

AC 2009-886: THE ONLINE SURVEY: AN EFFICIENT AND EFFECTIVE MEANS OF ENGINEERING GRADUATE STUDENT ASSESSMENT

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The Online Survey: An Efficient and Effective Means of Engineering Graduate Student Assessment

Abstract

A survey is a potent tool for assessing student needs and concerns to improve an engineering graduate program as demonstrated by recent, documented survey studies conducted in an environmental engineering graduate program. We extended the work done in prior studies employing paper surveys by conducting an online student assessment for the first time in the program history. With regard to survey design and analysis methods, we mostly adopted the methods established in the prior studies.

The online format was adopted primarily to increase the accessibility of the survey to students in our graduate program. Other benefits of the online format include a more efficient distribution process and an increased ability to preserve confidentiality in comparison to the paper format. The online format also allowed us to compile and analyze data with greater ease. In addition, conducting the online survey was cost-effective. The use of the survey online client required only a minimal cost and eliminated the relatively large stationery costs associated with paper surveys. Along with recognizing the advantages, we had to navigate potential obstacles associated with online surveying, such as ensuring that a respondent is able to complete the survey only once with uncompromised confidentiality and achieving a high response rate with limited personal interaction.

The survey was received well by students, achieving a high response rate (>72%) and garnering positive student feedback. Academic concerns perceived by students in the program with regard to a seminar course in our program, graduate coursework, and student-advisor relationships were identified and presented to the faculty. Some of the areas of discontent identified were the limited number of graduate classes offered in the program and the specificity of the seminar course directed only towards a small portion of the student population. In most cases, we believe that the online survey provided more accurate data than did the previous paper surveys. However, in some cases, data such as those from student-advisor relationship questions appear to have been affected by biases also present in the paper surveys.

The online administration of the survey provided numerous advantages, suggesting that it is a more preferable surveying method over the paper survey and will likely be implemented in future program assessments. This study can act as a model for other programs looking for efficient and effective assessment of their academic needs and concerns. To that end, we discuss our online survey method, how we considered the advantages and potential drawbacks of online surveying, and the significance of our survey findings extensively in this paper.

Introduction

A survey is a potent tool for assessing student needs and concerns in an academic environment when its design, distribution, and data analysis are carried out effectively, as recent study has demonstrated¹. We aimed in this work to improve the distribution method employed in that study by using an online format rather than a paper format. In this paper, we describe in detail the

online survey method we implemented in our environmental engineering graduate program, the advantages and drawbacks of online surveying observed in our study, and the significant findings resulting from our study regarding both the effectiveness of our online survey method and the experiences of students in our program.

Distributing a survey using the Internet can be beneficial compared to distribution through traditional modes, like the paper survey, for several reasons². The online survey tool subscription is less costly than the sum of paper stationery and printing costs. Further, distribution requires less effort and time as handling and collection of surveys in person is eliminated. Since each student can access the Internet at their own convenience, there are no restrictions with respect to the time or location to reach students, in contrast to past studies in our program¹ that used fixed distribution and collection points. Additionally, online surveys allow geographically distant respondents to be reached, increasing the population available to be surveyed. This is important in graduate programs where it is not uncommon for students to leave for days or weeks to go to conferences or perform research in the field or distant laboratories and hence, making it difficult to reach out to these students if survey distribution were done in the traditional way. An online survey provides an opportunity for students to complete the survey while they are absent from school. Finally, human data entry errors that may occur in the data processing of paper surveys are minimized using computer-based surveys, as these tasks can be performed by the online survey tool.

Another benefit of online assessments is the perceived feeling of improved anonymity compared to paper surveys. In the latter, students may feel that their handwritten responses, particularly in small populations, might reveal their particular identities because of their unique handwriting styles, or that personal interaction in handing in the completed survey may connect them with their individual surveys. An online survey solves both of these issues since respondents are not contacted through personal interaction for delivery or for collection, and responses are recorded through electronic media with standard fonts.

In addition to the advantages noted above, the online distribution approach has inherent benefits in survey design. Currently available online survey software is user-friendly and compatible with almost all operating systems. So, the designer can easily create attractive, professional-looking surveys that are easy to complete and that, in turn, would encourage students to complete a given survey more enthusiastically. Supporting this notion, some studies show that even with no difference in the number of closed-ended responses, online surveys were found to generate more and longer open-ended responses^{3,4}.

Despite these advantageous features, some drawbacks in using online surveys have also been noted in the literature. While online survey software continue to improve their levels of service and flexibility, different clients have different levels of user-friendliness. Hence, choosing a right online client is an important step in successful online assessment. Another argument against online surveys is that the results may be biased given that only those in the population with access to the Internet would have the opportunity to complete them⁵. However, as more and more people are acquiring Internet access, online surveys are improving in the ability to reach greater numbers of people. Engineering graduate students in particular have virtually unlimited access to computers and the Internet. Further, studies carried out to compare effects of the online

and paper modes of distribution on response rates have produced contrasting results, implying that response rates obtained with Internet surveys will depend on the demographics of the target audience with respect to Internet availability and usage³.

The graduate program at the center of this study was comprised of approximately 60 on-campus students pursuing either masters or doctoral degrees. There exists a diversity of backgrounds for graduate students in terms of undergraduate majors, year of study, country of origin, current program of study, previous graduate study experience, and other factors. Given such diversity of students in the program, student academic needs are expected to be equally diverse; thus, it is important to survey the student body on an ongoing basis in order to ensure that these needs are met and educational concerns are addressed.

