Faculty Perspectives and Institutional Climate for Teaching Quality in Engineering*

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This paper analyzes faculty comments collected in 1997, 1999, and 2002 in surveys of engineering faculty teaching practices using thematic analysis. The objective was to see if there were common themes in the comments from faculty in supportive/unsupportive climates. Comments from a 2014 survey administration were classified by teaching practices (traditional vs. non-traditional) and institutional climate (traditional vs. non-traditional), creating four conditions. These comments were then analyzed using a collective case study approach. The study of the two collections of open-ended comments was supplemented by multinomial logistic regression of survey items from the 2014 administration relating faculty teaching practices and the institutional climate for teaching. In the historical data, faculty views of student evaluations evolved from seeing it as a negative burden to describing is as positive evidence of student learning. Faculty comments included many references to administrators who only "pay lip service" to the importance of teaching, although some faculty spoke positively about their campus's commitment to quality teaching. Faculty awareness of and pressure to use student-centered methods increased with time. The collective case study identified faculty in all four conditions, although they were not equally prevalent, and illustrates the experience in each condition using faculty comments.

Keywords: engineering faculty; faculty development; institutional climate

1. Introduction

Active pedagogies are a better approach to student learning than lecture-based methods alone. Researchers have tried to (1) measure what faculty are actually doing in their classrooms [1–3], and (2) convince faculty to adopt a variety of different pedagogies [4–7]. Nevertheless, teacher-centered methods still dominate in engineering classrooms [8, 9]. This research investigates faculty perceptions about quality teaching to understand why they choose certain teaching methods and to help gain further insight into the change process. In this study, we explore the influence of institutional climate on a faculty member's choice of pedagogy. Climate is measured by faculty members' perceptions of the attitudes toward teaching quality of peers, administrators, and college policies and practices. This study builds on previous work from the Southeastern University and College Coalition for Engineering Education (SUCCEED) in the form of three surveys of faculty teaching practices between 1997 and 2002 [10–14], analyzing free-response comments that were collected but never studied. This research applies social cognitive theory, which posits that a person's cognition, behaviors, and external environment interact in various ways to simultaneously create a person's environment and

to shape the person as a product of the environment [15, 16]. Thus, social cognitive theory can be used to explain how the climate of an institution comes about. Henderson and Dancy used a toy model to explain the relationship between the environment, which they call situational characteristics, and the individual characteristics [17]. We use social cognitive theory with some applications of Henderson and Dancy's toy model in this research. The research questions that are addressed in this paper are:

1. How did faculty describe the quality and importance of teaching on their campus?
2. How did those descriptions change over time?
3. How do faculty describe their support for teaching climate at their university?
4. How does institutional climate affect faculty approaches to teaching?

2. Literature review

2.1 There have been large-scale efforts to change engineering teaching practices

As an initiative of the Vanderbilt-Northwestern-Texas-Harvard/MIT (VaNTH) Engineering Research Center, Cox has studied faculty teaching practices using the "How People Learn" (HPL)

framework and asked faculty how effective their teaching was after having participated in VaNTH, and what their perspective was before the program [18]. They demonstrated an increase in the use of effective teaching methods after participating in the program. Recognizing the prevalence of lecture-based instructional methods, Cox's finding that "respondents were most likely to describe themselves as student-centered instructors who believed in engaged learning" suggests a selection bias. The faculty that participated were volunteers, and thus may have been more inclined to accept the new teaching methods. Only "some" of Cox's respondents had a "lecture-based" view of effective teaching. Cox explored differences by faculty rank, an approach used in earlier studies of survey data from SUCCEED faculty [19]. An advantage of the data collected from faculty at SUCCEED institutions is that the survey was sent to all engineering faculty. Thus, while the SUCCEED data may still have a participation bias, the data were not collected exclusively from faculty who were engaged in NSF-sponsored engineering education reform. In fact, between 57% and 65% of respondents to the three surveys indicated that they had either not heard of the Coalition or had heard of it but not participated, indicating that a range of typical engineering faculty members responded [20].

2.2 There are still significant barriers to the adoption of student-centered teaching methods

It has been reported that roughly 82% of engineering faculty know about research-based pedagogies but only 47% are using them [21], and science, technology, engineering, and mathematics (STEM) faculty are the least likely to use student-centered teaching methods [9, 21]. Faculty rarely receive formal instruction in teaching [22]. In spite of the wealth of research that shows that student-centered pedagogies are a better form of teaching, many faculty still believe that good knowledge of the subject being taught is all that is needed for effective college teaching [23, 24]. Other barriers to why faculty do not use student-centered pedagogies have been identified as increased preparation time, a concern for covering all the material in the syllabus, student resistance, fear of not getting promoted, and limited resources and facilities [25–30]. Jaskyte, Taylor, and Smariga examined faculty and student perceptions where faculty and students free-listed innovative teaching characteristics and found that students and faculty have different perceptions of innovative teaching [31]. Faculty considered "gets students to learn how to construct knowledge themselves" as most important for innovative learning, the students had a similar item "facilitates students' discovery of material on their own" as

the lowest. Students ranked engaging and responding to their feedback as the most important characteristic, faculty ranked these much lower as definitions of innovative teaching.

