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ORIGINAL RESEARCH

## Academic Anesthesiologists Perceive Significant Internal Barriers to Intraoperative Teaching in a Cross-Sectional Survey

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### INTRODUCTION

In 2012, the Accreditation Council for Graduate Medical Education (ACGME) instituted a program to monitor and improve the learning environment in graduate medical education called the Clinical Learning Environment Review (CLE or CLER).<sup>1</sup> It was developed with the goal of developing competent physicians while maintaining the delivery of high quality, safe patient care. While previous definitions of the learning environment were broader and more encompassing, the overarching concepts still hold true.<sup>2,3</sup> The people involved in teaching and learning, local culture, physical space where learning occurs, regulatory and institutional policies that govern or affect their interactions, and leadership support all contribute to the effectiveness of the CLE.

For example, cultural factors such as the approach to teaching and time spent teaching affect faculty-resident interaction. The physical space may hinder clinical teaching through noise, inadequate privacy for provision of feedback, or the lack of space for nonbedside instruction. Departmental and regulatory policies may encourage faculty presence at key moments but may also limit the number of attempts by the learner for procedures. Leadership support may include faculty development courses on instruction. In addition, leadership support may attempt to ameliorate production pressure in this era of increasing and novel administrative demands on physician time.<sup>4</sup> In total, the people, the curriculum (defined broadly as

“everything that happens in a department”), and the physical space make up the CLE.<sup>5</sup>

Many attempts to improve bedside teaching begin with the faculty, as most lack formal training in teaching.<sup>3,6,7</sup> Systems-based approaches to improve teaching through changes in the CLE must also be undertaken but elucidating faculty perspectives on and perceived barriers to effective teaching is a necessary first step.<sup>2,3,7</sup> Trainee perspectives on CLE have been previously evaluated, and these studies may provide guidance for individual—but not systemic—improvement.<sup>8,9</sup> Surveys of faculty perspectives on the CLE may also be collected by the local institution or regulatory bodies.<sup>10</sup>

While local surveys are the mainstay of improving local teaching quality and the CLE, a multicenter and anesthesiology-specific survey should identify common perspectives and may help guide subsequent broader anesthesiology faculty development discussions and research. We seek to explore differences in faculty attitudes toward teaching and the clinical learning environment, stratified by location and different demographic groups. This study was designed to identify barriers to teaching that are common to our institutions and to our specialty of anesthesiology.

### MATERIALS AND METHODS

We followed STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) guidelines, recommended by the EQUATOR network, from concept to completion of this study.<sup>11</sup>

Four anesthesiologists at four tertiary academic medical centers (University of Texas Southwestern Medical Center (UTSW), University of Pennsylvania/Children’s Hospital of Philadelphia (UP/CHOP), University of Michigan (UM), and Massachusetts General Hospital (MGH)) partnered in surveying their faculties to identify perceived barriers to teaching. IRB exemption for this survey was obtained at all four sites.

Topics were selected based on review of existing literature on the teaching environment.<sup>2,5</sup> Survey topics were adjusted to fit the unique characteristics of anesthesiologist intraoperative teaching of resident physicians. Questions were derived in an iterative fashion with input from the four authors until consensus was obtained, in keeping with existing item generation recommendations.<sup>12</sup> The surveys were then pre-tested with faculty involved in education at each site for content and usability, and further modifications were made. The resulting survey included 4 demographic questions, 35 questions using Likert-style scales assessing faculty anesthesiologists’ perceptions of their teaching and learning environment, and one other question. All survey questions are presented verbatim in Tables 2 and 3, with Likert-style choices of “Strongly Agree,” “Agree,” “Neither Agree Nor Disagree,” “Disagree,” or “Strongly Disagree.”

Investigators at each site obtained a roster of faculty who had some role in clinical teaching of resident physicians.

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Departmental chairs and education directors at each site introduced this survey to the faculty on March 16, 2015; the survey was then distributed electronically via e-mail to each individual faculty member through REDCap.<sup>13</sup> Weekly e-mail reminders were sent for four weeks (March 20 and 27, and April 3 and 10, 2015) synchronously at each of the four institutions by the co-investigator at the respective site. Survey submissions were anonymous and confidential.

