to view different sections. Some navigation buttons may not appear on your final survey, depending on what access it is assigned. The survey will use the background color of the document in which it is embedded. If you have no further changes click **Finish** at the bottom of this page.

Section: 1 2 3 4 5 6 7

ACADEMIC PATHWAYS OF PEOPLE LEARNING ENGINEERING SURVEY

(APPLES)

PAGE 6 OF 7

For best viewing results, please maximize your browser window.

QUESTIONS MARKED WITH A * ARE REQUIRED.

*49. **Of the twenty-three design activities below, please put a check mark next to the SIX MOST IMPORTANT.**

- [ ] Abstracting
- [ ] Brainstorming
- [ ] Building
- [ ] Communicating
- [ ] Decomposing
- [ ] Evaluating
- [ ] Generating alternatives
- [ ] Goal setting
- [ ] Identifying constraints
- [ ] Imagining
- [ ] Iterating
- [ ] Making decisions
- [ ] Making trade-offs

- [ ] Modeling
- [ ] Planning
- [ ] Prototyping
- [ ] Seeking information
- [ ] Sketching
- [ ] Synthesizing
- [ ] Testing
- [ ] Understanding the problem
- [ ] Using creativity
- [ ] Visualizing
- [ ] *I prefer not to answer*

PAGE 6 OF 7

Previous Page | Save | Next Page

The survey title and other general fields are on the **General** tab. Individual survey questions are added and modified on the **Questions** tab. Questions may be re-ordered or deleted from the **Order** tab. You may see a preview of your survey at any time, by going to the **Preview** tab. If you have no further changes click **Finish** to go back to the Management Interface.
Click here to open the Help window.

General | Questions | Order | Preview | Finish

debug

p h p E S P

Survey Design

Help

General Questions Order Preview Finish

This is a preview of how this survey will look. In the preview the survey navigation buttons are inactive, use the section number buttons to view different sections. Some navigation buttons may not appear on your final survey, depending on what access it is assigned. The survey will use the background color of the document in which it is embedded. If you have no further changes click **Finish** at the bottom of this page.

Section: 1 2 3 4 5 6 7

ACADEMIC PATHWAYS OF PEOPLE LEARNING ENGINEERING SURVEY

(APPLES)

PAGE 7 OF 7

For best viewing results, please maximize your browser window.

50. **Is there anything you want to tell us about your experiences in engineering that we haven't already asked you about?**

PAGE 7 OF 7

Previous Page Save Submit Survey

The survey title and other general fields are on the **General** tab. Individual survey questions are added and modified on the **Questions** tab. Questions may be re-ordered or deleted from the **Order** tab. You may see a preview of your survey at any time, by going to the **Preview** tab. If you have no further changes click **Finish** to go back to the Management Interface.

Click here to open the Help window.

General Questions Order Preview Finish

Appendix 4-E
Cross-sectional Cohort (PIE) Surveys and Focus Group Questions

Cross-sectional Cohort survey fall 2005
Cross-sectional Cohort survey spring 2006
Cross-sectional Cohort Focus Group Interview Guide

Academic Pathways Study Fall'05 Survey

Large Midwestern Public University (LMPub)

Please click the SUBMIT button only after you have completed the survey. For best viewing results, please maximize your browser window.

1. What is your expected year of graduation from college?

- [ ] 2005
- [ ] 2006
- [ ] 2007
- [ ] 2008
- [ ] 2009
- [ ] 2010
- [ ] 2011
- [ ] 2012 or later

2. Do you intend to complete a major in engineering?

- [ ] Definitely Not
- [ ] Probably Not
- [ ] Not Sure
- [ ] Probably Yes
- [ ] Definitely Yes

3. What do you intend to major in?

- [ ] Aerospace engineering & mechanics
- [ ] Astrophysics
- [ ] Bio-based products engineering
- [ ] Biomedical engineering
- [ ] Biosystems & agricultural engineering
- [ ] Chemical engineering
- [ ] Chemistry

- Civil engineering
- Computer engineering
- Computer science
- Electrical engineering
- Geological engineering
- Geology
- Geophysics
- Materials science & engineering
- Mathematics
- Mechanical engineering
- Physics
- Statistics
- Arts & humanities
- Education
- Social Science
- Other non-engineering

4. If you intend to DOUBLE MAJOR, what is the second major you intend to complete? (Mark N/A if you do not intend to double major.)

- N/A
- Aerospace engineering & mechanics
- Astrophysics
- Bio-based products engineering
- Biomedical engineering
- Biosystems & agricultural engineering
- Chemical engineering
- Chemistry
- Civil engineering
- Computer engineering
- Computer science
- Electrical engineering
- Geological engineering
- Geology

- Geophysics
- Materials science & engineering
- Mathematics
- Mechanical engineering
- Physics
- Statistics
- Arts & humanities
- Education
- Social Science
- Other non-engineering

5. Do you intend to practice, conduct research in, or teach engineering for at least 3 years after graduation?

- Definitely Not
- Probably Not
- Not Sure
- Probably Yes
- Definitely Yes

6. If you are thinking of going to graduate school NOT IN ENGINEERING, please mark your most probable area of study. Otherwise, mark N/A.

- Business
- Education
- Medicine
- Law
- MA/Ph.D.
- Public Service
- Other
- N/A

7. We are interested in knowing why you are studying engineering now. Please

indicate below the extent to which the following reasons apply to you:

	Not a Reason	Minimal Reason	Moderate Reason	Major Reason
Technology plays an important role in solving society's problems	☐	☐	☐	☐
Engineers make more money than most other professionals	☐	☐	☐	☐
My parent(s) would disapprove if I chose a major other than engineering	☐	☐	☐	☐
Engineers have contributed greatly to fixing problems in the world	☐	☐	☐	☐
Engineers are well paid	☐	☐	☐	☐
Engineering is an occupation that is respected by other people	☐	☐	☐	☐
My parent(s) want me to be an engineer	☐	☐	☐	☐
An engineering degree will guarantee me a job when I graduate	☐	☐	☐	☐
Engineers are creative problem solvers	☐	☐	☐	☐
A faculty member, academic advisor, teaching assistant or other university affiliated person has encouraged and/or inspired me to study engineering	☐	☐	☐	☐
A non-university affiliated mentor has encouraged and/or inspired me to study engineering	☐	☐	☐	☐

8. Please indicate how strongly you disagree or agree with each of the statement:

	Disagree Strongly	Disagree	Agree	Agree Strongly
I prefer studying in a group to studying by myself	☐	☐	☐	☐
I prefer working as part of a team to working alone	☐	☐	☐	☐
I get along well with others in study situations	☐	☐	☐	☐
I am a collaborative person	☐	☐	☐	☐
Creative thinking is one of my strengths	☐	☐	☐	☐
I am familiar with what a practicing engineer does	☐	☐	☐	☐
I am skilled at solving problems that can have	☐	☐	☐	☐

multiple solutions				

9. Rate yourself on each of the following traits as compared to your classmates. We want the most accurate estimate of how you see yourself. (Mark one in each row.)