A study by Serow and colleagues claimed that faculty who were interested in new approaches to teaching, were funded for teaching-reform projects, served as an undergraduate coordinator or on a curriculum committee, and/or had received a teaching award were more interested in quality teaching than faculty who did not participate or get awards for their teaching [32]. They discovered two unique groups of faculty within this subgroup: one group embraced faculty development initiatives, the Scholarship of Teaching movement, and the work of campus wide teaching centers in general. The other group generally opposed educational research and related funding, believing that these interfered with teaching as the primary role of a professor [31]. This is particularly relevant because Serow's research was conducted at SUCCEED partner institutions.

2.3 The importance of climate in faculty approaches to teaching

Serow's work shows the influence of institutional and departmental climate on faculty approaches to teaching. Climate in higher education has been studied from various of perspectives [11, 24, 25], and is determined primarily by the institution, the faculty, and academic departments [33]. Henderson and Dancy theorized that a departmental climate could have a significant effect on faculty's choice in teaching techniques [25]. They conducted five interviews with physics professors and developed the model in Fig. 1 [25]. They claim that a faculty member who wants to teach non-traditionally (using alternative methods) in a departmental climate that is very traditional will use mixed, i.e., both non-traditional and traditional, teaching techniques, even though they believe in using non-traditional teaching techniques [25]. Likewise, if a faculty member is accustomed to using traditional teaching techniques and joins a department that supports and encourages non-traditional teaching techniques, that faculty member would be more likely to start using non-traditional techniques. Henderson and Dancy acknowledge that more exploration of this model is necessary because of the small sample of physics faculty [25]. Henderson and Dancy later created an adoption-invention continuum [25]. They find that situational characteristics play an important role in the instructor's choice of teaching methods when the situational characteristics—the teaching methods accepted in the department—do not match the individual's preferred teaching methods. "Alternative" methods are student-centered teaching methods, as opposed to "traditional"
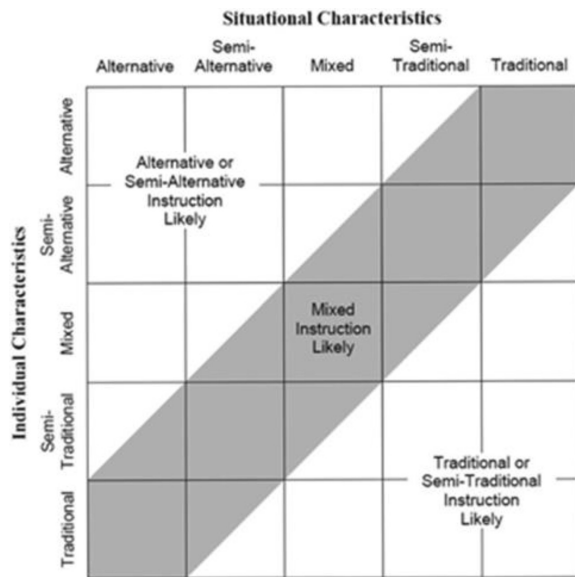
Fig. 1. Model proposed by Henderson and Dancy [26] showing the interaction of individual and situational characteristics of the teaching methods of physics faculty. Reproduced with permission from [C. Henderson and M. H. Dancy, Physics faculty and educational researchers: Divergent expectations as barriers to the diffusion of innovations, *American Journal of Physics*, **76**(1), 2008, pp. 79–91]. Copyright [2007], American Association of Physics Teachers.

approaches that focus on the use of lecture. An instructor who prefers alternative teaching methods who is in a department that only uses very traditional teaching methods is unlikely to use student-centered teaching methods. Conversely, if a department uses alternative teaching methods and hires a faculty member who typically uses traditional teaching methods, the faculty member is likely to adopt more student-centered approaches. Fig. 1 shows this graphically. Henderson and Dancy's toy model predicts a relationship between the environment and the individual, consistent with Social Cognitive Theory.

Thus, this work uses both social cognitive theory and this toy model as a framework to explore the effect of climate on faculty members' pedagogical choices.

