AC 2012-3208: STUDENT PERSPECTIVES OF FACULTY CLASSROOM PRACTICES

Dr. Shanna R. Daly, University of Michigan

Shanna R. Daly is an Assistant Research Scientist at the University of Michigan in engineering education, earning her doctorate from Purdue University’s Engineering Education program in 2008. Her research focuses on the investigation and application of complex professional skills, specifically design ideation, innovation practices, and creative processes within engineering, outside of engineering, and cross-disciplinarily. Her research includes an emphasis on the translation of research to practice in the form of pedagogy, curriculum development, and faculty support and programming in implementing evidence-based best practices in teaching and learning.

Dr. Cynthia Finelli, University of Michigan

Dr. Cynthia Finelli, Ph.D., is Director of the Center for Research and Learning in Engineering and research associate professor in the College of Engineering at the University of Michigan. In addition, she actively pursues research in engineering education and assists other faculty in their scholarly projects. She is past Chair of the Educational Research and Methods Division of ASEE.

Mr. Ameen Basim Al-Khafaji, College of Engineering at the University of Michigan

Ameen Al-Khafaji is a junior in the College of Engineering at the University of Michigan. He majors in electrical engineering. He contributed to this project through the Undergraduate Research Opportunity Program (UROP).

Ms. Martha Jane Neubauer, College of Engineering at the University of Michigan

Martha Neubauer is a sophomore in the College of Engineering at the University of Michigan. She majors in chemical engineering, and she contributed to this project through UROP.

©American Society for Engineering Education, 2012
Student Perspectives of Faculty Classroom Practices

Abstract

Faculty teaching practices can have a direct impact on student success. Research demonstrates a number of practices that help students succeed; however, the adoption of those practices has been historically slow. We propose an institutional change model that will motivate faculty change using multiple sources of data. One aspect of local data includes student perspectives on faculty teaching practices. In this paper, we report outcomes from a student survey that revealed common practices among all faculty, as well as “game-changing” behaviors that students report as being implemented by supportive faculty.

Key Words: faculty classroom practices, institutional change

Introduction

A number of reports have indicated the need to improve the quality of science, technology, engineering, and mathematics (STEM) education to support a diverse student body and prepare engineers to be competitive in a global workforce\(^1,2,3\). Research, such as the pivotal work of Seymour and Hewitt\(^4\) and Tobias\(^5\), has demonstrated that, in many cases, faculty teaching practices can greatly affect the quality of STEM education. In particular, faculty teaching practices can have a direct impact on student achievement (e.g., student involvement, engagement, knowledge construction, and cognitive development) and, as a result, on student decisions to persist in engineering\(^6,7,8\).

Historically, the translation of research to actual classroom practice has been slow, thus indicating that a sustained effort is required to implement institutional change. As part of a larger project, we aim to develop an evidence-based plan for motivating transformative change in faculty teaching practices to support a diverse student body in engineering. Our research is founded on the premise that these initiatives will be more effective if they are (1) grounded in research about successful faculty teaching practices, (2) integrated with local evidence regarding institutional context, student perspectives, and faculty perceptions and behavior, and (3) informed by theories of learning, faculty development, and institutional change. This model of evidence-based change is represented in Figure 1.
This paper reports on data gathered to understand student perspectives on faculty classroom practices, specifically what students believe supports and inhibits their success. As institutional change will be dependent on multiple components, including perspectives of students on faculty classroom practices, we expect this work to be one important piece that will contribute to motivating change.

Background and Theoretical Framework

The scope of our larger project includes three key components of data collection that will inform the plan for institutional change of faculty classroom practices:

- **Contextualize the problem** using existing literature about faculty teaching practices, student demographic and academic data, and interviews with academic advisors.
- **Understand student perspectives** using student surveys and focus groups.
- **Understand faculty practices and perspectives** through classroom observations of engineering faculty, surveys and interviews about their teaching practices, the impact of their practices on student success, and factors that might motivate them to change their practices.

This paper reports on the student perspectives aspect of the project, specifically, questions from the student survey, however, the background section includes a discussion of our work to contextualize the problem, as that work provided the basis for the development of the survey instrument.