	Lowest 10%	Below Average	Average	Above Average	Highest 10%
Self confidence (social)	☐	☐	☐	☐	☐
Leadership ability	☐	☐	☐	☐	☐
Public speaking ability	☐	☐	☐	☐	☐
Math ability	☐	☐	☐	☐	☐
Science ability	☐	☐	☐	☐	☐
Computer skills	☐	☐	☐	☐	☐
Communication skills	☐	☐	☐	☐	☐
Ability to apply math and science principles in solving real world problems	☐	☐	☐	☐	☐
Business ability	☐	☐	☐	☐	☐
Ability to perform in teams	☐	☐	☐	☐	☐
Critical Thinking skills	☐	☐	☐	☐	☐

10. How important do you think each of the following skills and abilities is to becoming a successful engineer? (Mark one in each row.)

	Not Important	Somewhat Important	Very Important	Crucial
Self confidence (social)	☐	☐	☐	☐
Leadership ability	☐	☐	☐	☐
Public speaking ability	☐	☐	☐	☐
Math ability	☐	☐	☐	☐
Science ability	☐	☐	☐	☐
Computer skills	☐	☐	☐	☐
Communication skills	☐	☐	☐	☐
Ability to apply math and science principles in solving real world	☐	☐	☐	☐

problems				
Business ability	☐	☐	☐	☐
Ability to perform in teams	☐	☐	☐	☐

11. Please rate your satisfaction with this institution on each of the aspects of campus life listed below. If you do not have experience with this aspect, mark N/A.

	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied	N/A
Quality of instruction by faculty	☐	☐	☐	☐	☐
Quality of advising by faculty	☐	☐	☐	☐	☐
Availability of faculty	☐	☐	☐	☐	☐
Quality of instruction by teaching assistants	☐	☐	☐	☐	☐
Quality of advising by teaching assistants	☐	☐	☐	☐	☐
Availability of teaching assistants	☐	☐	☐	☐	☐

12. Please rate your satisfaction with each of the following at this institution. If you do not use the service or facility, mark N/A.

	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied	N/A
Computer facilities	☐	☐	☐	☐	☐
Libraries	☐	☐	☐	☐	☐
Classrooms	☐	☐	☐	☐	☐
Tutoring	☐	☐	☐	☐	☐
Academic advising	☐	☐	☐	☐	☐
Laboratories	☐	☐	☐	☐	☐

13. Since the beginning of the Fall term, how often have you taken courses which required your engagement in individual and/or group projects?

- ☐ Never
- ☐ Rarely
- ☐ Occasionally
- ☐ Frequently

14. Think about the engineering classes you have taken since the beginning of the Fall term (engineering, math, and science classes). Indicate how often you: (Mark N/A if you have not taken any engineering related classes.)

	Never	Rarely	Occasionally	Frequently	N/A
Came late to engineering class	☐	☐	☐	☐	☐
Skipped engineering class	☐	☐	☐	☐	☐
Turned in engineering assignments that did not reflect your best work	☐	☐	☐	☐	☐
Turned in engineering assignments late	☐	☐	☐	☐	☐
Thought engineering classes were boring	☐	☐	☐	☐	☐

15. Think about the liberal arts classes you have taken since the beginning of the Fall term (not engineering, math, or science classes). Indicate how often you: (Mark N/A if you have not taken any non-engineering related classes.)

	Never	Rarely	Occasionally	Frequently	N/A
Came late to liberal arts class	☐	☐	☐	☐	☐
Skipped liberal arts class	☐	☐	☐	☐	☐
Turned in liberal arts assignments that did not reflect your best work	☐	☐	☐	☐	☐
Turned in liberal arts assignments late	☐	☐	☐	☐	☐
Thought liberal arts classes were boring	☐	☐	☐	☐	☐

16. How often have you interacted with the following people since the beginning of the Fall term (e.g. by phone, e-mail, Instant Messenger, or in person)? (Mark

one for each item.)

	Never	1-2 times per Term	1-2 times per Month	Once per Week	2-3 times per Week	Daily
Faculty during class	☐	☐	☐	☐	☐	☐
Faculty during office hours	☐	☐	☐	☐	☐	☐
Faculty outside of class or office hours	☐	☐	☐	☐	☐	☐
Teaching Assistants during class	☐	☐	☐	☐	☐	☐
Teaching Assistants during office hours	☐	☐	☐	☐	☐	☐
Teaching Assistants outside of class or office hours	☐	☐	☐	☐	☐	☐

17. What portion of the courses you have taken since the beginning of the Fall term have been taught primarily by graduate students?

- ☐ None
- ☐ Very little
- ☐ Less than half
- ☐ About half
- ☐ More than half
- ☐ All or nearly all

18. Since the beginning of the Fall term, what portion of your classes used the following teaching methods?

	None	Very little	Less than half	About half	More than half	All or nearly all
Lectures	☐	☐	☐	☐	☐	☐
Individual Projects	☐	☐	☐	☐	☐	☐
Team Projects	☐	☐	☐	☐	☐	☐
Labs	☐	☐	☐	☐	☐	☐
Seminars	☐	☐	☐	☐	☐	☐

19. To what extent have your courses required your engagement in individual and/or group projects?

- ☐ Too Few
- ☐ Enough
- ☐ Too many

20. Some people are involved in non-engineering activities on or off campus, such as hobbies, civic or church organizations, campus publications, student government, social fraternity or sorority, sports, etc. How important is it for you to be involved in these kind of activities?