3. Methods and data

This study assesses changes in faculty perceptions of quality teaching practices over a 17-year period. In 1997, members of SUCCEED's faculty development and assessment teams designed a survey of instructional practices and attitudes regarding the climate for teaching on the Coalition campuses. The survey respondents were asked about the frequency with which they used various teaching methods (e.g., active learning, team homework, and technology-assisted instruction), their involvement in

faculty development programs, and the effect of faculty development workshops on their teaching. They were further asked to rate the importance of quality teaching to themselves, their colleagues, and their department, college, and university administrators and about the faculty reward system at their university. The survey was first administered in late 1997 [11, 12], modified and administered a second time in 1999 [13, 14], and modified slightly in 2002 for a third administration [20]. These three survey administrations yielded 503 usable responses in 1997, 511 responses in 1999, and 375 responses in 2002. A comprehensive analysis of trends across all three administrations was published after the third administration [20]. The survey was modified to update technological terms and to add questions that are studied elsewhere, and was administered in 2014 to two of the original eight institutions, University of Florida and University of North Carolina at Charlotte.

While partnerships developed from SUCCEED continue (e.g. [34]), NSF support ceased in 2002. As a result, even where there is sufficient political capital to have the survey deployed by a high-level college administrator, the SUCCED name recognition and the reciprocal benefit of Coalition funding that bolstered response rates in the past had weakened. Further, the ubiquity of electronic survey tools has made it easier to survey—and over-survey—university faculty, leading to policies that restrict survey distribution (e.g. [35]). Thus, a combination of low institutional participation and low participant response rate made it impossible to compare the 2014 responses to the earlier responses as intended. Purdue University and University of Colorado were invited to participate in the survey, even though those new institutions would not have comparison data from earlier administrations. Therefore, two related studies evolved that combine to develop a clearer picture of faculty teaching practices than either study alone. All respondents had taught undergraduate students in the past three years. More complete details of the survey methods are provided elsewhere [36].

3.1 Changes in the influences on quality teaching during the SUCCEED coalition

This study focuses on data from a final open-ended question, "Please provide any comments you may have about the quality or importance of teaching on your campus." In the earlier administrations, it was noted that, perhaps because of the placement of this question at the end of the survey, faculty commented not only on the quality or importance of teaching, but also on the survey and other matters. These comments from the 1997, 1999, and 2002 surveys had not been studied previously, so they were used

to identify influences on quality teaching and patterns of change from the 1997 administration to 2002 administration.

Earlier quantitative studies showed changes in teaching practices in subsequent administrations and a relationship between faculty values and the values of others at an institution. Studying data from the first three administrations, we address the research question: How did faculty describe the quality and importance of teaching on their campus, and how did those descriptions change over time? To answer this research question, the open-ended comments from 1997, 1999, and 2002 were studied using thematic analysis and a constant comparative methodology. Using open coding, the lead author compared and contrasted events, actions, and/or interactions among the faculty comments, grouping conceptually similar events into categories. Using axial coding, these categories were tested against the entire set of data. Using selective coding, all categories were unified around core ideas and descriptive detail was added to the categories. This coding sequence made it possible to study the prevalence of various codes across the administrations to explore longitudinal changes. While this study does not have sufficient control to claim that observed changes are due to Coalition activities, the Coalition undoubtedly had some influence.

3.2 The influence of climate on quality teaching (data from the 2014 administration)

While differences in sampling procedure for the 2014 administration made it difficult to compare responses from 2014 to those from earlier administrations, similar methods were used to analyze qualitative comments from the 2014 administration. In addition to studying the open-ended comments from the 2014 survey, this study also used quantitative responses describing the use of certain teaching methods and stakeholder views on quality teaching. The data needed to replicate this study was collected in 1997, 1999, and 2002 as well, but was not available when this work was conducted.

The 2014 administration included quantitative responses regarding the importance of quality teaching to various stakeholders. Specifically, the question stem was, "How important is quality teaching to" followed by these stakeholders: "you," "faculty colleagues," "the department head," "the dean," and "top administrators." Responses were collected on a 7-point Likert-type scale from 1 (Not important at all) to 7 (Extremely important). These responses were used to classify the environment for quality teaching as either "supportive" (faculty who answered a six or seven for at least two of the climate questions) or "non-supportive" (faculty who reported a one or a two in

at least two climate questions). In the set of responses studied, these categories were mutually exclusive.

The questions used to report teaching methods used the stem, "Please think of a typical undergraduate course that you teach, and indicate how frequently you use each of the following teaching techniques as indicated by the response choices:"

Q1. Lecture for most of the class period.
Q2. Put students into pairs or small groups for MOST of the class period to answer questions or solve problems.
Q3. Assign homework to individuals (as opposed to teams).
Q4. REQUIRE students to work in teams (2 or more) to complete homework.
Q5. Give writing assignments (any exercise that requires verbal explanations and not just calculations).

Faculty teaching methods were classified as "traditional" (faculty that reported 'every class' for Q1 and Q3, and reported 'never' or 'one or more times per semester' for Q2, Q4, and Q5) or "nontraditional" (faculty who answered 'never' or 'one or more times per semester' for Q1 and Q3, and 'every class' or 'one or more times per week' for Q2, Q4, and Q5). The response choices for these questions were "every class," "one or more times per week," "one or more times per month," "one or more times per semester" and "never." Lecture (Q1) and assigning homework to individuals (Q3) were reverse-coded. Similar to the previous study, constant comparative analysis was used to explore faculty members' comments from the last question on the survey, "Please share any comments about the quality or importance of teaching on your campus." Because the respondents are being classified into subgroups for analysis, the method used here is more characteristic of a collective case study [37], where the richness of the case comes from qualitative and quantitative data from the participants in each group rather than exclusively from richer qualitative data from each participant.