Such program surveys have been implemented annually since 2004 but hitherto those surveys were administered as paper surveys rather than online ones. In the 2007-2008 academic year, an online format was adopted for the first time. An online survey client was used to design the layout and to collect responses. The online format was chosen primarily to increase the accessibility of the survey to students in the graduate program. To elaborate, it is increasingly more convenient to communicate with students electronically. Given the migration of much communication in academia to the virtual realm and high comfort and competence level of students with this form of media³, we found that it was more appropriate to administer the survey online. The online survey is in wide use for many other types of studies that take place on our campus and as a result, students are accustomed to this format of information collection. Further, some students in the program have offices and labs in buildings on campus separated by relatively large distances, and many students do not have offices at all, making personal delivery of paper surveys as done in those past studies¹ more challenging and potentially exclusionary. Although some prior studies have suggested that paper surveys can actually increase accessibility⁶, we believed that, in our case, an online administration would increase survey accessibility based on graduate engineering students being the target population. Considering all of these factors, it was expected that the survey would be well received if it was administered in an online format. This paper describes in detail the successful employment of the online survey in addressing student concerns in our engineering graduate program.

Survey Design

Design Objectives

Survey design objectives that we considered important to ensure accurate results in this study were (1) identifying prominent student concerns, (2) designing questions that are specific enough to adequately collect information on these concerns, (3) reducing biases arising from question design, and (4) ensuring uncompromised confidentiality of respondents.

A committee of eight students was formed for the purpose of designing and administering the survey. With the aim of gathering as many student perspectives as possible, the committee was comprised of a diverse group in terms of year of study, research group, native country and language. We identified areas of potential concerns within our program by collecting verbal feedback from students. The survey was targeted for students of the program who were

registered for the semester on the Atlanta campus since the topics of the survey pertained to specific concerns faced by Atlanta-campus students only.

Question Design

Questions were designed largely in the same manners as they were in the survey conducted in our program in 2006¹. Question design is outlined in detail in that study, but it is summarized below with applications to this study.

Background Questions. For analysis purposes, several questions were included which provided background information on the respondent. Only information deemed relevant for the analysis of the results was requested and responses to these questions were not mandatory for completion of the rest of the survey. Questions 1 through 8 are background questions and request information such as year of study, M.S. or Ph.D. student, and membership on the survey committee. The full text of the survey can be found in Appendix A.

Control Questions. Several control questions were included in the survey in order to determine if survey participants were eligible to answer certain questions in the survey. For example, question 12 asks about a student's frequency of attendance in the seminar course. This information is useful for assessing how well a student would be able to answer question 13, which asks about the helpfulness of the course.

Question Quality Assurance. The inclusion and phrasing of questions underwent several reviews both internally within the committee and externally by objective reviewers before taking their final form. The input of faculty in the program was sought, in addition to that of the school's Office of Assessment Coordinator of Survey Research, who specializes in survey design. Only after all comments had been considered was the survey finalized.

Answer Formats. Several answer formats were used throughout the survey. These formats include multiple choice, five-point temporal scale, five-point rating scales, open-ended short-answer, and open-ended extended-answer. The type of answer format used was determined on a case-by-case basis with a closed-ended format used when possible and open-ended questions used either to supplement a closed-ended question or to provide information unable to be captured by a closed-ended question. These answer formats were used in the prior survey and are described in detail by Rogers et al¹.

Online Survey Format

Figure 1 shows a section of the survey as it appeared online as a representative sample of the complete survey. Upon beginning the survey, respondents were taken to a webpage which served as an introduction. It listed the purpose and need of the survey as well as a brief description of the organization carrying out the survey. The second paragraph assured the respondent of the confidentiality of responses in an effort to alleviate privacy concerns. The approximate time required to complete the survey (calculated through pilot studies) was also provided to give respondents a sense of the time commitment necessary. Finally, respondents were provided with

appropriate contact information (e-mails as well as phone numbers) in case they had any questions about the survey itself or their role as participants.

Each additional webpage of the survey contained questions on a single topic. This organization was adopted in recognition of past literature supporting surveys presented in manageable sections⁷. Providing further clarity to the respondent, a progress bar was featured on the top of each page indicating the percentage of the survey that had been completed.

The survey was divided into five sections from A to E. Section A contained the background questions discussed above. Sections B, C, and D contained questions relating to perceived academic concerns in the program. Section B was designed to address the level of student satisfaction regarding a mandatory research seminar course in the program. Section C collected feedback on the quality of graduate coursework in the program. Section D addressed concerns regarding to student-advisor relationships. To aid in the design of future surveys, the final set of questions, section E, asked respondents to evaluate the quality of the survey itself. Section B through E had open-ended questions asking for respondents' comments and suggestions. These questions were placed at the end of the section in order to supplement the responses provided for each section.

AEES DAEC: 4th Annual GT-EnvE Graduate Student Survey [Exit this survey >>](#)

3. CEE 8094 Fall Seminar

50%

The following set of questions assesses your views on the CEE 8094, 'Environmental Engineering Seminar' course offered in the FALL semester

1. Have you always registered for CEE 8094 EnvE seminar, when it has been available, during your tenure at GT-EnvE?

YES

NO

2. If "NO", please provide the reason(s) for not registering for the seminar (check all that apply):

Did not want to attend

Forgot to register

Schedule conflict

Off-campus at the time

Request of the advisor

Other (please specify)

3. Did you register for CEE 8094 EnvE seminar course for the Fall 2007 semester?

Figure 1. A snapshot of the administered online survey.