Literature on Practices that Support Student Success

Our work to contextualize the problem included a synthesis of literature on classroom practices and their impact on student success. There are many resources on teaching practices shown to be effective in promoting student engagement and success (e.g., 9, 10, 11, 12, 13). Though others have categorized teaching behaviors in different ways, five key categories of practices emerged from our literature search, and form the theoretical framework this study. The categories include faculty-student rapport, instructional style, feedback and evaluation, course goals, and course content.
Rapport. Establishing a good faculty-student rapport is an important teaching practice that can impact students’ motivation to learn. Tobias asserted that many traditional science courses suffer from a lack of community and that many students desire this relationship and are more successful when it is incorporated into the classroom. Research has shown that good rapport can increase the likelihood that students will ask questions in class and will seek help from faculty outside of class, and can lead to increased student success. Faculty can facilitate rapport in many ways, such as providing clear expectations, making themselves accessible to students in office hours and before or after class, learning student names, sharing personal enthusiasm and experiences related to course material, soliciting midterm student feedback (and acting upon it), communicating openly, and showing empathy.

Instructional style. Approaching teaching in a variety of ways, and using activities that focus on visual, auditory, and tactile delivery of content can support learning. Murray documented instructor enthusiasm as an important feature of instructional style. While the ways instructor present material is important, students’ level of engagement and involvement in their own education is essential for their success. Even in the best lecture classes, student gains are lower than in interactive engagement classes. Active learning has been shown to have a positive impact on personal development, personal satisfaction, quality of relationships, psychological adjustment, attitudes toward the college experience, and desire to stay in engineering. Best practices in instructional style also include facilitating student teamwork; group interaction can lead to more engagement with material and a support structure for completing assignments, preparing for exams, and persisting in engineering. In a review of the impact of cooperative learning, over 300 studies indicated that cooperative learning promoted higher student individual achievement. Chickering and Gamson provide suggestions for supporting team interactions including creating study groups, incorporating small group activities during class, and asking students to discuss key points of the class with each other.

Feedback and evaluation. Providing high quality and timely feedback, especially as it relates to course grades, is another way to be clear about course goals, and it also has been demonstrated to impact student success. Faculty feedback can help students recognize their own misconceptions and identify areas for improvement as well as confirm their understanding of material. Students rate their perceived ability to succeed as a primary factor in their decisions to persist in or leave STEM majors, and because course grades are not always indicative of ability to succeed, students’ decisions are often ill informed. Thus, efforts to help students more accurately evaluate their academic performance and capacity for success in engineering, especially by better connecting actual ability with measures of assessment, may improve student success.

Course goals. Setting clear expectations of what students should achieve in the course and what work is expected can provide students motivation and direction in a course. Employing a backward design approach supports clear alignment of course goals with lecture topics, assignments, and exam content. By having and communicating clear course policies and objectives, faculty can provide a better overall view of the course goals to the students. Students often have difficulty determining what concepts are most important; Murray’s work indicated the importance of stressing important points in each class period so that students recognize what to focus on.
Course content. Clear explanations that connect to students’ prior knowledge foster students’ ability to integrate new knowledge and skills into their mental frameworks of a discipline\textsuperscript{27, 28}. As students come to courses with various levels of proficiency, professors are tasked with meeting students at their level of understanding; one approach to this is to provide extra material or exercises for students who lack essential background knowledge or skills\textsuperscript{10}. Students’ perceptions of the usefulness of content affect their motivation to engage with course material, and therefore their desire to persist in STEM majors\textsuperscript{29, 30, 31}. Establishing the relevance of course material to students’ potential future careers, applications of the material practice, and everyday situations are critical teaching practices that have been linked to student success. Research shows that many students would respond better to engineering if scientific knowledge were more closely and explicitly linked to important societal issues\textsuperscript{5}. Initiatives that intentionally introduce real-world or service-learning components into traditional engineering courses bring awareness to both students and faculty on the importance of engineering topics included in their courses\textsuperscript{32, 33, 34}. In Burn & Holloway’s\textsuperscript{35} study of two sections of an “introduction to computers” course, one instructor used a “traditional” approach and one emphasizes real-world contexts. The results of the study revealed that students’ perceptions of the importance and relevance of the course material were markedly greater in the “real-world” course. Moreover, gaps in academic performance on exams and homework assignments between males and females and between students of color and white students were smaller in the section integrating real-world contexts.

Academic Advisors’ Perspectives on Faculty Practices

Another aspect of our work to contextualize the problem involved speaking with staff and faculty advisors who regularly work with students having difficulties with their academic coursework. We held three focus groups with fifteen academic advisors during which we discussed ways faculty classroom practices can support student success. All but one of the key themes that emerged from the focus group were consistent with the themes that emerged from the literature, specifically, 1) Rapport: Be approachable and caring; 2) Pedagogy: Use more interaction and group work in class; 3) Feedback: Provide early and frequent feedback, 4) Grading: Use an objective, non-competitive grading scale, and 5) Relevance: Provide relevant examples and real world applications. The academic advisors also emphasized that faculty could support student success by recognizing mental health issues, and attributed some of the struggles in engineering success to challenges with mental health.