3.3 Establishing the quality of the qualitative data

Various measures can be taken to ensure the quality of qualitative data [38]. The theoretical validation of the data in this study is limited by including participants only from large, public, research institutions. Nevertheless, the population still has some important modes of variation. The average amount of time teaching was 16 years, so we are not measuring novelty effects, yet there is still good variation across faculty rank and position [39, Table 3]. By studying the responses of faculty in non-supportive environments and/or using tradi-

tional teaching methods, the study addresses various types of negative cases. Procedural validation is established by triangulation using qualitative and quantitative data. Further, the constant comparative method was used to make sure that the researcher was staying consistent with coding the definitions of quality teaching [38]. Communicative validation cannot be established because this data used an open-ended survey, representing only one-way communication. A positive outcome of this approach was enhanced process reliability by ensuring that all participants received a consistent question prompt through the survey [38].

4. Results and discussion

Although the 1997 survey was administered after some SUCCEED faculty development interventions, it still served as a baseline before a concerted effort toward large-scale faculty development was made by SUCCEED during 1997–2000. In 1997, comments were included by 147 of the 503 respondents. In the 1999 administration, 195 of 511 respondents provided comments. In 2002, 113 of 375 respondents did so. The survey respondents in 2014 provided 37 comments in 97 responses. Overall, the comments in 1997 were more negative than later surveys when asked about the quality or importance of teaching quality, with 90 percent making negative comments and 63 percent having positive comments in that administration. In 1999, 55 percent made negative comments, 47 percent in 2002, and 65 percent in 2014 (recall that the 2014 sample includes different institutions). In spite of the reduction in the prevalence of negative comments from 1997 to 1999 to 2002, positive comments were outnumbered by negative comments each survey year, which is a finding in itself that agrees with the earlier discussion of barriers to pedagogical change [27].

4.1 Student evaluations evolve from a negative burden to positive evidence of student learning

Many faculty commented that administrators measure quality teaching primarily through student evaluations. In 1997, 18 responses mentioned student end-of-course evaluations. Faculty resented being evaluated by students who they viewed as unqualified for the task.

> *"Too much emphasis is placed upon student evaluations of teaching effectiveness in spite of the fact that the students have no metric for what is important for them to learn. . ."* (#76, 1997)

This raises an interesting dialog about students' ability to understand what they need to know to be an engineer, and is still debated in the engineering community. Another faculty member said:

> *"These opinions strictly measure student comfort and bear no relation to how much students learn."* (#317, 1997)

These faculty perspectives run counter to significant evidence that student evaluations of teaching correlate well with a variety of other measures of teaching effectiveness [40]. If a faculty member believes that student evaluations measure comfort, there is a disincentive to push students out of their comfort zone by using non-traditional teaching methods or even by challenging the students. Considering Vygotsky's notions of a zone of proximal development, such a cautious approach to teaching is not likely to create a positive environment for learning [41]. To support a faculty member with these concerns, institutional support would be critical to ensure the faculty member that they will be able to weather student resistance to innovative teaching methods.

In 1999, 16 faculty mentioned student end-of-course evaluations in response to the same question. Thus, there were more overall comments but fewer comments about student end-of-course evaluations in 1999. One faculty member seems to try to articulate the dilemma identified from the 1997 data:

> *"The student critiques that are used to judge faculty may be having a detrimental effect on the quality of teaching."* (#392, 1999)

Again, there is a sense that fear of poor evaluations leads faculty to engage in teaching practices that will not attract negative attention. Only four faculty respondents in 2002 commented about student end-of-course evaluations, and two of those comments were positive comments describing high student evaluation marks. The multiple administrations of the survey occurred over a span of five years, and these findings suggest that faculty shifted their perceptions about student evaluations during that time.

4.2 Many faculty claim that administrators care little about teaching, but "pay it lip service"

There was a sense that university leadership says teaching is important but fails to reward it, as expressed in 29, 23, and 10 comments in the three successive surveys. There was surprising consistency in the words used to express this problem, with the phrase "lip service" used often.