Sensitivity and Confidentiality Considerations

Given the relatively small student population, it was imperative to take steps to address sensitivity concerns, in order to minimize potential bias, which was shown to be important in the previous survey analysis¹. To that end, questions were phrased so as not to request identifying information about the respondent. An example of this is seen in Section D, student-advisor relationships, which was the most sensitive section of the survey. This section asked only about general advisor characteristics and did not ask the respondent to name their advisor specifically. The background and control questions discussed above enabled the committee to detect possible biases resulting from any of those sensitive questions. For example, membership on the

committee could create a bias in survey response, so the question asking about membership could be used to separate responses into member and non-member subgroups for a given question so that the sensitivity analysis described in detail in the past study¹ could be performed in order to determine if committee members answered the particular question differently than non-members at a significant level.

Distribution

The survey was administered during a two-week period in February 2008. A time period in the beginning of the semester was chosen in order to minimize biases related to stress during the academic year, as was suggested previously¹. The target population was restricted to students in the program registered for the Fall 2007 academic semester. New students entering the program in Spring 2008 were intentionally excluded given their only limited exposure to academic affairs and functionality in the program.

The survey was distributed to students electronically via an online client, SurveyMonkey (<http://www.SurveyMonkey.com>)⁹. While there are several options in terms of online survey design tools, SurveyMonkey was chosen due to its popularity, trustworthiness, and ease of use. The program has been utilized by other on-campus departments for surveying the general student population. Further, SurveyMonkey has been used by 80% of Fortune 100 companies⁸; and thus, was considered a professional option.

While a cost-free version of the online client was available, this version was limited in terms of allowable survey length and maximum number of responses. To overcome these restrictions, the committee purchased a professional-level account with SurveyMonkey for a nominal fee of \$19.95/month. Considering that one month of the upgraded service was sufficient to conduct the survey and weighing this against the time and monetary costs associated with the administration of paper surveys in the past¹, it was determined that the use of the online client was the economically favorable option because it eliminated stationary costs in addition to the time consumption involved in personal distribution and data processing.

The online client offered several options in terms of distribution procedure and response collection. The mode of distribution could be in the form of an e-mail link or a website popup. Under the e-mail link option, a single web link could be utilized by all survey respondents, or e-mail addresses could be uploaded to the site in order to provide a unique link for each e-mail address provided. The latter option was chosen to ensure that only students in the target population had access to the survey. The unique e-mail link option also provided that each student would complete the survey once since each survey link could be used for only a single response to the survey. Settings were chosen such that respondents could go back to previous pages in the survey and update existing responses until the survey was finished, after which the respondent was not able to access the survey. When responses are collected, the client is able to record the IP address associated with each response; however, this feature was disabled to preserve the anonymity of individual respondents. As a result, committee members could view each response to the survey but the responses were not linked to individual respondents.

While the paper survey distribution process had personal interaction built-in with surveys being hand delivered to each student, the electronic distribution itself lacks this feature. In order to prevent this factor from inhibiting response rates, several steps were taken to ensure personal interaction and encouragement of students to participate in the survey. Multiple emails were sent to the student mailing list serve at strategic times during the survey period. The first email served as an introduction to the survey process and alerted students to expect a forthcoming email containing the survey link. The full text of this email can be found in Appendix B.

Specifically, this first message outlined the following points:

- The purpose and objectives of the survey
- The importance of a student's contribution towards improvement of the program
- The process of accessing and completing the survey
- The estimated time requirement for completion
- The deadline for completion
- Assurance of confidentiality of responses

Approximately 24 hours after the introductory email was sent, a subsequent email was sent that contained a link directing students to the survey. Students were initially allotted the next 15 days to complete the survey. During this time, committee members were encouraged to interact with students in the program, especially within their own research groups, in order to increase awareness about completing the survey. Approximately one week into the surveying period, a reminder message was sent out by the president of the student organization that conducted the survey. Since the president is a relatively public figure within the program, it was thought that support of the survey effort by this student leader would provide additional motivation for students to complete it. As a final effort to maximize response rate, an additional e-mail was sent via SurveyMonkey three days prior to the deadline. SurveyMonkey is able to differentiate the e-mail addresses for population subjects who have completed the survey and those who have not. This advantageous feature was utilized to send the final reminder e-mail to only those e-mail addresses associated with students who had not yet completed the survey. While a generic reminder e-mail was the default setting in the program, the text of this message was edited to explain the need for participation in our survey in particular. The program also allowed specification of the "From" field. This option was set such that the e-mail would appear to come from the committee chairperson's e-mail address. Moreover, the recipient would see only their email address in the "To" field, further personalizing the reminder message.

Although the original deadline for completing of the survey was 15 days after it was made available, the end date was extended an additional 5 days in order to ensure that time constraint was not a factor in response rate. Students were informed through email of this change a week prior to the extended deadline. After this date had passed, the web links provided in the e-mail were disabled, restricting any further survey responses.

Analysis

We used statistical analytical methods similar to those used by Rogers et al¹. For the convenience of the reader, analytical methods are presented here in brief.