Survey questions were grouped into six categories by the authors for data analysis. The categories were faculty perceptions related to (1) the environment, (2) the resident, (3) role in engagement and teaching responsibility, (4) enjoyment of teaching, (5) self-efficacy in their teaching (defined as “belief about his/her ability and capacity to accomplish a task”<sup>14</sup>), and (6) preparedness of teaching (Table 4). Data from each category were subjected to principal component analysis to define more specific subcategories, and reliability was assessed using the Cronbach  $\alpha$  if they included five or more elements with values  $> 0.6$  being deemed acceptable for this exploratory study.<sup>12,15</sup> Please refer to Table 4 for detailed descriptions of each category and sub-category. Principal component analysis produced a z-score for each respondent for each category and subcategory, allowing for weighted comparisons of responses by each demographic group using *t* tests. Survey responses in each category were analyzed using ANOVA, and correlations between categories were analyzed by Pearson correlation. The independence of these associations between categories was tested using linear regressions.

Data were analyzed using IBM SPSS 24 (IBM, Armonk, NY). For ease of analysis, demographic variables were dichotomized as follows: fellowship training (yes/no), multiple fellowships (yes/no), and experience ( $>10$  years,  $\leq 10$  years), full-time employment (defined as 4 or more workdays per week) (yes/no), clinical time spent primarily with residents (yes/no), and mostly clinical (as opposed to nonclinical) appointment (yes/no).

## RESULTS

Of 566 academic anesthesiologists who received survey invitations, 230 surveys were returned (40.6%), of which 228 were complete (Table 1). All data was sent to the University of Michigan for collation and analysis. The full survey and its results are presented in Tables 2 and 3. Statistically significant differences among sites were found for 6 questions (A3, A12, A14, B4, B8, and B10). Twenty-one of the 35 Likert questions had a majority of respondents in one category (agreement or disagreement). Sixty percent of faculty report feeling significant clinical production pressure, and 37.5% feel that this precludes education. A notable proportion of faculty report not having time to teach (33.3%) or covering multiple rooms makes them unable to focus on the resident (30.7%). Faculty perceive that departmental leadership is supportive, with 76.8% reporting that their departmental chair supports teaching, and 82.9% reporting that the daily anesthesiologist in charge (the “board runner”) supported time for teaching.

A majority of respondents agreed with the following statements: On the night before they work together, they use a pre-operative phone call with their resident to teach; they feel they have something to teach, they enjoy teaching, they take responsibility for initiating teaching, and they return during the maintenance phase of the anesthetic to teach; they have prepared mini-lectures or didactics for use in the operating room; they would like to improve their teaching and would attend seminars to do so; residents seem receptive to and are interested in their clinical teaching; teaching is not burdensome, and their departmental chair supports their teaching.

Respondents at the four sites were similar with regard to their time spent teaching and work patterns (Table 1). They differed in years of experience and whether they were fellowship trained generally and, more specifically, in pediatric anesthesiology and pain management. No statistically significant difference was seen in time spent teaching by institution or by comparison using any other demographic category. There were no differences in reported time spent teaching in junior ( $< 10$  years’ experience) as compared to senior

faculty; part-time compared to full-time; those with mostly clinical appointments compared to those with mostly nonclinical appointments, and between those with fellowship training and those without.

Principal component analysis identified sub-categories for the environmental category and for the engagement and responsibility category (hereafter termed “responsibility”) (Table 4, Supplemental Table 1). Reliability was acceptable ( $\alpha > .6$ ) for the three categories tested; the remainder had too few questions to be meaningfully tested. Of the 15 categories and sub-categories of questions, there were differences between institutions of 7 by ANOVA ( $P < .05$ ) (Table 4).

Independent sample *t* tests using dichotomized demographic variables and each principal component revealed the following differences (Figure 1). Junior faculty reported more proactivity. Fellowship-trained faculty had more prepared teaching materials, which was an independent factor by linear regression. Faculty who spent  $>50\%$  time working clinically reported a less supportive environment and lower prioritization of teaching as compared to those with primarily nonclinical work time, which were independent factors by linear regression. There were no differences between those who were full- or part-time, or between those who work primarily with residents and those who work primarily without residents. Those who reported above average teaching time ( $>30$  minutes) reported a greater prioritization of teaching, greater enjoyment, more preparedness, and a greater perceived self-efficacy in teaching than those who spent less time teaching (Figure 2).