> *"[Teaching] is important personally to many of the faculty but gets only lip service from administration. Lousy teaching is punished by the dean, but superior teaching is usually ignored or resented for the popularity it engenders for the individual instructor."* (#23, 1997)

Based on this quote, while the Dean acts as an authoritarian in enforcing the cultural rejection of substandard teaching, faculty peers act to suppress teaching that stands out for its quality. Faculty also articulated the overvaluation of research and the undervaluation of teaching:

> *"At a research university, research is the only item that really matters. If a faculty member is obtaining significant grants, he/she may not even be required to teach! Those who only teach are treated as second-class citizens. They are considered intellectually second-class and their salaries reflect the true value placed on their services by the administration."* (#270, 1999)

One faculty member wrote in 2002:

> *"The administration doesn't take teaching seriously, even though they claim to do so. Spending time on teaching is suicidal for a career."* (#32, 2002)

Faculty perspectives from 1997 through 2002 are rife with disincentives to quality teaching.

4.3 Nevertheless, many spoke positively about their campus' commitment to quality teaching

Some faculty thought their college, colleagues, and department were doing a better-than-average job of teaching. In 1997, there were 21 comments that expressed positive views of teaching on their campus, about 14 percent of the total comments that year. One faculty member commented:

> *"An effective teacher can do well here, even if they are only average at research. That is not the case at many schools."* (#149, 1997)

Many faculty who made positive comments in 1997 echoed the expectation that this was atypical in the university setting. Another said:

> *"The College of Engineering is truly committed to providing a quality educational experience for the undergraduate students, and I believe they generally achieve that goal."* (#440, 1997)

In 1999, the number of positive comments increased to 45, or 23 percent of those who commented, and the most of all 3 surveys. These faculty thought their department or college was doing a good job of recognizing quality teaching and supporting its importance. One faculty member states:

> *"Teaching is the primary mission and the faculty respects this. Research is a tool to complement teaching of new science and ideas."* (#24, 1999)

The comments were less likely to express this as being uncommon or unusual. Some faculty expressed the importance of being a good teacher in the promotion process:

> *"It is the 'ticket of admission' to our faculty; if you're not devoted to it and good at it, you don't get appointed, tenure, promoted, raises."* (#99, 1999)

There were 22 positive comments about quality teaching in 2002, about 19 percent of the total comments.

> *"I believe teaching is considered of high importance in this institution, with its land grant state university character, and I like that. I believe overall teaching quality to be quite high as well."* (#183, 2002)

4.4 Diverse perspectives on quality teaching are evident

The perspective that highly skilled researchers are automatically highly-skilled teachers as well was found, even in the 2002 survey:

> *"Students want to be taught by the very best and work in state-of-the-art labs. . . any student would choose being taught by a technical leader in the field instead of someone who has won all the teaching awards but is mediocre technically."* (#70, 2002)

Another faculty member states:

> *"Students want to be taught by world-class experts and world-class experts enhance teaching through their research."* (#93, 1999)

These comments indicate a belief that subject matter expertise is the predominant requirement of a great teacher, typical of the content-focused notion of "covering the syllabus" expressed by a 1997 respondent:

> *"I feel that we need to encourage nontraditional methods but not at the expense of content."* (#21, 1997)

Faculty with this perspective see a trade-off between the efficiency of lecture-based methods and the effectiveness of other methods, but do not value the improved learning outcomes offered by the latter.

4.5 Faculty awareness of and pressure to use student-centered methods increased

Particularly in the later surveys, faculty comments indicate an increasing awareness of and even pressure to use student-centered teaching methods:

> *"I think the emphasis on group work, active learning, multimedia, etc. is misplaced and often a detriment to giving our students a quality education."* (#54, 1999)

Another professor shared:

> *"So much time is spent on activities in class that far too little real new material is presented. . . a professor should profess—pass on knowledge to their students. Much of today's classroom activities should be done by students on their own, not in the classroom. When this university decides to award a diploma to a team of students, then I will consider teamwork important. At present, teamwork is used to coddle students."* (#333, 2002)

This professor thinks that teamwork is not an effective teaching approach despite much research

that shows that collaboration is much more effective for deeper learning of the material.

This is in contrast to the 1997 administration, in which active learning was not mentioned in the comments. Another faculty member in 1999 also seemed to respond to pressure to adopt new methods—in this case, to adopt certain kinds of educational technology:

> *"There is more than one method for successful teaching. . . I believe in person-to-person teaching and not in computer teaching."* (#81, 1999)

By 2002, more extensive use of pedagogical terms such as "active learning" and "cooperative learning" is evident. Some faculty in 2002 were confident enough in their grasp of nontraditional teaching methods to recommend changes to the design of the survey:

> *"I take issue with your use of "active learning" for a particular teaching technique. However we teach, active learning is the ONLY real learning there is."* (#107, 2002)

These findings taken collectively suggest some interesting lines of inquiry. While the comments indicate that there is still a negative institutional culture as modeled by administrators with respect to teaching, the faculty are developing an awareness of nontraditional teaching methods and even, in some cases, passionate reactions to them—both positive and negative. This is consistent with the first of the subculture groups identified in Serow's work—it may be that one of the Coalition's achievements was helping such a community to form.