Results obtained were analyzed quantitatively with the help of Microsoft Excel™'s analytical toolbox. A textbook authored by DeVore et al.⁹ provided useful guidance for calculating statistical variables and interpreting survey results. Survey questions were divided into three major groups for analysis purposes: informative questions where the feedback provides the background information of respondents (e.g., year of study), closed-questions asking respondents for feedback about academic attributes, and open-ended questions where respondents usually expressed their comments or offered some suggestions. For the first two groups of questions, univariate (UVA) and multivariate (MVA) analysis were employed, while comments and suggestions of respondents were recorded without any further analysis for the third group.

Univariate Analysis

Univariate analysis is the process of describing the sample by examining and summarizing the distribution of each individual variable. All answers for the first two groups of questions mentioned above were treated as independent variables for UVA. For the first group of questions, only numbers and percentages of respondents were reported for each question. For the second group of questions, UVA was carried out to know the central tendency of a sample or most common values for a variable, the variability of response for a variable, and the shape of the overall distribution. Mean, mode and median were used to quantify central tendency. Standard error, standard deviation, range, and sample variance were calculated to quantify variability; while kurtosis and skewness were calculated and histograms were constructed to understand the shape of the overall distribution.

Multivariate Analysis

Multivariate analysis assesses the possibility of a relationship between two or more variables. For this survey we employed MVA primarily to relate responses for a given question to respondent background data (from responses to questions in Section A). Questions suspected of having varied responses according to particular student subgroups (e.g. perceived effectiveness of research seminar among students in different years of the graduate program) were analyzed with MVA. The MVA tools utilized were t-tests, linear regression and tabularizations with chi-square analysis. Using a recommendation provided by literature⁹, the threshold p -value for our study was 0.05.

Results and Discussion

Our survey was received well, garnering a high response rate and positive student feedback. The online surveying was effective and efficient for achieving accurate demographic/characteristic representativeness, for reducing biases, and for conducting meaningful statistical analysis. The following sections discuss significant findings and evaluate the effectiveness of online survey methodology by comparing the results of the paper survey conducted in 2006¹.

Survey Response

The domain of respondents was identified based on the list of students registered in the program at the start of the academic year, as stated previously. The program had 64 registered students at

that time. However, only 61 students were identified as the subject of this survey since the other 3 students were located on a different campus of the program, and for these students some of the sections in the survey were not relevant.

Overall, we achieved feedback from 44 students in the program, which constitutes a 72% response rate. The survey was conducted in the Spring semester of the academic year and a number of students had graduated before the start of it, and hence, may not have thought the survey applied to them. We estimated the number of respondents on campus at the time of the survey was 51. Since the personal interaction with graduated students was limited, the probability of them completing the survey was minimal. This leads us to believe that the observed response rate may have been higher had these graduated students been removed from the target population. However, due to the anonymous nature of responses, we were unable to identify the number of responses from graduated students. Thus, we report the observed rate as 72%.

Background of Survey Participants

Figure 2 summarizes the key background information for the 44 respondents with respect to the year of study, degree program and undergraduate major found from responses to questions in Section A.

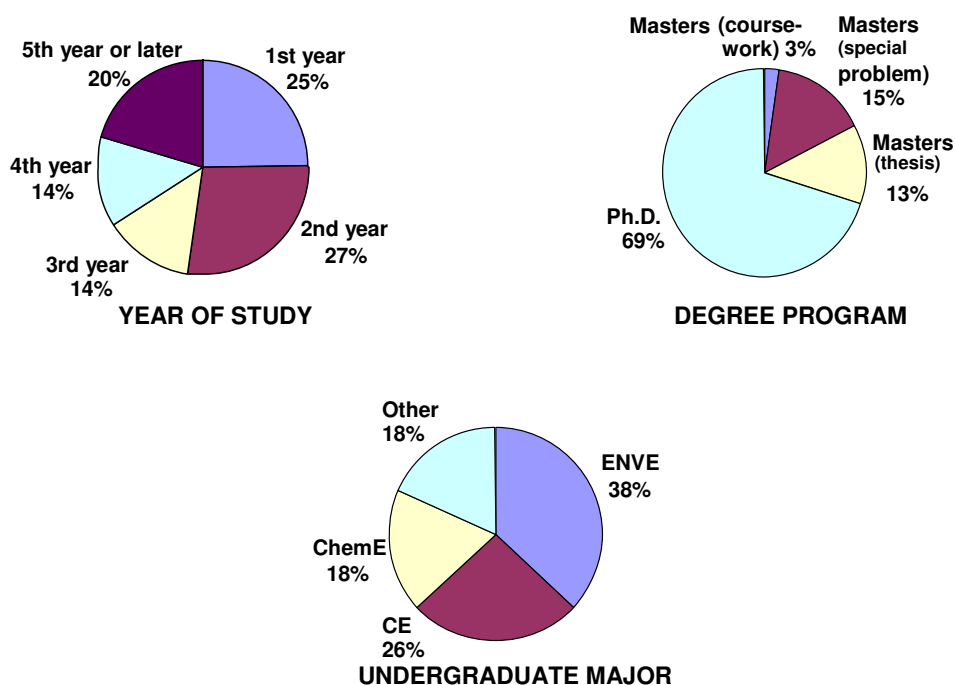


Figure 2. Demographic profile of survey respondents.

These data demonstrate that major student subgroups in our program were well represented in the survey. Numbers of respondents were approximately equally divided among different years of study with slight skewness towards the first and second years due to the numbers of masters' students that constitute those year-of-study subgroups. Responses also illustrated variation in

undergraduate majors among survey respondents with environmental engineering as the most common undergraduate major. From the responses to questions 5 and 6, approximately half the respondents already had a graduate degree from our institution or another institution. Question 7 asked respondents to choose from a list of extracurricular activities they took part in before starting their current degree program. More than 90% of respondents had some form of research or industrial experience before starting their current graduate program. Eight students (18% of the respondents) acknowledged participation in the committee responsible for survey design, and 36 students indicated that they had not been members of the committee. These numbers appear accurate as the committee had 8 members.