The literature and local data from advisors indicated specific classroom practices of faculty as important to students success thus they guided the development of the data collection on student perspectives.

Research Methods

This paper reports on one aspect of our student survey data, specifically student perceptions of classroom practices for faculty who support students’ success (supportive faculty) and faculty who inhibit their success (non-supportive faculty). We were guided by the following research question: What classroom practices do students report for supportive faculty and non-supportive faculty?
Survey Instrument
Following our literature analysis, we developed and pilot-tested a student survey. The survey included both open-ended questions as well as multiple-choice options, and comprised 48 total items. It focused on student perspectives of faculty classroom practices and the value students placed on these specific practices. Specifically, the survey asked students if they had a professor in an engineering lecture-based course who had a positive impact on their success in engineering and if they had a professor in an engineering lecture-based course who inhibited their success in engineering. We specified “success” in engineering courses as supporting learning, engagement, and interest in the field.

If students reported having either or both type of professor (supportive and non-supportive), they answered a series of questions about their classroom practices. The questions were guided by the themes that emerged from our prior work to contextualize the problem discussed in the background section of this paper: faculty-student rapport, instructional style, feedback and evaluation, course goals, and course content.

No existing validated surveys ask students to report on the practices of specific professors, thus the development of our survey included operationalizing variables known from the literature to be related to supportive classroom practices. To ensure validity, the instrument underwent pilot testing. This included one phase where we used verbal protocol elicitation with two participants as they completed the survey, an iteration based on those results, and a second phase in which we employed another round of survey tests with six students who took the survey and provided feedback on the questions. Our survey does not include psychometric items, and our goal was not to consolidate items into scales. Thus, our pilot work in combination with review by our team of instructional consultants, having nearly 15 years of practice and experiences collecting student feedback, observing faculty in action, and working with faculty to improve their teaching practices, provided sufficient content validity.

Table 1 includes survey items related to the practices included in each category. For each set of practices, the survey read, “please indicate if the professor did the following.” Students had the option to answer, “Yes,” “No,” “Not Sure,” and “Not Applicable.”
Table 1. Survey Questions related to Professor Practices

<table>
<thead>
<tr>
<th>Rapport</th>
<th>Instructional Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>• had an approachable and caring demeanor</td>
<td>• approached teaching in different ways (used a variety of ways to help me learn)</td>
</tr>
<tr>
<td>• knew students by name</td>
<td>• promoted student involvement in class</td>
</tr>
<tr>
<td>• showed enthusiasm about material</td>
<td>• provided hands-on experiences</td>
</tr>
<tr>
<td>• encouraged students to use office hours</td>
<td>• encouraged students to ask questions</td>
</tr>
<tr>
<td>• encouraged me to receive extra help or seek-out a study center</td>
<td>• had students work together in groups</td>
</tr>
<tr>
<td>• talked with students before or after class</td>
<td>• taught problem solving skills</td>
</tr>
<tr>
<td>• praised students for good comments and answers</td>
<td>• asked questions of the class</td>
</tr>
<tr>
<td>• had an ‘open door’ policy (made it clear that students could stop by at any time)</td>
<td>• was engaging while lecturing</td>
</tr>
<tr>
<td></td>
<td>• had an organized lecture</td>
</tr>
<tr>
<td>Feedback and Evaluation</td>
<td>Course Goals</td>
</tr>
<tr>
<td>• provided me with ample opportunities to do graded work</td>
<td>• provided me with a good syllabus that represented the course plan</td>
</tr>
<tr>
<td>• was prompt in returning graded work</td>
<td>• followed a clear course plan</td>
</tr>
<tr>
<td>• provided me with good feedback on my work</td>
<td>• stressed important points</td>
</tr>
<tr>
<td>• provided suggestions for how to prepare for exams</td>
<td>• provided resources to help me learn (e.g., readings, websites, etc.)</td>
</tr>
<tr>
<td>• graded work fairly</td>
<td>• made me aware of course goals</td>
</tr>
<tr>
<td>• talked to me if I performed poorly on an assignment or exam</td>
<td>• gave assignments that aligned with course goals</td>
</tr>
<tr>
<td>• gave me enough information to estimate my grade by midterm</td>
<td>• gave exams that aligned with course goals</td>
</tr>
<tr>
<td>• applied clear criteria for grading</td>
<td></td>
</tr>
<tr>
<td>• routinely administered exams that didn't require bumping up the class grade to result in a reasonable class average</td>
<td></td>
</tr>
</tbody>
</table>

Data Collection

We identified the undergraduate population of engineering undergraduates with at least a sophomore status (as we felt freshman did not have enough engineering courses to be able to participate) and divided the resulting group of 4,153 students into four quartiles based on cumulative GPA. The subdivision allows us to look for differences by varying achievement levels reported.