4.6 Climate analysis in 2014

The data was grouped into quadrants as shown in Table 1. Quadrant 1 included faculty reporting that they use non-traditional teaching techniques and have a supportive environment for non-traditional teaching. Faculty in Quadrant 2 use non-traditional teaching methods in a non-supportive environment. Faculty in Quadrant 3 use traditional teaching techniques even though they are in a supportive environment for quality teaching, and faculty in Quadrant 4 use traditional teaching in an environment that is non-supportive for quality teaching.

The researchers collected 97 surveys, but only 77 survey responses could be classified into one of these quadrants, and 48 percent (37 comments) of them gave comments at the end of the survey. Those that could not be classified included those who responded N/A or neutral scale responses (scores of 3, 4, or 5 on the 7-point scale). Quadrant 1 included 10 percent of respondents, Quadrant 2 had 22 percent, Quadrant 3 had 52 percent, and Quadrant 4 had 16 percent.

4.6.1 Quadrant one: non-traditional teaching and supportive environment

The first quadrant includes faculty who reported using non-traditional teaching techniques—putting students into small groups for most of the class period to answer questions or solve problems, require students to work in teams (2 or more) to complete homework, and/or giving writing assignments (an exercise that requires verbal explanations and not just calculations). Faculty in this quadrant tended to avoid lecturing for most of the class period and assigning homework to individuals (as opposed to teams). This was the smallest group, perhaps because it is harder to find an engineering department that supports quality teaching and does non-traditional teaching techniques in their classrooms. This faculty describes how institutional support comes from the department and department chair:

> *"I think the department values the quality of teaching in undergrad classes but the Dean's actions re-rewarding research disproportionately to teaching puts the dept. at odds with the Dean in this area."* (#97, 2014)

Thus, even though these professors report a supportive environment in the survey, they still talked about non-supportive environments, such as:

> *"Quality can be improved immediately by. . . providing time, money, and support staff (true support staff, not administrators) to professors to implement their good ideas. . ."* (#66, 2014)

This faculty member is referring to quality teaching, and is pointing out that quality teaching is not rewarded but another faculty member views quality teaching as a personal commitment to students and feels that they are getting support from the institution in other ways:

> *"It's valued, just not explicitly rewarded. This does not impact my choices about teaching—I have my own goals, and I try to reach them."* (#72, 2014)

Table 1. This table shows the quadrants of the faculty's teaching techniques and environments

	Supportive Environment	**Non-supportive Environment**
Non-traditional Teaching	**Quadrant 1**: Non-traditional Teaching & Supportive Environment	**Quadrant 2**: Non-traditional Teaching & Non-supportive Environment
Traditional Teaching	**Quadrant 3**: Traditional Teaching & Supportive Environment	**Quadrant 4**: Traditional Teaching & Non-supportive Environment

Another faculty member shares how quality teaching does not help them get promoted:

> "While its impact on promotion and tenure is still slight, the emphasis is growing" (#94, 2014).

4.6.2 Quadrant two: non-traditional teaching and non-supportive environment

Quadrant two captures the perspective of faculty who report using non-traditional teaching methods in spite of a lack of institutional support. Every comment that was collected in this group said something about not being supported by the department, department head, or top administrators. The way this was coded in the survey suggests that the faculty felt strongly the lack of support from at least two of the four options, which were colleagues, department head, dean, or top administrators. The faculty had the option to rate each one from low (not important) to high (extremely important) and were given an option to not report (N/A).

4.6.2.1 Department head
One faculty member said:

> "Engagement with UGs in the classroom is not a high priority for my Head compared to research productivity, so the quality of the experience for our students is left to the intrinsic drive of the faculty." (#90, 2014)

Another expresses a similar view:

> "I have been personally been told by the Head of our Department, that the research is the most important aspect for promotion. . . That view is not held at higher administration, like the Dean and University who value teaching more." (#92, 2014)

The latter faculty member reported a low score for the colleagues and the head of the department, and high scores for the dean and top administrator. The perception of the department head's attitude toward quality teaching and colleagues is not supportive of quality teaching.

4.6.2.2 Colleagues
Another faculty member in this quadrant explains why they think their fellow colleagues are not focused on quality teaching, but gives colleagues and department head a higher score than the dean or top administrator:

> "My department includes faculty who are deeply concerned about undergraduate student learning, some of whom still engage in practices that run counter to their values for various reasons . . . high research expectations. . . more frequently and more loudly voiced than the institution's expectations regarding teaching . . . demands on faculty time can make faculty time-management a frantic activity that lacks focus outside of the development of a research program. Others. . . prefer to devote their energies to graduate education. Although I mentor graduate students, I teach

> exclusively undergraduate classes and seek to develop academic relationships that will have an impact on their lives." (#95, 2014)

Another faculty member talks about their colleagues saying:

> "Most faculty care deeply about teaching, but there are strong disincentives to spending more than minimal time on it. Few faculty have a professional attitude towards teaching in terms of seeking to improve their teaching systematically." (#56, 2014)