Significant Findings

A. Program Seminar Course. The majority of students acknowledged registering for the mandatory seminar course when it was available as indicated by responses to question 9. However, there was a significant portion of respondents who skipped the seminar registration either intentionally or due to schedule conflicts with other classes, forgetfulness, or being off-campus. Approximately three out of four respondents said they registered for the Fall 2007 seminar course and the majority of those respondents attended the seminar always or often. Responses to question 13 revealed significant concerns regarding the seminar course's effectiveness in helping students in their research, in improving student oral presentation skills and in improving critical thinking skills. There was a difference between student subgroups recognized in these responses by conducting MVA. Overall, first-year students thought the seminar course was more helpful in improving the above skills mentioned than the rest of the students. The majority of respondents were also unsatisfied with the effectiveness of the seminar course in helping them interact with faculty and other students of the program, according to data for question 13. This was alarming since improved interaction was one of the reasons the seminar course was made mandatory in the program¹⁰. When asked if the seminar course was interesting through question 14, the majority of respondents found it interesting only sometimes or rarely. It was then not surprising to see a majority of respondents not wanting a mandatory registration of the seminar course for every student, instead preferring to keep it mandatory only for the first year students in the program (question 18). Questions 19 and 20 asked respondents for their suggestions and comments on improving the seminar course. There were 17 suggestions and 13 comments recorded. Suggestions ranged from asking the participation of the entire faculty in the seminar course, making the seminar topics more diverse and less detailed, to including discussion of current relevant topics in the field and inclusion of alumni talks in the seminar about their career experiences.

B. Graduate Coursework. Survey questions 21 to 30 were formulated to address student concerns about graduate coursework in the program. Question 21 was aimed at determining factors motivating students' decisions to register for courses. Relevance to the PhD comprehensive examination and applicability to research and job prospects were the significant factors influencing students to choose a particular class. Also the advisor's recommendation and core course requirements to obtain a degree played a significant role in students' decisions to register for classes, while the particular faculty member teaching the course and the course description on the institution's official course information website did not play a significant part in students' choices of classes. In addition, difficulty of courses, personal interest and need for

financial assistance were other factors for choosing particular classes identified through an open-ended follow-up question. Questions 23 and 24 asked respondents about their initial preparedness and the contribution of classes in developing research and communication skills, respectively. These questions were of much significance since by comparing responses for these two sets side by side, one can estimate the contribution of coursework in developing certain skills in the student population. For example, graduate coursework in the program seemed to have helped students in understanding fundamental concepts in environmental engineering as was observed from significant difference in the confidence interval (from the UVA results) of initial preparedness and contribution of courses in that area. Conversely, for analyzing and interpreting data, for locating technical literature, for conducting experiments and for written and oral communication, the difference in confidence intervals was not significant. These are certainly important areas of concern as some of the above mentioned skills are part of the learning outcomes for graduate courses in our program's curriculum¹⁰.

Questions 26, 27 and 28 asked respondents about the quality of classes in the program curriculum and their satisfaction level with those classes. The majority of students were satisfied with the quality of classes offered in the program. However, a significant portion of respondents was unsatisfied with the number of classes offered in their research areas and suggested additional classes through the open-ended follow-up question. There were 14 suggestions recorded from respondents to improve the quality of graduate coursework, including courses geared towards solving practical problems and creating awareness about new and emerging technologies in the field as well as giving flexibility to students in choosing courses rather than requiring students to take a set of core courses.

C. Student – Advisor Relationships. Survey questions 31 to 40 were designed to address student concerns arising from their relationship with their advisors. In our program, all graduate students are assigned with one of the faculty as an advisor at the start of their graduate program if they did not choose on their own. Advisors play an important role in the overall academic experience of a student and, hence, it was thought that this area needed attention since there was a scarcity of data available on this topic from past surveys in the program. Questions included in this section covered a variety of subtopics in identifying concerns of academic advisement in our program. For example, respondents were asked about availability of their advisors, willingness of advisors to help them, their satisfaction level regarding guidance of advisors in course selection, in student career plans, and in research. The majority of students responded with favorable feedback to most of the questions regarding student-advisor relationship. However, we believe there might be a bias associated with the results in these questions and hence, care should be taken in interpreting these data. Detailed discussion of this bias is provided in a later section.

Evaluation of the Effectiveness of the Online Survey

A. Survey Response. The online survey response rate of 72 % compared favorably to the surveys conducted in the program since 2004, proving the effectiveness of the online assessment to reach participants. Personal interaction was one of the concerns raised in planning this online survey study since past surveys were paper-based and involved personal interaction with participants during survey distribution¹. The personal interaction we employed (described in survey design) proved to be an effective strategy as the response rate for online survey jumped significantly

following the day personal communication started between committee members and respondents.

In addition, reminder emails about survey completion and extending the survey deadline by five more days, played critical roles in increasing the survey response. This may be the result of the first e-mail getting overlooked amongst the daily workload for some respondents, with the second email providing a useful reminder. Thus, we believe that follow-up emails are essential for high response rates in online surveys.