- ☐ Not Important
- ☐ Somewhat Important
- ☐ Very Important
- ☐ Essential

21. How often are you involved in the kinds of non-engineering activities described above?

- ☐ Never
- ☐ Rarely
- ☐ Occasionally
- ☐ Frequently

22. Thinking about your college experience since the beginning of the Fall term, please indicate how much pressure you are feeling related to the following:

	No Pressure	Reasonable Pressure	Extreme Pressure
Course load (amount of course material being covered)	☐	☐	☐
Course pace (the pace at which the course material is being covered)	☐	☐	☐
Balance between social and academic life	☐	☐	☐

23. How well are you meeting the workload demands of your coursework?

- ☐ I am meeting all of the demands easily
- ☐ I am meeting all of the demands, but it is hard work
- ☐ I am meeting most of the demands, but cannot meet some
- ☐ I can meet some of the demands, but cannot meet most
- ☐ I cannot meet any of the demands

24. How stressed do you feel in your coursework right now?

- ☐ No stress
- ☐ Some stress
- ☐ Reasonable stress
- ☐ Significant stress
- ☐ Extreme stress

25. Do you have any concern about your ability to finance your college education?

- ☐ None (I am confident that I will have sufficient funds)
- ☐ Some (but I probably will have sufficient funds)
- ☐ Major (not sure if I will have sufficient funds to complete college)

26. How do you meet your college expenses?

	None	Very little	Less than half	About half	More than half	All or nearly all
Self (income)	☐	☐	☐	☐	☐	☐
Self (savings)	☐	☐	☐	☐	☐	☐
Parents and family	☐	☐	☐	☐	☐	☐
Employer support	☐	☐	☐	☐	☐	☐
Scholarships and grants	☐	☐	☐	☐	☐	☐
Loans	☐	☐	☐	☐	☐	☐

27. Do you have family members who are practicing engineers?

- Yes
- No

28. Do you have close friends who are practicing engineers?

- Yes
- No

29. How much exposure have you had to a professional engineering environment as a visitor, intern, or employee?

- No exposure
- Limited exposure
- Moderate exposure
- Extensive exposure

30. About how many hours do you spend in a typical 7-day week doing each of the following?

	0	1-5	6-10	11-15	16-20	21-25	26-30	more than 30
Preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)								
Working for pay								
Participating in co-curricular activities (organizations, campus publications, student government, social fraternity or sorority, intercollegiate or intramural sports, etc.)								
Relaxing and socializing (watching TV, partying, exercising, etc.)								
Providing care for dependents living with you (parents, children, spouse,								

etc.)								
Commuting to class (driving, walking, etc.)	◻	◻	◻	◻	◻	◻	◻	◻

31. Please rate the overall quality of your collegiate experience so far:

- ◻ Very dissatisfied
- ◻ Dissatisfied
- ◻ Satisfied
- ◻ Very satisfied

32. What did you do this past summer that was particularly important to you?

33. Did your summer experience advance your interest in studying engineering?

- ◻ Yes
- ◻ No

34. Did you participate over the summer in any of the following? (Mark all that apply.)

- ☐ Engineering related internship/job
- ☐ Engineering related research
- ☐ Engineering related coursework
- ☐ N/A

35. In the space provided, list 5 terms you would use to describe “engineering”:

36. In the space provided, list 5 terms you would use to describe “design”:

37. In the space provided, list 5 activities you think engineers do at work.

38. Of the 20 items below, please put a check mark next to the five you think are MOST IMPORTANT for practicing engineers.

- ☐ Business knowledge
- ☐ Communication
- ☐ Conducting experiments
- ☐ Contemporary issues
- ☐ Creativity
- ☐ Data analysis
- ☐ Design
- ☐ Engineering analysis
- ☐ Engineering tools
- ☐ Ethics
- ☐ Global context
- ☐ Leadership
- ☐ Life-long learning
- ☐ Management skills
- ☐ Math
- ☐ Problem solving
- ☐ Professionalism
- ☐ Science
- ☐ Societal context

- ☐ Teamwork

39. Your sex:

- ☐ Female
- ☐ Male

40. Please indicate your ethnic background: (Mark all that apply)

- ☐ White/Caucasian
- ☐ African American/Black
- ☐ American Indian/Alaska Native
- ☐ Asian American/Asian
- ☐ Native Hawaiian/Pacific Islander
- ☐ Mexican American/Chicano
- ☐ Puerto Rican
- ☐ Other Latino
- ☐ Other

41. Citizenship status:

- ☐ U.S. Resident
- ☐ Permanent resident (Green card)
- ☐ Neither

42. Do any of your immediate family members hold an engineering degree? (Mark all that apply)

- ☐ No
- ☐ Yes, both parents
- ☐ Yes, father only
- ☐ Yes, mother only
- ☐ Yes, sibling(s)

43. What is the highest level of education that your mother completed? (Mark one box)

- ☐ Did not finish high school
- ☐ Graduated from high school
- ☐ Attended college but did not ocmplete degree
- ☐ Completed an Associate's degree (A.A., A.S., etc.)
- ☐ Completed a Bachelor's degree (B.A., B.S., etc.)
- ☐ Completed a Master's degree (M.A., M.S., etc.)
- ☐ Completed a Professional degree (J.D., M.D., etc.)
- ☐ Completed a Doctoral degree (Ph.D., Ed.D)

44. What is the highest level of education that your father completed? (Mark one box)

- ☐ Did not finish high school
- ☐ Graduated from high school
- ☐ Attended college but did not complete degree
- ☐ Completed an Associate's degree (A.A., A.S., etc.)
- ☐ Completed a Bachelor's degree (B.A., B.S., etc.)
- ☐ Completed a Master's degree (M.A., M.S., etc.)
- ☐ Completed a Professional degree (J.D., M.D., etc.)
- ☐ Completed a Doctoral degree (Ph.D., Ed.D)

45. What is your best estimate of your parents' total income last year? Consider income from all sources before taxes. (Mark one)

- ☐ Less than $10,000
- ☐ $10,000-14,999
- ☐ $15,000-19,999
- ☐ $20,000-24,999
- ☐ $25,000-29,999
- ☐ $30,000-39,999
- ☐ $40,000-49,999

- [ ] $50,000-59,999
- [ ] $60,000-74,999
- [ ] $75,000-99,999
- [ ] $100,000-149,999
- [ ] $150,000-199,999
- [ ] $200,000-249,999
- [ ] $250,000 or more

Academic Pathways Study Spring'06 Survey

Large Midwestern Public University (LMPub)

Please click the SUBMIT button only after you have completed the survey. For best viewing results, please maximize your browser window.

1. What is your expected year of graduation from college?

- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013 or later

2. Do you intend to complete a major in engineering?

- Definitely Not
- Probably Not
- Not Sure
- Probably Yes
- Definitely Yes

3. What do you intend to major in?

- Aerospace engineering & mechanics
- Astrophysics
- Bio-based products engineering
- Biomedical engineering
- Biosystems & agricultural engineering

- Chemical engineering
- Chemistry
- Civil engineering
- Computer engineering
- Computer science
- Electrical engineering
- Petroleum engineering
- Geological engineering
- Geology
- Geophysics
- Materials science & engineering
- Mathematics
- Mechanical engineering
- Physics
- Statistics
- Arts & humanities
- Education
- Social science
- Other non-engineering

4. If you intend to DOUBLE MAJOR, what is the second major you intend to complete? (Mark N/A if you do not intend to double major.)