4.6.2.3 Dean
A faculty member explains how their dean has had a negative impact on the climate for quality teaching:

> "For our college, it is dismal. Our Dean is contemptuous of teaching and only cares about research and rankings. Over the years the Dean has inculcated an atmosphere consistent with a disdain for teaching. Respect for teaching is currently at its lowest ebb in my career." (#29, 2014)

4.6.3 Quadrant three: traditional teaching & supportive environment

Quadrant three could be mistakenly characterized as an environment that is supportive of faculty teaching, but not quality teaching. The survey asked: "How important is teaching *quality* to each of the following. . . ," in which teaching quality could be interpreted differently by different people [35, 41]. The definition of teaching quality was clarified: "Setting high but attainable standards for learning, enabling most students to meet or exceed those standards, and producing high levels of satisfaction and self-confidence in the students." Over half of faculty were in this quadrant, reporting that they were using traditional teaching techniques although they were in a supportive environment for quality teaching.

4.6.3.1 Passionate teaching
Many faculty in this quadrant reported being passionate about teaching, although their teaching techniques were reported as traditional:

> ". . . many of us have a personal mission to do a great job teaching and take great satisfaction from educating and motivating our students and helping them reach their educational and career goals." (#14, 2014).

Faculty show signs of pressure to move away from traditional approaches to teaching, such as lecture-focused teaching techniques, yet still think that a traditional lecture-style teaching is still the best way to teach:

> "I have observed an increased use of active learning and moderated group discussions in class. While these appear to be more engaging learning experiences, they are being overused. A course needs a balance of both formal lectures and in-class learning exercise. Right now, there

is an emerging climate that formal lectures are taboo, while prepared lectures with relevant content to the students are still a highly successful means of education." (#21, 2014)

4.6.3.2 Evaluations

In the previous comments from the surveys collected in 1997, 1999, and 2002, there was a decrease in the negative comments about student evaluations, but there seems to be more concern about student evaluations in the 2014 data. This could be because these are faculty from different schools, or that in the intervening 12 years concern has grown. The faculty views from 2014 bring up past concerns that the student evaluations are not helping to maintain quality teaching, but rather forcing professors to give out "easy A's":

"Faculty who do not give out an easy A will get lower evaluations. And evaluations are taken into account for tenure and promotion, so therefore faculty will do what is necessary to make the students happy; which has led to grade inflation. . . courses have become considerably easier. . . It would be best to only use evaluations in a personal manner, as constructive feedback, and not in a punitive manner, which hurts both faculty and the top students." (#40, 2014)

One faculty member returns to earlier notions that question what student evaluations measure, regardless of significant evidence that student evaluations of teaching correlate well with other measures of teaching effectiveness [39]:

"Quality of teaching cannot be measured with end of semester evaluations. So at this point in time, we have not implemented ways of measuring the quality of teaching by individual faculty. . . We need to stop assuming 'popularity surveys' are the same as 'quality of teaching'." (#68, 2014)

4.6.3.3 Supportive environment

One faculty member talks about the supportive environment:

"Very strong department in supporting new ideas to test in the classroom (which is great, because that's what I've always done)." (#18, 2014)

Another talks about the environment, but does not relate it to personal experience:

"More teachers are interested in teaching well... willing to change how they teach... willing to be reflective about what they do in the classroom." (#22, 2014)

One faculty member admits that they are in a different environment than their peers at another campus, which puts them in a position to teach with less pressure from colleagues or upper administration to fit in or teach counter to their beliefs:

"I don't teach at the main campus, but in a partnership program at another university. As a result, I teach in a very different environment than that of my employing

institution. I have very small class sizes and am able to do far more hands-on work with my students." (#51, 2014)

One faculty member says the overall environment is not supportive to quality teaching:

"It is my impression that the focus on quality teaching (which was always much, much lower than on research funding and publications) has only continued to decrease throughout the years. I do not feel encouraged to teach to my best ability, but rather to try this, or try that, or metric this, or rubric that. As I read about other campuses, I see that I am not alone in this perspective. If the mission of a university is teaching, then we need to do better. If the mission is NOT teaching, then we need to stop lying to ourselves and our students." (#91, 2014)

4.6.3.4 Administration

Many faculty see top administrators working against them, rather than helping make quality teaching happen in the classrooms. This particular faculty member rated their colleagues and department head very high for being supportive, and reported using traditional teaching techniques:

"They [faculty] seem to either enjoy teaching or view it as a burden. . . Few are the faculty that can strike a good balance between the myriad of responsibilities they have. . . bureaucracy (administration) grows uncontrolled while adding nothing to the quality of teaching. Indeed it often detracts from our commitment to our students—wasting our time 'bean counting' to prove some 'innovative' pet program or to justify our jobs to administrators. . . We pay our administrators to make our job easier when in reality they do the opposite." (#36, 2014)