Moderate-strength correlations were found between prioritizing teaching and each of the following components: faculty perceptions of self-efficacy in teaching, enjoyment, a supportive environment, preparedness, and resident (Supplemental Table 2). Using linear regression, all were found to have independent effects except for “resident.” Prioritizing teaching was also independently associated with spending more than 30 minutes spent teaching. Other correlations included enjoyment with self-

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efficacy in teaching, preparedness with self-efficacy in teaching, and a supportive environment with resident receptivity to teaching—all independent factors by linear regression. More than 30 minutes spent teaching was correlated with self-efficacy in teaching and prioritizing teaching, which were independent factors by linear regression, and with enjoyment, which was not independent by linear regression. No other moderate-strength correlations were found.

## DISCUSSION

In this multicenter survey of anesthesiologists at tertiary academic centers, a high degree of uniformity was found between centers. Results of this survey can be used to support behaviors for academic anesthesiologists as being normal in our centers. For example, a majority of faculty feel that discussion of cases the night before is necessary, and they also return to the operating room to teach after induction of anesthesia. Respondents exhibited a high degree of engagement with their role as educator. They varied widely in their level of experience and training, in their administrative or other nonclinical work commitments, as well as in full- or part-time status. Site differences related more to aspects of production pressure and availability of teaching seminars.

This study was undertaken to help elucidate the barriers to teaching with the expectation that the greatest barriers to teaching would be factors in the CLE *external* to the faculty. These would include the local culture, environment and, most notably, clinical production pressure. Operating room efficiency drives overall hospital revenue,<sup>16</sup> thus, the pressure to improve clinical throughput and increase revenue has and will continue to encroach on nonclinical priorities such as education, research, and quality improvement. Those with primarily clinical appointments felt that the environment was less supportive to teaching, which may be due to the daily experience of the difficulty of clinical production pressure.

Barriers to teaching that are *internal* to the faculty were surprisingly common. These internal barriers included their knowledge

and attitudes toward giving feedback, their teaching role, and residents. Less than half of faculty reported knowing what summative and formative feedback were, and only 30% provided daily feedback to residents. Nearly half said they did not have time to provide feedback at the end of the day, while 40% said they only provide feedback when there is a deficiency. Providing feedback is a hallmark of high-quality instruction in anesthesia and a cornerstone of graduate medical education.<sup>6</sup> Notably, half of faculty worried about the repercussions of delivering negative feedback, and a minority (17%) did not feel supported by leadership to give formative feedback. This concern is widely known in academic anesthesiology and particularly relevant as many departments use resident evaluations of faculty as performance metrics for incentives and promotion. The concern with retaliatory behavior may be reduced by having faculty members submit confidential or anonymous written evaluations about residents. However, expressions of anger, frustration, and other nonverbal communications may indeed affect assessment of faculty teaching behaviors.<sup>17</sup>

Only 58.5% of faculty felt that their teaching was of adequate quality. Notably, faculty who were fellowship trained describe more comfort with teaching and may be attributable to an increased grasp of knowledge or enhanced pedagogical preparation during the additional training. Faculty self-efficacy had positive associations with enjoyment of teaching, prioritization of teaching, and having prepared materials to use in teaching. Furthermore, enjoyment of teaching was not independently associated with a greater amount of time spent teaching. This suggests that faculty invest time in teaching for the benefit of the residents and not for themselves.

Perceptions of resident receptivity to teaching was independently associated only with perceptions of the environment as a whole. This may represent a halo effect and indicates that the overarching quality of the CLE depends more on leadership, clinical production pressure, and faculty factors. In short, the residents are not to blame (or credit).

Faculty development that focuses on

clinical instruction and feedback skills may therefore provide improvements in faculty perceptions of multiple facets of the CLE. These workshops, however, should promote educational opportunities in personal areas of interest and focus on the development of strengths.<sup>18</sup> Job crafting, or the selection of duties that better fit one's interests, may allow for the most effective and efficient use of faculty for teaching, so long as the specific needs of the learners are met.<sup>19</sup>

Strengths of this study include the multicenter design with attempted 100% cross-sectional sampling and repeated reminders by departmental leadership for survey completion. Additionally, the robust item generation methodology, survey pre-testing, and lack of strong correlations between different domains of questions argue for high face and content validity.<sup>12</sup>

We acknowledge that a limitation is the use of a convenience sample with low response rate (40.6%). The results of this study may not be generalizable to faculty of smaller departments whose clinical and educational milieu differ from the institutions sampled. Inherent in a study such as this is self-selection bias, so the results may reflect the practice of more proactive faculty. While this may be perceived as skewed data, some may argue that it is precisely the insights of these faculty that are invaluable when focusing resources to improve pedagogical skills in motivated and unmotivated faculty alike. In the least, despite the low response rate, the variability in responses exposed the several important interactions between attitudes toward the CLE, which merit further study. Minor limitations of this work include the lack of validation or reliability testing of the survey instrument prior to use and the use of less than 5 questions to sample several domains, which limited reliability testing.