- Aerospace engineering & mechanics
- Astrophysics
- Bio-based products engineering
- Biomedical engineering
- Biosystems & agricultural engineering
- Chemical engineering
- Chemistry
- Civil engineering
- Computer engineering
- Computer science
- Electrical engineering

- Petroleum engineering
- Geological engineering
- Geology
- Geophysics
- Materials science & engineering
- Mathematics
- Mechanical engineering
- Physics
- Statistics
- Arts & humanities
- Education
- Social science
- Other non-engineering

5. Do you intend to practice, conduct research in, or teach engineering for at least 3 years after graduation?

- Definitely Not
- Probably Not
- Not Sure
- Probably Yes
- Definitely Yes

6. If you are thinking of going to graduate school NOT IN ENGINEERING, please mark your most probable area of study. Otherwise, mark N/A.

- Business
- Education
- Medicine
- Law
- MA/Ph.D.
- Public Service
- Other
- N/A

7. We are interested in knowing why you are studying engineering now. Please indicate below the extent to which the following reasons apply to you:

	Not a Reason	Minimal Reason	Moderate Reason	Major Reason
Technology plays an important role in solving society's problems	☐	☐	☐	☐
Engineers make more money than most other professionals	☐	☐	☐	☐
My parent(s) would disapprove if I chose a major other than engineering	☐	☐	☐	☐
Engineers have contributed greatly to fixing problems in the world	☐	☐	☐	☐
Engineers are well paid	☐	☐	☐	☐
Engineering is an occupation that is respected by other people	☐	☐	☐	☐
My parent(s) want me to be an engineer	☐	☐	☐	☐
An engineering degree will guarantee me a job when I graduate	☐	☐	☐	☐
Engineers are creative problem solvers	☐	☐	☐	☐
A faculty member, academic advisor, teaching assistant or other university affiliated person has encouraged and/or inspired me to study engineering	☐	☐	☐	☐
A non-university affiliated mentor has encouraged and/or inspired me to study engineering	☐	☐	☐	☐

8. Please indicate how strongly you disagree or agree with each of the statements:

	Disagree Strongly	Disagree	Agree	Agree Strongly
I prefer studying in a group to studying by myself	☐	☐	☐	☐
I am a competitive person	☐	☐	☐	☐
I prefer working as part of a team to working alone	☐	☐	☐	☐
I get along well with others in study situations	☐	☐	☐	☐
I strive to get higher grades than my classmates	☐	☐	☐	☐

The educational institution I am attending promotes competitive work				
My instructors often remind students that they need to do better than other students to obtain high grades				
I have easy access to work spaces where I can participate in peer study/discussion sessions with my fellow students				
I am encouraged by my instructors to initiate or participate in peer study sessions with my fellow students				
I am a collaborative person				
The educational institution I am attending promotes collaborative work				

9. Please indicate how strongly you disagree or agree with each of the statements:

	Disagree Strongly	Disagree	Agree	Agree Strongly
Creative thinking is one of my strengths				
I am familiar with what a practicing engineer does				
I am skilled at solving problems that can have multiple solutions				

10. Rate yourself on each of the following traits as compared to your classmates. We want the most accurate estimate of how you see yourself. (Mark one in each row.)

	Lowest 10%	Below Average	Average	Above Average	Highest 10%
Self confidence (social)					
Leadership ability					
Public speaking ability					
Math ability					
Science ability					
Computer skills					
Communication skills					
Ability to apply math and science					

principles in solving real world problems					
Business ability	☐	☐	☐	☐	☐
Ability to perform in teams	☐	☐	☐	☐	☐
Critical Thinking skills	☐	☐	☐	☐	☐

11. How important do you think each of the following skills and abilities is to becoming a successful engineer? (Mark one in each row.)

	Not Important	Somewhat Important	Very Important	Crucial
Self confidence (social)	☐	☐	☐	☐
Leadership ability	☐	☐	☐	☐
Public speaking ability	☐	☐	☐	☐
Math ability	☐	☐	☐	☐
Science ability	☐	☐	☐	☐
Computer skills	☐	☐	☐	☐
Communication skills	☐	☐	☐	☐
Ability to apply math and science principles in solving real world problems	☐	☐	☐	☐
Business ability	☐	☐	☐	☐
Ability to perform in teams	☐	☐	☐	☐

12. Please rate your satisfaction with this institution on each of the aspects of campus life listed below. If you do not have experience with this aspect, mark N/A.

	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied	N/A
Quality of instruction by faculty	☐	☐	☐	☐	☐
Quality of advising by faculty	☐	☐	☐	☐	☐
Availability of faculty	☐	☐	☐	☐	☐
Quality of instruction by teaching assistants	☐	☐	☐	☐	☐
Quality of advising by teaching assistants	☐	☐	☐	☐	☐

Availability of teaching assistants	☐	☐	☐	☐	☐

13. Please rate your satisfaction with each of the following at this institution. If you do not use the service or facility, mark N/A.

	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied	N/A
Computer facilities	☐	☐	☐	☐	☐
Libraries	☐	☐	☐	☐	☐
Classrooms	☐	☐	☐	☐	☐
Tutoring	☐	☐	☐	☐	☐
Academic advising	☐	☐	☐	☐	☐
Laboratories	☐	☐	☐	☐	☐

14. Since the beginning of the Spring term, how often have you taken courses which required your engagement in individual and/or group projects?

- ☐ Never
- ☐ Rarely
- ☐ Occasionally
- ☐ Frequently

15. Think about the engineering classes you have taken since the beginning of the Spring term (engineering, math, and science classes). Indicate how often you: (Mark N/A if you have not taken any engineering related classes.)

	Never	Rarely	Occasionally	Frequently	N/A
Came late to engineering class	☐	☐	☐	☐	☐
Skipped engineering class	☐	☐	☐	☐	☐
Turned in engineering assignments that did not reflect your best work	☐	☐	☐	☐	☐
Turned in engineering assignments late	☐	☐	☐	☐	☐
Thought engineering classes	☐	☐	☐	☐	☐

were boring					

16. Think about the liberal arts classes you have taken since the beginning of the Spring term (not engineering, math, and science). Indicate how often you: (Mark N/A if you have not taken any non-engineering related classes.)

	Never	Rarely	Occasionally	Frequently	N/A
Came late to liberal arts class	☐	☐	☐	☐	☐
Skipped liberal arts class	☐	☐	☐	☐	☐
Turned in liberal arts assignments that did not reflect your best work	☐	☐	☐	☐	☐
Turned in liberal arts assignments late	☐	☐	☐	☐	☐
Thought liberal arts classes were boring	☐	☐	☐	☐	☐

17. How often have you interacted with the following people since the beginning of the Spring term (e.g. by phone, e-mail, Instant Messenger, or in person)? (Mark one for each item.)