Then, we used a rolling-recruitment process to invite students to complete the survey whereby multiple recruitment times were used to contact invited students. We did four rounds of sampling, inviting different numbers of students from each quartile at each sample time in an
attempt to have 100 completed student surveys for each GPA quartile. To increase the potential response rate, students who participated received a $15 incentive.

Participants
In total, 386 students are included in our sample. The breakdown by gender and quartile is represented in Table 2 below.

<table>
<thead>
<tr>
<th>Quartile</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartile 1: 3.552-4.0</td>
<td>66</td>
<td>31</td>
<td>97</td>
</tr>
<tr>
<td>Quartile 2: 3.204-3.551</td>
<td>64</td>
<td>35</td>
<td>99</td>
</tr>
<tr>
<td>Quartile 3: 2.795-3.203</td>
<td>67</td>
<td>36</td>
<td>103</td>
</tr>
<tr>
<td>Quartile 4: Below 2.795</td>
<td>51</td>
<td>36</td>
<td>97</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>248 (64%)</strong></td>
<td><strong>138 (36%)</strong></td>
<td><strong>386</strong></td>
</tr>
</tbody>
</table>

Figure 2 shows the population breakdown by major. Students could report multiple majors, thus the total count here is greater than our population total.

Figure 2. Majors Represented in Sample Population

Additional information about participant demographics is shown in Table 3. Note that for race and ethnicity, students could check more than one, and for all questions, students could skip it if they chose.
Table 3. Additional Participant Information

<table>
<thead>
<tr>
<th>Class level</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sophomores</td>
<td>107 (28%)</td>
</tr>
<tr>
<td>Juniors</td>
<td>140 (36%)</td>
</tr>
<tr>
<td>Seniors</td>
<td>133 (35%)</td>
</tr>
<tr>
<td>Other</td>
<td>5 (1%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race and ethnicity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>289</td>
</tr>
<tr>
<td>Asian</td>
<td>94</td>
</tr>
<tr>
<td>Black</td>
<td>10</td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
<td>5</td>
</tr>
<tr>
<td>Hispanic/ Latino</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Range 18-30</td>
<td></td>
</tr>
<tr>
<td>Average 20.4 years</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education Path</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Started at same 4-year institution</td>
<td>356 (93%)</td>
</tr>
<tr>
<td>Transfer</td>
<td>26 (7%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Full-Time Status</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Time</td>
<td>375 (97%)</td>
</tr>
<tr>
<td>Part Time</td>
<td>11 (3%)</td>
</tr>
</tbody>
</table>

Results

We report the outcomes from the quantitative analysis of student-reported behaviors of faculty who students perceived as having a positive impact on their success in engineering and faculty who students perceived inhibiting their success in engineering. The results are presented according to the five categories of faculty practices that emerged from our earlier work. Figures 3-7 represent student perceptions of faculty practices related to rapport, instructional style, feedback and evaluation, course goals, and course content, respectively. Above each set of bars in the figures is the percent difference in students’ perceptions of the behavior of their supportive faculty and non-supportive faculty.
Figure 3. Student Perceptions of Faculty Classroom Practices related to Rapport

Figure 4. Student Perceptions of Faculty Classroom Practices related to Instructional Style
Figure 5. Student Perceptions of Faculty Classroom Practices related to Feedback and Evaluation

- Routinely administered exams that didn't require bumping up
- Applied clear criteria for grading
- Gave me enough information to estimate my grade by midterm
- Talked to me if I performed poorly
- Graded work fairly
- Provided suggestions for how to prepare for exams
- Provided good feedback
- Prompt in returning graded work
- Provided ample opportunities to do graded work

Non-supportive Professor
Supportive Professor

Figure 6. Student Perceptions of Faculty Classroom Practices related to Course Goals

- Gave exams that aligned with course goals
- Gave assignments that aligned with course goals
- Made me aware of course goals
- Provided resources
- Stressed important points
- Followed a clear course plan
- Provided good syllabus

Non-supportive Professor
Supportive Professor
Discussion

In our analysis of reported percentages of practices by both supportive and non-supportive faculty as well as the differences between both groups, we developed three categories of practices: Consistent Practices, “Game-Changers,” and Under-Utilized Practices. Our definitions for each of these practices are listed in Table 4, and we discuss these practices and their implications in the following sections.