The reasons for nonresponses from our student population varied from preoccupation due to nearing graduation to forgetfulness as confirmed through oral communication, but no indications of the online survey itself causing nonresponses surfaced. Hence, the authors do not believe the online assessment hinders respondents from completing the survey. In fact, the online survey client with features like reminder emails and the automatic identification of non-respondents could have conceivably enhanced the response rate for our online survey.

B. Background of Survey Participants. Comparing background responses from our online survey with the paper survey results of previous years¹, we found a very similar subgroup breakdown of the student population with slight variations arising from changes in the subject population due to graduation and incoming new students. Students enrolled in the Ph.D. program clearly outnumbered students enrolled in the masters program as was seen in the past paper survey¹ with similar percentage distribution. Similarly, environmental engineering was the most recorded undergraduate major of respondents followed by civil and chemical engineering as was the case for previous surveys. Distribution for year-of-study was also similar with the highest percentage of responses coming from second year students. Considering the above similarities, our online survey results were assumed to be valid for the program population as a whole and were believed to represent the true demographic distribution of our program.

C. Survey Confidentiality. Concerns regarding confidentiality were observed in the analysis of previous surveys conducted in the program. The paper survey method used in the past raised issues of handwriting recognition and the act of physically handing the completed survey to a person. As noted, this created a “perceived loss of privacy”¹ that potentially could have impacted survey results. The online format of the survey eliminated these issues, allowing the respondent to complete the survey anonymously online. We note again that though we allowed the online client to recognize the subjects not responding to the survey, we disabled the option provided by the client to tie any particular responses to participants through IP address as mentioned earlier, hence, better preserving confidentiality.

D. Survey Satisfaction. The survey concluded with a section asking respondents to evaluate the survey itself. The first three questions in this section were aimed to assess the effectiveness of the survey in addressing student questions on the prior three sections. All three questions received positive feedback suggesting that the survey was effective in addressing student concerns in these areas. The fourth question asked about the satisfaction level regarding the overall survey content. This question, too, received positive feedback, implying that the assessment effort was successful in addressing major concerns of students in the program. The survey concluded with two open-ended questions asking students to provide comments or

suggestions about the survey and asking them about additional issues that may need attention for future program assessments. Some of the future assessment topics suggested were evaluating first year student experience in the program, assessing communication between students and faculty, and probing program resources available to students. At least some of these concerns will be addressed in future program assessments.

Positive feedback for this section served as a surrogate measure for evaluating the success of our online methodology as none of the students voiced any concerns over the online aspect of the survey. Though comparisons can not be made with previous paper surveys due to lack of past data, we believe that the reason behind positive student feedback for this section might be related to an appropriate design of questions as well as an effective online assessment.

E. Biases Observed. The authors believe that conducting the survey online resulted in reduced biases due to the sense of confidentiality and security of responses associated with online assessment. However, one shortcoming observed for the current survey was the bias detected in responses to questions related to advisor-student relationships. Overall, questions in this category received exaggerated positive responses which were surprising since this was one of the three prominent areas of concerns identified verbally by many students. It is highly unlikely that there was a sudden change of opinion within the student population about their advisors. Thus, we suspect that there existed a bias associated with the sensitive nature of these questions.

The suspected bias was confirmed during an informal presentation of results for this section in front of several students of the program. Most students were perplexed to learn of such a positive feedback to questions regarding student-advisor relationship. Many admitted they were afraid to respond negatively for fear of their identity being revealed, and the resulting academic repercussions should their advisor learn of this information. In addition, this section reported the fewest responses to any of the open-ended questions than open-ended questions of other sections. In sum, we learned that the student-advisor relationship is a very sensitive topic and careful attention is needed for improving the assessment efforts in the future. In spite of this, the authors do not believe the potential bias was caused exclusively by the online assessment methodology. The previous paper-based survey¹ also reported the presence of similar bias for their responses. Further research is needed in this area to assess measures that can be taken to alleviate security concerns of respondents associated with their online response. For such sensitive questions, the authors recommend asking respondents to type responses online for avoiding fears related to hand-writing recognition associated with paper surveys, and to submit printouts of their responses for avoiding fears related to IP tracking associated with online surveys. This process may prove effective in eliminating the disadvantages of both methodologies.

Concluding Remarks

A student survey was administered online for the first time in the history of our environmental engineering graduate program. We deem this venture highly successful based on the high response rate and feedback received from students as well as from faculty of the program that praised the survey's professional look and its effectiveness due to the online administration. Not only did the online administration expedite the survey distribution, but it also saved valuable time in collection of data and compilation for quick statistical analysis. In addition, the survey

was more economical than traditional paper surveys by eliminating significant costs associated with stationery. Survey responses were successfully kept anonymous through the disabling of IP address recognition technology. This ensured more trust of respondents as fears associated with traditional paper surveys regarding identity revelation through factors such as handwriting recognition were minimized. Although repeated assurances were made during the distribution phase of the survey about enhanced confidentiality, there was potentially a bias associated with the section concerning student-advisor relationship which authors believe was the result of the sensitive nature of the topic and not because of the survey methodology.

This assessment also yielded some obvious concerns among students about the program seminar course. The failure of the seminar course to meet its goals in improving research skills, critical thinking, and increasing faculty-student interactions was identified. The survey also identified areas of concerns among graduate courses and gathered useful suggestions for improving the quality of graduate coursework in the program. These findings were presented to faculty and students in the program and were received very well. A number of program faculty members contacted the committee and encouraged continuation of such efforts in the future. In particular, the faculty member in charge of designing the seminar for the following year contacted one of the committee members in order to get recommendations on improving the seminar course based on survey results. We are pleased to report that this faculty member implemented those suggestions, and there were significant changes in the format of the seminar in the following academic year.