	Never	1-2 times per Term	1-2 times per Month	Once per Week	2-3 times per Week	Daily
Faculty during class	☐	☐	☐	☐	☐	☐
Faculty during office hours	☐	☐	☐	☐	☐	☐
Faculty outside of class or office hours	☐	☐	☐	☐	☐	☐
Teaching Assistants during class	☐	☐	☐	☐	☐	☐
Teaching Assistants during office hours	☐	☐	☐	☐	☐	☐
Teaching Assistants outside of class or office hours	☐	☐	☐	☐	☐	☐

18. What portion of the courses you have taken since the beginning of the Spring term have been taught primarily by graduate students?

☐ None

- Very little
- Less than half
- About half
- More than half
- All or nearly all

19. Since the beginning of the Spring term, what portion of your classes have used the following teaching methods?

	None	Very little	Less than half	About half	More than half	All or nearly all
Lectures						
Individual Projects						
Team Projects						
Labs						
Seminars						

20. To what extent have your courses required your engagement in individual and/or group projects?

- Too Few
- Enough
- Too many

21. Some people are involved in non-engineering activities on or off campus, such as hobbies, civic or church organizations, campus publications, student government, social fraternity or sorority, sports, etc. How important is it for you to be involved in these kind of activities?

- Not Important
- Somewhat Important
- Very Important
- Essential

22. How often are you involved in the kinds of non-engineering activities described above?

- Never
- Rarely
- Occasionally
- Frequently

23. Thinking about your college experience since the beginning of the Spring term, please indicate how much pressure you are feeling related to the following:

	No Pressure	Reasonable Pressure	Extreme Pressure
Course load (amount of course material being covered)			
Course pace (the pace at which the course material is being covered)			
Balance between social and academic life			

24. How well are you meeting the workload demands of your coursework?

- I am meeting all of the demands easily
- I am meeting all of the demands, but it is hard work
- I am meeting most of the demands, but cannot meet some
- I can meet some of the demands, but cannot meet most
- I cannot meet any of the demands

25. How stressed do you feel in your coursework right now?

- No stress
- Some stress
- Reasonable stress
- Significant stress
- Extreme stress

26. Do you have any concerns about your ability to finance your college education?

- ☐ None (I am confident that I will have sufficient funds)
- ☐ Some (but I probably will have sufficient funds)
- ☐ Major (not sure if I will have sufficient funds to complete college)

27. How do you meet your college expenses?

	None	Very little	Less than half	About half	More than half	All or nearly all
Self (income)	☐	☐	☐	☐	☐	☐
Self (savings)	☐	☐	☐	☐	☐	☐
Parents and family	☐	☐	☐	☐	☐	☐
Employer support	☐	☐	☐	☐	☐	☐
Scholarships and grants	☐	☐	☐	☐	☐	☐
Loans	☐	☐	☐	☐	☐	☐

28. Do you have close friends who are practicing engineers?

- ☐ No
- ☐ Yes

29. Do you have family members who are practicing engineers?

- ☐ No
- ☐ Yes

30. How much exposure have you had to a professional engineering environment as a visitor, intern, or employee?

- ☐ No exposure
- ☐ Limited exposure
- ☐ Moderate exposure

- Extensive exposure

31. About how many hours do you spend in a typical 7-day week doing each of the following?

	0	1-5	6-10	11-15	16-20	21-25	26-30	more than 30
Preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)	☐	☐	☐	☐	☐	☐	☐	☐
Working for pay	☐	☐	☐	☐	☐	☐	☐	☐
Participating in co-curricular activities (organizations, campus publications, student government, social fraternity or sorority, intercollegiate or intramural sports, etc.)	☐	☐	☐	☐	☐	☐	☐	☐
Relaxing and socializing (watching TV, partying, exercising, etc.)	☐	☐	☐	☐	☐	☐	☐	☐
Providing care for dependents living with you (parents, children, spouse, etc.)	☐	☐	☐	☐	☐	☐	☐	☐
Commuting to class (driving, walking, etc.)	☐	☐	☐	☐	☐	☐	☐	☐

32. Please rate the overall quality of your collegiate experience so far:

- Very dissatisfied
- Dissatisfied
- Satisfied
- Very satisfied

33. Some students during their academic career have a specific experience that prompts them to doubt their decision to major in engineering. Have you had any such experiences?

- No

- [ ] Yes

34. If YES, please indicate the type(s) of reason(s) and/or experience(s) that prompted you to DOUBT your decision to major in engineering. Check all that apply.

- [ ] Assignment/test/exam grade in a math or science class
- [ ] Assignment/test/exam grade in an engineering-related class
- [ ] Workload-related experience
- [ ] Course material in a math or science class
- [ ] Course material in an engineering-related class
- [ ] Course instruction
- [ ] Interaction with peers (e.g. group project, in-class activities, etc.)
- [ ] Interaction with a faculty member or instructor
- [ ] N/A - I have not had any experiences that prompted me to doubt my decision to major in engineering.
- [ ] Other:

35. Please indicate the type(s) of reason(s) and/or experience(s) that prompted you to CONFIRM your decision to major in engineering. Check all that apply.

- [ ] Assignment/test/exam grade in a math or science class
- [ ] Assignment/test/exam grade in an engineering-related class
- [ ] Workload-related experience
- [ ] Course material in a math or science class
- [ ] Course material in an engineering-related class
- [ ] Course instruction
- [ ] Interaction with peers (e.g. group project, in-class activities, etc.)
- [ ] Interaction with a faculty member or instructor
- [ ] N/A - I have not had any experiences that prompted me to confirm my decision to major in engineering.
- [ ] Other:

36. Since coming to college, have you had any research experience(s)?

- No
- Yes, in engineering related areas
- Yes, in non-engineering related areas

37. Your sex:

- Male
- Female

38. Please indicate your ethnic background: (Mark all that apply)

- White/Caucasian
- African American/Black
- American Indian/Alaska Native
- Asian American/Asian
- Native Hawaiian/Pacific Islander
- Mexican American/Chicano
- Puerto Rican
- Other Latino
- Other

39. Citizenship Status:

- U.S. Resident
- Permanent Resident (Green Card)
- Neither

40. What was your average grade in high school? (Mark one)

- A or A+
- A-
- B+
- B

- B-
- C+
- C
- C-
- D

41. What is the highest level education that your mother completed? (Mark one)

- Did not finish high school
- Graduated from high school
- Attended college but did not complete degree
- Completed an Associate's degree (A.A., A.S., etc.)
- Completed a Bachelor's degree (B.A., B.S., etc.)
- Completed a Master's degree (M.A., M.S., etc.)
- Completed a Professional degree (J.D., M.D., etc.)
- Complete a Doctoral degree (Ph.D.)

42. What is the highest level education that your father completed? (Mark one)

- Did not finish high school
- Graduated from high school
- Attended college but did not complete degree
- Completed an Associate's degree (A.A., A.S., etc.)
- Completed a Bachelor's degree (B.A., B.S., etc.)
- Completed a Master's degree (M.A., M.S., etc.)
- Completed a Professional degree (J.D., M.D., etc.)
- Complete a Doctoral degree (Ph.D.)