Table 4. Categories of Practices

<table>
<thead>
<tr>
<th>Teaching Practice</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistent Practices</td>
<td>&gt;60% Occurrence by both Supportive and Non-Supportive Faculty</td>
</tr>
<tr>
<td>Game Changers</td>
<td>&gt;50% Difference between Supportive and Non-Supportive Faculty</td>
</tr>
<tr>
<td>Under-Utilized Practices</td>
<td>&lt;80% Use by both Supportive and Non-Supportive Faculty</td>
</tr>
</tbody>
</table>

Consistent Practices
Students reported that both supportive and non-supportive faculty employed some practices. Examples of these practices included:

- Showed enthusiasm about material
- Encouraged students to use office hours
- Asked questions of the class
- Provided ample opportunities to do graded work
- Was prompt in returning graded work
As both supportive and non-supportive faculty demonstrate these behaviors, we hypothesize that they are standards practices of most college faculty.

“Game-Changing” Practices
There are some practices that supportive faculty exhibit but non-supportive faculty do not exhibit as often. These offer ways that faculty seeking to improve could make changes. The differences also indicate areas in which we should concentrate our institutional change efforts. These can be considered “game-changing” behaviors because they can have a significant impact on students’ success. Our results indicated differences in the following practices based on students’ perceptions of professors who had a positive impact on their success and professors who inhibited their success:

- Knew students by name
- Praised students for good comments and answers
- Had an approachable and caring demeanor
- Had an ‘open-door’ policy
- Engaging during lecturing
- Approached teaching in different ways
- Taught problem-solving skills
- Promoted student involvement
- Encouraged questions
- Provided me with good feedback on my work
- Talked to me if I performed poorly
- Provided suggestions for how to prepare for exams
- Administered exams that did not require bumping up grades
- Explained concepts in easy to understand ways
- Gave helpful demonstrations of principles
- Presented material at an appropriate level of difficulty
- Used everyday examples to explain concepts
- Discussed potential careers relevant to course material
- Stressed important points
- Provided resources to help me learn

For example, in regards to large differences in classroom practices in the category of rapport, approximately 90% of supportive faculty knew students by name versus only approximately 20% of non-supportive faculty. These “game changing” practices triangulate with literature findings and other data collected on student success.

Underutilized Practices
There were a few practices that have been documented in the literature as having a significant impact on student success, but our results indicated room to increase these practices, even with supportive faculty. If even faculty who students consider the best are not using these practices, this is a clear indication of room for institutional practices to grow. The practices with the most room for growth were:

- Having students work in groups
- Providing hands-on experiences

Connecting Results to Our Larger Project
As part of a larger project, we aim to develop an evidence-based plan for motivating transformative change in faculty teaching practices to support a diverse student body in engineering. This work was focused on “Understanding the student perspective.” A next step will be to consider these outcomes in light with other outcomes of our work.

Our prior work, which included observations of 26 faculty with a corresponding survey on their perceptions of their own practices\(^{36}\) made evident that interactive modes of teaching did not happen with high frequency. Although a few faculty used multiple active learning exercises, and some included a single active learning exercise requiring significant time, such as a group discussion, 16 of the 26 observed class periods used no active learning.

We also found high variation in classroom style among participants, for example, in frequency of faculty-asked and student-answered questions as well as in student-asked questions. While students reported in the survey in this study that most faculty asked questions of the class, our observations revealed that many times questions are rhetorical or are unanswered. Finally, based on survey responses, we found that participants did not perceive their own actions in ways that were consistent with outsider observations. This means that a faculty member may believe he or she is fostering considerable interaction or is bringing clarity by stressing important points; but a trained observer – and possibly a student in the class – might not share this belief.

Conclusions
This study revealed classroom practices that can make a difference in students’ feelings of support from their professors. The data presented here is one piece of the student perspective that informs our greater effort to positively impact faculty adoption of practices shown to support student success. This evidence-based approach to enabling institutional change can serve as a model for other institutions. Our future work will focus on the analysis of additional data to inform the student perspective, gathering data related to local faculty beliefs about the adoption of new practices, and the triangulation of the local perspectives of students and faculty with literature and theories on professional development and institutional change.

Acknowledgements
This material is based upon work supported by the National Science Foundation under Grant Number 0941924. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
References