We believe, based on the observed results, this study can act as a model for future engineering program studies aiming to conduct efficient and effective assessment with an online survey.

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Appendix A.

Survey Instrument

Note: All questions from the survey are included below along with the contents of the front page of the online survey. However, the survey has been altered in physical appearance for the sake of brevity.

4th Annual GT-EnvE Graduate Student Survey

The Graduate Student Survey is administered on an annual basis by the Dialogue for Academic Excellence Committee (DAEC), a branch of the Association of Environmental Engineers and Scientists (AEES). The intent of this survey is to get feedback from current students on the quality of academic life in the Environmental Engineering department at Georgia Tech (GT-EnvE) and to help identify areas of satisfaction and areas that may need improvement.

The DAEC would like to ask for your complete and honest opinion on this survey. Your responses to this survey will not be associated with your academic record in any way. Your responses will remain confidential and no information associated with your name will ever be released. By completing the survey you are giving your consent to participate in this program evaluation.

Thank you for taking the time to complete this survey. The survey should take approximately 10 minutes to complete.

If you have any questions about this survey or the program evaluation, please contact Lokesh Padhye, AEES DAEC chair at 404-385-7089, or by email: lokesh.padhye@gatech.edu. If you have any questions about your rights or role as a participant in this project, please contact the Georgia Tech Institutional Review Board at 404-894-6942.

A. The following set of questions reviews your academic background information

(1) What is your current year-of-study?

1st year 2nd year 3rd year 4th year 5th year or later

(2) What is your current degree program at Georgia Tech (GT)?

Master's (coursework option) Master's (special research project option)
 Master's (thesis option) Ph.D.

(3) Is Environmental Engineering (EnvE) your major at GT?

YES NO (If "NO", please provide name of the department: _____)

(4) What was your undergraduate major?

(5) Did you already have a graduate degree from GT before starting your current program of study?

YES NO

(6) Did you already have a graduate degree from another institution before starting your current program of study?

YES NO

(7) Please indicate using the list below the activities outside of degree work in which you have participated before starting your current graduate program in GT-EnvE: (Check all that apply.)

Undergraduate Research Research Internship Design/Consulting work
 Research for Government or Military Entity Research at Private Firm
 Other(s) not listed above: _____, _____, _____
 None of the above

(8) Are you a member of Dialogue for Academic Excellence Committee (DAEC)?

YES NO

B. The following set of questions assesses your views on the CEE 8094, 'Environmental Engineering Seminar' course offered in the Fall semester

(9) Have you always registered for CEE 8094 EnvE seminar, when it has been available, during your tenure at GT-EnvE?

YES NO

(10) If "NO", please provide the reason(s) for not registering for the seminar (check all that apply):

Did not want to attend Forgot to register Schedule conflict
 Off-campus at the time Request of advisor
 Other(s) not listed above:

(11) Did you register for CEE 8094 EnvE seminar course for the Fall 2007 semester?

YES NO

(12) If "YES", how frequently have you attended the CEE 8094 EnvE seminar during the Fall 2007 semester?

Always Often Sometimes Rarely Never

(13) Please rate the contribution of CEE 8094 in the following areas

(Please checkmark or put 'X' in the appropriate box under the corresponding column)

	Extremely Helpful	Very Helpful	Helpful	Somewhat Helpful	Not Helpful
Providing you exposure to different EnvE-related subject areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helping you in your current research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helping you learn oral presentation skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improving your critical thinking skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helping you interact with GT-EnvE Faculty and Students	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(14) When you did attend the CEE 8094 seminar, how frequently was the seminar interesting?

Always Often Sometimes Rarely Never

(15) When you did attend the CEE 8094 seminar, how frequently did you understand the material discussed in the seminar?

Always Often Sometimes Rarely Never

(16) How frequently would you like to have non-EnvE faculty present for CEE 8094 seminar?

Always Often Sometimes Rarely Never

(17) Which grading option would you prefer to have for CEE 8094 seminar?

'Letter Grade' 'Pass/Fail' 'Audit'

Why?: _____

(18) Should CEE 8094 seminar be mandatory for GT EnvE graduate students?

YES, for all students YES, for 1st-year students only NOT for any students

Why?: _____

(19) Please provide suggestions on the ways the GT-EnvE can improve the CEE 8094 seminar course:

(20) Please provide any other specific comments you have about the CEE 8094 seminar:

C. We would like you to provide us with some input regarding various aspects of graduate courses at GT-EnvE.

(21) How important were the following factors to you while choosing graduate courses at GT-EnvE?

	Extremely Important	Very Important	Important	Somewhat Important	Not Important	N/A
Faculty teaching the course	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Advisor's recommendation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Application to your research area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Application to job prospects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relevance to the PhD comprehensive examination	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Catalog description of the course on OSCAR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Core course requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suggestions from more experienced students	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(22) Are there any other factors not listed in (C.1) that were important to you while choosing the graduate courses in GT-EnvE?

(23) How prepared were you in the following skills **before** starting your graduate program at GT-EnvE?