43. What is your best estimate of your parents’ total income last year? Consider income from all sources before taxes. (Mark one)

- Less than $10,000
- $10,000-14,999

- $15,000-19,999
- $20,000-24,999
- $25,000-29,999
- $30,000-39,999
- $40,000-49,999
- $50,000-59,999
- $60,000-74,999
- $75,000-99,999
- $100,000-149,999
- $150,000-199,999
- $200,000-249,999
- $250,000 or more

44. How many years of college did you complete before you transferred to the LMPub?

- Not applicable - I did not transfer to LMPub.
- None
- One year completed
- Two years completed
- Three years completed
- Four years completed
- More than four years completed

45. What type of institution did you attend before you transferred to LMPub?

- Not applicable - I did not transfer to LMPub.
- 2-year college
- 4-year public college/university (other than LMPub)
- 4-year private college/university (e.g., other school names)
- Another LMPub campus
- Another college on the “Big City” campus of LMPub
- Other: ____

46. Do any of your immediate family members hold an engineering degree? (Mark all that apply)

- ☐ No
- ☐ Yes, both parents
- ☐ Yes, father only
- ☐ Yes, mother only
- ☐ Yes, siblings

47. Please rate the extent to which you agree that each of the following is a reason why you are currently majoring in or considering majoring in engineering:

	Strongly Disagree	Moderately Disagree	Disagree	Unsure	Agree	Moderately Agree	Strongly Agree
I think engineering is interesting	○	○	○	○	○	○	○
I am majoring in engineering for my own good	○	○	○	○	○	○	○
I am supposed to major in engineering	○	○	○	○	○	○	○
There may be good reasons to major in engineering, but personally, I don't see any	○	○	○	○	○	○	○
I think engineering is pleasant	○	○	○	○	○	○	○
I think engineering is good for	○	○	○	○	○	○	○

me							
Majoring in engineering is something that I have to do	◘	◘	◘	◘	◘	◘	◘
I am majoring in (considering majoring in) engineering, but I am not sure if it is worth it	◘	◘	◘	◘	◘	◘	◘
Majoring in engineering is fun	◘	◘	◘	◘	◘	◘	◘
It is my personal decision	◘	◘	◘	◘	◘	◘	◘
I don’t have any choice	◘	◘	◘	◘	◘	◘	◘
I don’t know. I don’t see what the activity brings me	◘	◘	◘	◘	◘	◘	◘
I feel good when I am doing engineering activities	◘	◘	◘	◘	◘	◘	◘
I believe engineering is important for me	◘	◘	◘	◘	◘	◘	◘
I feel that I have to do it	◘	◘	◘	◘	◘	◘	◘
I am doing it, but am not sure it is a good thing to pursue	◘	◘	◘	◘	◘	◘	◘

48. Of the twenty-three design activities below, please put a check mark next to the SIX MOST IMPORTANT.

- ☐ Abstracting
- ☐ Brainstorming
- ☐ Building
- ☐ Communicating
- ☐ Decomposing
- ☐ Evaluating
- ☐ Generating alternatives
- ☐ Goal Setting
- ☐ Identifying constraints
- ☐ Imagining
- ☐ Iterating
- ☐ Making decisions
- ☐ Making trade-offs
- ☐ Modeling
- ☐ Planning
- ☐ Prototyping
- ☐ Seeking information
- ☐ Sketching
- ☐ Synthesizing
- ☐ Testing
- ☐ Understanding the problem
- ☐ Using creativity
- ☐ Visualizing

49. Of the twenty-three design activities below, please put a check mark next to the SIX LEAST IMPORTANT.

- ☐ Abstracting
- ☐ Brainstorming
- ☐ Building
- ☐ Communicating

- ☐ Decomposing
- ☐ Evaluating
- ☐ Generating alternatives
- ☐ Goal Setting
- ☐ Identifying constraints
- ☐ Imagining
- ☐ Iterating
- ☐ Making decisions
- ☐ Making trade-offs
- ☐ Modeling
- ☐ Planning
- ☐ Prototyping
- ☐ Seeking information
- ☐ Sketching
- ☐ Synthesizing
- ☐ Testing
- ☐ Understanding the problem
- ☐ Using creativity
- ☐ Visualizing

50. For the following engineering design activities, please indicate your level of confidence. For example, if you have little or no confidence in your ability to model engineering solutions, then mark poor. If you are extremely confident in your ability, mark excellent.

	Poor	Fair	Good	Very Good	Excellent
Defining what the problem really is	○	○	○	○	○
Searching for and collecting information needed to solve the problem	○	○	○	○	○
Thinking up potential solutions to the problem	○	○	○	○	○
Detailing how to build the solution to the problem	○	○	○	○	○
Assessing and passing judgment on a possible or planned solution to the problem	○	○	○	○	○
Comparing and contrasting two solutions to the problem on a particular dimension such as cost	○	○	○	○	○

Selecting one idea or solution to the problem from among those considered					
Communicating elements of the design in sketches, diagrams, lists, and written or oral reports					

51. For the following engineering design activities, please indicate how often you engaged in the activity in your coursework in the current academic year.

	Never	1-2 times per term	1-2 times a month	Once a week	2-3 times a week	Daily
Defining what the problem really is						
Searching for and collecting information needed to solve the problem						
Thinking up potential solutions to the problem						
Detailing how to build the solution to the problem						
Assessing and passing judgment on a possible or planned solution to the problem						
Comparing and contrasting two solutions to the problem on a particular dimension such as cost						
Selecting one idea or solution to the problem from among those considered						
Communicating elements of the design in sketches, diagrams, lists, and written or oral reports						

52. For the following engineering design activities, please indicate how well you think your courses are preparing you to engage in the activity. For example, if you think they are not preparing you at all, then mark poor. If you think they are preparing you extremely well, then mark excellent.

	Poor	Fair	Well	Very well	Excellent
Defining what the problem really is					
Searching for and collecting information needed to solve the problem					

Thinking up potential solutions to the problem	☐	☐	☐	☐	☐
Detailing how to build the solution to the problem	☐	☐	☐	☐	☐
Assessing and passing judgment on a possible or planned solution to the problem	☐	☐	☐	☐	☐
Comparing and contrasting two solutions to the problem on a particular dimension such as cost	☐	☐	☐	☐	☐
Selecting one idea or solution to the problem from among those considered	☐	☐	☐	☐	☐
Communicating elements of the design in sketches, diagrams, lists, and written or oral reports	☐	☐	☐	☐	☐

53. From the following list, please put a check mark next to the FIVE kinds of information you would MOST LIKELY NEED as you work on a typical engineering problem.