The next quote shows that individual faculty members have a personal commitment to teaching, and are getting lip-service from the administration, which was reported often in 1997, 1999, and 2002:

"Teaching remains very important to most faculty. This is fortunate, because it is of decreasing functional importance to school administration. While everyone feels compelled to _say_ that they value teaching, measures of financial and facilities support reveal its ever decreasing importance in the eyes of administration." (#77, 2014)

4.6.4 Quadrant four: traditional teaching & non-supportive environment

Quadrant four includes faculty who reported using traditional teaching techniques in a non-supportive environment for quality teaching. Faculty in this group could be reporting their lack of support for the teaching methods they are using. There were very few comments from this group, but the faculty that did comment shared about the non-supportive environment, and the comment that follows is telling of the faculty's views of quality teaching:

"Our campus does not care in the least bit how much students learn in a course and simply care about the student evaluations which lead to easy classes and

graduates with poor knowledge. The easiest way to get a good evaluation is to make students think they have learned a lot through assignments and tests that very closely correlate to HW and in class examples. This approach while rewarded at the university does not teach the students problem solving or challenge their capabilities to maximize knowledge transfer." (#6, 2014).

Lip service was a common theme in each of the previous surveys from 1997, 1999, and 2002 and the term showed up in the comments in this quadrant as well:

> *"Lip service given, but resources to support teaching continue to be cut."* (#8, 2014)

Faculty from Purdue University in the COACHE survey reported the need for more clarity from administration in the expectations for tenure and promotion policies [43], which is along the same lines as some of these research findings. Another faculty member sees lip service having contributed to these different metrics of self-satisfaction:

> *"Teaching has always been given a lot of lip service, but the interesting thing is that of late it appears there really is interest in it but with different metrics. The main change is from technical competence to self-satisfaction. The level of competence has declined dramatically, it is very evident and could be measured if there were interest."* (#89, 2014)

This faculty member remains concerned about content even though surveys of employers consistently indicate that students' technical skills are adequate, whereas there is greater need to improve students' professional skills.

4.7 Future work

Identifying changes in how faculty perceive the quality and importance of teaching may help engineering education researchers better understand the process of change and its time constant, and perhaps how to foster further change in the attitudes and practices of engineering faculty with respect to non-traditional pedagogies. This understanding should be of particular value in the design and implementation of faculty development programs. Faculty development programs need to account for institution-specific and department-specific climate concerns to understand and help develop faculty's skills as educators. Faculty in this research all received the same survey, and many chose to write in the last comment box about the climate for teaching quality at their institution. This is an indication the climate is foremost in the minds of many faculty as they consider what pedagogical techniques to use in their classrooms. Faculty developers and researchers should consider assessing the development of the institutional and departmental climate for teaching quality, where they can build a supportive environment around quality teaching. This might suggest development workshops for institutional and departmental leadership and institution-level incentives to encourage a positive climate. More research is needed to see how an effective faculty development program can create systemic change within an institution or department for the use of higher quality teaching.

5. Conclusions

The comments and themes identified show diverse beliefs about how the university acknowledges the quality and importance of teaching on campus and consistently demonstrate that the climate for teaching has an effect on engineering faculty's pedagogical decisions. The comments reported above from 1997, 1999, and 2002 show a shift in engineering faculty's perspective of the quality and importance of quality teaching through the changes seen in their comments regarding student evaluations. In 1997, there were many negative comments about student evaluations, and by 2002, there were only four such comments, and two of those were positive. It is encouraging to consider the possibility that such a change in attitude could be effected in only five years, although this research cannot necessarily attribute that change to the SUCCEED Coalition or its programs. While it is challenging to compare the comments from earlier administrations to the comments in 2014 because two-thirds of the comments were from different institutions, the continued use in 2014 of the term "lip-service" that was prevalent in the earlier administrations is further evidence that some aspects of the culture are resistant to change.

The conclusions from the 2014 survey results were compelling. Very few participants felt they are in an environment that is supportive of the non-traditional pedagogies they use. Participants using non-traditional methods were aware of the lack of support and articulate how uncomfortable the climate is for their choice in pedagogy. There are many engineering faculty using traditional methods in a supportive climate for teaching and are defensive about their choice in pedagogy, expressing strong beliefs that traditional teaching methods are still the best way to teach. They accused the administration of changing metrics capriciously, so they feel some administrative pressure to change. The faculty in the most uncomfortable position were those continuing to use traditional methods, even though the climate was supportive of a transition to non-traditional methods. It is not clear whether they feel unsupported because they are using traditional teaching techniques or they are struggling because there is a poor fit between them and the department and/or institution. All groups of

respondents had some complaints about the administration, although they did not use the term lip service as often as the 1997, 1999, and 2002 group did. There is tension between the climate at the institution and engineering faculty's choice of pedagogy that was shown through the comments in 2014.

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