	Very Well-Prepared	Well Prepared	Prepared	Somewhat Prepared	Not Prepared	N/A
Understanding fundamental concepts in EnvE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communicating in writing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communicating orally	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Critically analyzing information & arguments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conducting experiments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Analyzing & interpreting data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Locating technical literature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Learning from literature you've read	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(24) How beneficial has your graduate course work at GT-EnvE been in preparing you for the following tasks?

	Very Beneficial	Mostly Beneficial	Beneficial	Somewhat Beneficial	Not Beneficial	N/A
Understanding fundamental concepts in EnvE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communicating in writing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communicating orally	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Critically analyzing information & arguments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conducting experiments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Analyzing & interpreting data	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Locating technical literature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Learning from literature you've read	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(25) How frequently do you find the content of GT-EnvE courses meet their catalog description on OSCAR?

- Always Often Sometimes Rarely Never

(26) How satisfied are you with the number of classes offered at GT-EnvE in the area of your interest?

- Very satisfied Satisfied Neither satisfied nor unsatisfied Unsatisfied Very unsatisfied

(27) Please provide any specific areas of environmental engineering in which you would like to see additional course(s) being offered _____

(28) How satisfied are you with the overall quality of graduate courses at GT-EnvE?

- Very satisfied Satisfied Neither satisfied nor unsatisfied Unsatisfied Very unsatisfied

(29) Please provide any suggestions on the ways the GT-EnvE can improve the GT-EnvE graduate courses:

(30) Please provide any specific comments you have about the issues related to GT-EnvE graduate courses:

D. In this section, we would like to have your feedback regarding your relationship with your advisor.

If you are pursuing research at GT-EnvE, advisor refers to the research advisor.

If you are NOT pursuing research at GT-EnvE, advisor refers to the academic advisor.

(31) Did you choose your advisor before starting your studies at GT-EnvE?

YES NO

(32) Were you able to get enough information about research areas of the faculty members at GT-EnvE through the CEE website or other resources provided by GT-EnvE before choosing your advisor?

YES NO

(33) Were you able to get enough information about means of communication for the faculty members at GT-EnvE through the CEE website or other resources provided by GT-EnvE before choosing your advisor?

YES NO

(34) How frequently is your advisor available to meet you during office hours, by appointment or by email throughout the semester?

Always Often Sometimes Rarely Never

(35) How frequently does your advisor encourage you to ask questions and/or to discuss your concerns?

Always Often Sometimes Rarely Never

(36) If your advisor cannot respond to your concerns, how frequently does he/she make an effort to refer you to the appropriate person, office, or resource in the department?

Always Often Sometimes Rarely Never

(37) How would you rate the

	Very Satisfactory	Satisfactory	Neither satisfactory nor unsatisfactory	Unsatisfactory	Very Unsatisfactory	N/A
Communication between you and your advisor(s)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helpfulness of your advisor(s) for course advisement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Guidance from your advisor(s) regarding your graduation plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Guidance from your advisor(s) regarding your current research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Understanding of what your advisor(s) expects from you in your research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(38) How frequently have you interacted with your advisor throughout this academic year?

Always Often Sometimes Rarely Never

(39) Please provide any specific comments you have about the issues related to the academic advisement at GT-EnvE:

(40) Please provide suggestions on the ways the GT-EnvE can improve the academic advisement for new students:

E. Please provide feedback to the following questions for evaluating this survey study.

(41) How well did this survey cover your concerns regarding the CEE 8094 Seminar?

Extremely well Very well Well Somewhat well Not well

(42) How well did this survey cover your concerns regarding the graduate course work at GT-EnvE?

Extremely well Very well Well Somewhat well Not well

(43) How well did this survey cover your concerns regarding the student-advisor interaction at GT-EnvE?

Extremely well Very well Well Somewhat well Not well

(44) How satisfied are you with the content of the survey itself?

Very satisfied Satisfied Neither satisfied nor unsatisfied Unsatisfied Very unsatisfied

(45) Please provide any additional comments you have about the survey itself or its contents:

(46) Are there any other issues, not covered in this survey, regarding academic life in GT-EnvE that you think should be investigated or surveyed by the Dialogue for Academic Excellence Committee?

Appendix B.

Survey Introduction Email

Good Morning Everyone,

The Dialogue for Academic Excellence Committee (DAEC), a branch of the Association of Environmental Engineers and Scientists (AEES), is excited to announce that this year's annual graduate student survey is ready for the input of graduate students in our department.

We are pleased to offer the survey online for the first time in the history of DAEC. Students registered for the current academic year (2007-2008) will soon receive an email containing a link for taking the survey online. Just click on the link and you will be taken to the survey website.

Please note, however, that the survey link will only work for your email address, so please do not forward the link. If you do not receive an email with the survey link in your GT email account within next hour, please contact us at lokesh.padhya@gatech.edu.

The survey should take approximately 10 minutes to complete. The deadline for the completion of the survey is next Friday, February 22, 2008.

The intent of this survey is to get feedback from current students on the quality of academic life in the Environmental Engineering department at Georgia Tech (GT-EnvE) and to help identify areas of satisfaction and areas that may need improvement.

Every year, DAEC recognizes academic issues of concern for graduate students in GT EnvE and tries to voice their opinions to the faculty. This is your opportunity to make our department function better and improve the overall experience of graduate students at GT-EnvE.

The DAEC would like to ask for your complete and honest opinion on this survey. Your responses will remain completely ANONYMOUS and the information entered will NOT be associated with you in any way.

We hope that you will spare some of your time and provide valuable feedback to make this survey meaningful.

Many Thanks,

Your 2007-2008 DAE Committee