- ☐ Problem scope and severity
- ☐ Specifications and requirements
- ☐ Legal, regulatory, and industry standards
- ☐ Risks and safety
- ☐ Available budget
- ☐ Project costs
- ☐ Materials
- ☐ Labor
- ☐ Maintenance
- ☐ Schedule and deadlines
- ☐ Project and team coordination
- ☐ User demographics and opinion
- ☐ User behavior
- ☐ Client who hired engineers
- ☐ Other stakeholders (non-user, non-client)
- ☐ Impact on natural environment
- ☐ Social and physical context
- ☐ Anticipated benefits
- ☐ Aesthetics
- ☐ State of the art in engineering and technology

54. From the following list, please put a check mark next to the FIVE kinds of information you would LEAST LIKELY NEED as you work on a typical engineering problem.

- ☐ Problem scope and severity
- ☐ Specifications and requirements
- ☐ Legal, regulatory, and industry standards
- ☐ Risks and safety
- ☐ Available budget
- ☐ Project costs
- ☐ Materials
- ☐ Labor
- ☐ Maintenance
- ☐ Schedule and deadlines
- ☐ Project and team coordination
- ☐ User demographics and opinion
- ☐ User behavior
- ☐ Client who hired engineers
- ☐ Other stakeholders (non-user, non-client)
- ☐ Impact on natural environment
- ☐ Social and physical context
- ☐ Anticipated benefits
- ☐ Aesthetics
- ☐ State of the art in engineering and technology

55. Please rank the following items in terms of how important you think they are to engineering problem-solving. For each of your answers, mark a rank between 1 and 6. A rank of "1" indicates the most important item and "6" indicates the least important item. Use each number only once.

	1	2	3	4	5	6
Economic context	☐	☐	☐	☐	☐	☐
Global context	☐	☐	☐	☐	☐	☐
Natural context	☐	☐	☐	☐	☐	☐
Societal context	☐	☐	☐	☐	☐	☐
Technological context	☐	☐	☐	☐	☐	☐

Political context

56. What is your expected grade point average this academic term?

- A or A+ (3.9-4.0)
- A- (3.5-3.8)
- B+ (3.2-3.4)
- B (2.9-3.1)
- B- (2.5-2.8)
- C+ (2.2-2.4)
- C (1.9-2.1)
- C- (1.5-1.8)
- D (less than 1.4)

57. What are your summer plans?

Academic Pathways Study of Engineering Education: Large Midwestern Public University
Focus Group Discussion Guide (April 5, 2007)

Introduction
Good evening, thanks for taking time to help us with this study.
My name is **[name of researcher]** and I am working for the **[name of department]**, along with engineering schools at **four other universities** around the country. We are studying the experiences of engineering students so we can find ways to improve the education process.

You were invited because, **obviously, you are engineering students** and we want to hear about **your experiences and your opinions** of your education programs.

There are **no right or wrong answers** and we expect you will have different points of view about and different experiences. Please feel free to tell us about your experiences **even if they are different** from others. And we want to hear negative as well as positive comments.

We are **tape recording** this session because we don't want to miss any comments. Be assured that all your **information is confidential** and no one will be identified in the final report. I have **consent forms** here, if you want.

The **name tents** are only for this discussion to help me remember your names and help you follow up on other peoples' comments. **If you agree or disagree,** please say so. **Don't feel like you have to talk to me** all the time, this is a discussion with you guys as the experts.

We want to **hear from each one** of you, so if you haven't said anything for awhile—I may call on you for your comments. If you are talking all the time, I may ask you to wait and let others talk. Feel free to **help yourself to the food** and drinks.

OK? Let's get started.

First, I'd like to know who you are, your **first name**, what is **your major**, your **hometown**, and how did you **end up choosing LMPub**.

Academic Pathways Study of Engineering Education: Large Midwestern Public University
Focus Group Discussion Guide (April 5, 2007)

Pre-discuss	Fill out demographics (graduation year, major)
00:00 – 00:05	Consent Process ▪ Hand out consent process forms and allow participants to read form
00:05 – 00:10	Background Information ▪ Overview and benefits of APS study
00:10 – 00:35	Motivation to study engineering ▪ Why did you choose to study engineering? (motivations) - Financial? - Family? - Societal benefit? ▪ Was anyone influential in your decision? Who? ▪ What previous exposure to and experience with engineering?
00:35 – 01:15	Knowledge and skills of engineering ▪ Describe engineering (five words) *write descriptions on post-it notes and group into categories on flip chart paper on wall* ▪ What do you think engineers do at work ("a day in the life" "real world")? ▪ What knowledge do you think engineers use in daily practice? - What knowledge is important for practice? - What do engineers need to know to practice? ▪ In what engineering-related knowledge and skills are you most confident yourself? - How confident are you in solving problems with multiple solutions? - How confident are you is your ability to apply math and science to solving real world problems? Experience with projects? -
01:15 – 01:30	Institutional experience (discuss satisfaction with facilities and faculty) ▪ Overall satisfaction with LMPub ▪ Satisfaction with [name of department] (facilities) ▪ Satisfaction with your interactions in classes ▪ Satisfaction with your interactions with faculty ▪ Satisfaction with your interactions with TAs ▪ Participation in non-engineering activities
01:30 – 01:50	Managing workload ▪ How do you feel about your course load? (*probe for* pressure, stress, motivation to continue) ▪ What is the value of your course content? (*probe for* relevance)

	· Discuss engagement/disengagement with coursework · Discuss participation in and value of extra-curricular activity · How do you balance social and academic demands?
01:50 – 2:00	Anything else I should know? Concluding comments? Thank you.

Appendix 5-A
Sample APPLES Response Report (day 2)

Orchard University Response Report - *SAMPLE*
Tuesday, February 12, 2008

Strata	*Target*	11 Feb 2:55pm	12 Feb 2:45 pm	13 Feb	14 Feb	15 Feb	Status
All	*140*	106	176				FULFILLED
Freshmen	*25*	13	24				
Sophomore	*25*	21	24				
Juniors	*25*	35	58				FULFILLED
Seniors	*25*	29	44				FULFILLED
Transfer students	*10*	9	9				
Non-persisters	*25*	7	9				
Male students	*70*	79	100				FULFILLED
Female students	*25*	28	50				FULFILLED
Ethnic minority students	*25*	8	16				
International students	*25*	20	26				FULFILLED
Part-time students	*10*	0	1				

NOTES:

- There were a relatively large number of graduate students who took the survey, please check recruitment methods if reminders are sent to the same lists.
- Non-persisters and ethnic minority student responses are lower than expected. You may want to consider implementing Plan B for these strata.

Appendix 5-B
APS Research Team
Cumulative; compiled December 2008

University of Washington

Robin Adams, PhD
Assistant Director, Research, Center for Engineering Learning and Teaching
(Continued APS involvement from Purdue University beginning August 2005)

Daniel Amos, PhD
Research Scientist

Cindy Atman, PhD
Professor, Industrial Engineering
CAEE PI

Sylvia Bach
Administrator, Center for Engineering Learning and Teaching

Shelley Balanko, PhD
Program Evaluator

Theresa Barker
Graduate Research Assistant, Industrial Engineering

Philip Bell, PhD
Associate Professor, Educational Psychology

Jim Borgford-Parnell, PhD
Assistant Director, Research, Center for Engineering Learning and Teaching

Laurie Collins, PhD
Program Evaluator

Lari Garrison
Graduate Research Assistant, Education

Partricia Gomez
Administrative Assistant

Lorenza Ibarrientos
Program Operations Specialist

Andrew Jocuns
Research Associate

Jana Jones
Graduate Research Assistant

Deborah Kilgore, PhD
Research Scientist

Jennifer Light, PhD
NAE Fellow

Angela Linse, PhD
Research Scientist

Tina Loucks-Jaret
Technical Communications Specialist

Dennis Lund
Assistant Director

Bayta Maring, PhD
Program Evaluator

Andrew Morozov
Graduate Research Assistant

Liz Moore, PhD
Program Evaluator

Quan Nguyen
Program Assistant

Kevin O’Connor, PhD
Postdoctoral Research Associate, Educational Psychology
(Continued APS involvement from Univ. of Rochester beginning August 2005)

Natalie Quilter
Assistant to CAEE Director (through July 2005)

Ed Rhone
Graduate Research Assistant

Portia Sabin, PhD
Postdoctoral Research Associate

Jason Saleem, PhD
Research Scientist

Tom Satwicz
Graduate Research Assistant

Katie Schatz
Graduate Research Assistant

Carmen Smith
Graduate Research Assistant

Reed Stevens, PhD
Associate Professor, Educational Psychology
CAEE co-PI

Heather Toomey Zimmerman
Graduate Research Assistant, Education

Jennifer Turns, PhD
Associate Professor, Technical Communication

Ken Yasuhara
Graduate Research Assistant, Computer Science and Engineering

Colorado School of Mines

Ravel Ammerman, PhD
Lecturer, Electrical Engineering

Kimberley Breaux
Research Associate

Monica Geist
Graduate Research Assistant (U. Northern Colorado)

Tawni Hoeglund, PhD
Research Associate

Heidi Loshbaugh, PhD
Postdoctoral Research Associate, Liberal Arts and International Studies

Ronald Miller, PhD
Professor, Chemical Engineering

Barbara Olds, PhD
Office of Academic Affairs and Division of Liberal Arts and International Studies

Ruth Streveler, PhD
Director, Center for Engineering Education
CAEE co-PI
(Continued APS involvement from Purdue University after August 2006)

Candace Sulzbach, PhD
Lecturer, Civil Engineering

Howard University

Caryn Bailey, PhD
Research Scientist

Wade Boykin, PhD
Professor, Psychology

Karen Bland, PhD
Research Associate

Angela Cole, PhD
Assistant Professor, Psychology

Kimarie Engerman, PhD
Research Associate, Psychology
(Continued APS involvement from University of the Virgin Islands after August 2006)

Lorraine Fleming, PhD
Professor, Civil Engineering
CAEE co-PI

Ashley Griffin
Graduate Research Assistant, Psychology

Marcus Jones
Graduate Research Assistant

Sislena Ledbetter
Research Associate

Janice McCain
Research Associate

David Mitchell
Graduate Research Assistant

Rashika Rentie
Graduate Research Assistant

Andrene Taylor
Graduate Research Assistant

Dawn Williams, PhD
Assistant Professor, Educational Administration and Policy

Stanford University

Jeff Aldrich
IT Consultant

Tori Bailey
Graduate Research Assistant, Mechanical Engineering

Helen Chen, PhD
Research Associate, Center for Innovations in Learning

Mia Clark
Technical Writer

Laura Crenwelge
Graduate Research Assistant

Krista Donaldson, PhD
Research Scientist

Özgür Eris, PhD
Research Associate, Center for Design Research, Mechanical Engineering
(Continued APS involvement from Franklin W. Olin College beginning August 2005)

John Feland
Graduate Research Assistant

Kristyn Jackson
Graduate Research Assistant

Larry Leifer, PhD
Professor, Mechanical Engineering Design, School of Engineering
CAEE co-PI

Gary Lichtenstein, EdD
Consultant

Sheri Sheppard, PhD
Professor, Mechanical Engineering Design, School of Engineering
CAEE co-PI

George Toye, PhD
Stanford Center for Design Research

University of Minnesota

Karl Smith, PhD
Professor, Civil Engineering, Institute of Technology
co-PI, Campus PI
(Continued APS involvement from Purdue University (split appointment) after June 2006)

Russ Korte
Graduate Research Assistant
(Continued APS involvement from University of Texas at Tyler and University of Illinois after August 2007)

Purdue University

Holly Matusovich
Graduate Research Assistant

Aidsa Santiago
Graduate Research Assistant

University of Rochester

Lisa Perhamus
Graduate Research Assistant

Derek Seward
Graduate Research Assistant

Debbie Chachra, PhD
Research Associate, Center for Design Research, Mechanical Engineering
Franklin W. Olin College

University of Wisconsin

Susan Millar, PhD
Senior Research Advisor

Undergraduate Research Assistants

Lakshmi Akella (UW)
Pydi Akella (UW)
Lisa Asari (SU)
Elisa Bovos (CSM)
Audrey Brown (SU)
Kaitlyn Chen (UW)
Brittany Claar (CSM)
Tyler Cummings-Bond (UW)
Jeremy Donato (UW)
Collin Donohoue (CSM)
Joe Douglas (UW)
Angela Du (UW)
Lisel Forbes (HU)
Jonathan Gabrio (SU)
Beza Getahun (UW)
Sandria Gray (HU)
Johanna Hayenga (UW)
John Haynes (CSM)
Rachel Hsu (SU)
Laura Julich (UW)
Marvin Kendall (HU)
Angela King (UW)
Marvin Kendall (HU)
Bradley Knapp (CSM)
Alex Kwan (SU)
Shante Mason (HU)
Rukaya Mehter (UW)
Emily Milian (CSM)
Aprill Nelson (CSM)
Debbie Park (SU)
Jennifer Rees (UW)
Charlene Reyes (UW)
Claire Rosenbaum (SU)
Brook Sattler (UW)
Chloe Valencia (UW)
Esenia Valente (CSM)
Lamar Warren (HU)
Jesse Whitney-Blane (CSM)
Atrice Williams (HU)
Mary Williams (UW)