In conclusion, academic anesthesiologists at four sites expressed a high level of engagement in their teaching role and enjoyment of teaching while also describing the negative impact of clinical production pressure on teaching. Faculty self-efficacy in the teaching role had myriad positive effects on their perceptions of other aspects of the teaching environment. These results imply that mitigating clinical production

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pressure and offering faculty development courses that focus on teaching skills and faculty engagement with the teacher role present the best avenues to improve faculty perceptions of the environment in which they teach. These efforts aimed at faculty development and at reducing production pressure may also increase time spent and the quality of teaching by the faculty.

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## Abstract

**Background:** Academic anesthesiologists have numerous demands on their time, and this can erode teaching quality. Reducing barriers to teaching may ameliorate this. The primary aim of this study is to evaluate the learning environment and identify barriers to clinical teaching using a multicenter survey approach.

**Methods:** Anesthesiologists at four academic centers were surveyed to understand barriers to clinical teaching. Demographic data and time spent teaching were collected. Faculty attitudes regarding teaching, resident physician perceptions of their teaching, supportiveness of departmental and operating room leadership, whether they enjoyed teaching, and the perceived quality of their own teaching (“self-efficacy”) were assessed using Likert scales. Principal component analysis was performed to identify themes in these data. Pearson correlation, t test, and linear regression analyses were used to evaluate interactions between themes.

**Results:** The response rate was 40.6% (230/566). Responding faculty expressed a high level of engagement with the teaching role. Clinical production pressure was a common theme. Faculty who spent more time teaching reported greater enjoyment of teaching, feeling better about their teaching, and were better prepared to teach. Enjoyment of teaching was not independently associated with more time spent teaching. Regression analysis revealed that perceptions of environmental factors (including production pressure) had no independent effect on time spent teaching or on self-efficacy in teaching quality. Faculty self-efficacy was positively related to enjoyment of teaching as well as making teaching a higher priority.

**Conclusions:** Improving perceptions of the learning environment might be best achieved by mitigating production pressure and improving faculty self-efficacy in their teaching.

**Key Words:** Anesthesiology, faculty, surveys and questionnaires, education, medical, graduate, clinical, teaching & learning

# Figures

**Table 1.** Respondent Demographics

	MGH	UM	UP/CHOP	UTSW
Surveys received/sent (%)	36/134 (28.9)	50/130 (38.5)	73/159 (45.9)	70/143 (49)
Years of experience, no. of respondents (%)				
< 5	5 (13.9)	18 (36)	17 (23.3)	21 (30)
5–10	6 (16.7)	18 (36)	18 (24.7)	17 (24.3)
10–15	9 (25)	5 (10)	6 (8.2)	10 (14.3)
15–20	4 (11.1)	4 (8)	5 (6.9)	8 (11.4)
> 20	12 (33.3)	5 (10)	27 (37.0)	14 (20)
Number of respondents with 0.8 or greater FTE appointment (%)	26 (83.9%)	30 (75.9%)	48 (81.4%)	46 (85.2%)
>50% of appointment is clinical	28 (90.3%)	37 (94.9%)	54 (91.5%)	50 (93.6%)
Work primarily with residents/fellows	28 (90.3%)	37 (94.9%)	53 (89.8%)	45 (83.3%)
Any fellowship training	28 (77.8%)	36 (72%)	63 (86.3%)	43 (61.4%)
Pediatric	6 (16.7%)	16 (32%)	45 (61.6%)	11 (14.1%)
Cardiac	8 (22.2%)	4 (8%)	10 (13.7%)	13 (18.6%)
Critical care	7 (19.4%)	9 (18%)	12 (16.4%)	8 (11.4%)
Pain medicine	5 (13.9%)	1 (2%)	3 (4.1%)	11 (15.7%)
Obstetric	1 (2.8%)	2 (4%)	4 (5.5%)	2 (2.9%)
Regional	0	0	1 (1.4%)	3 (4.3%)
Other (anesthesiology)	3 (8.3%)	7 (14%)	4 (5.5%)	2 (2.9%)
Other (nonanesthesiology)	4 (11.1%)	0	3 (4.1%)	2 (2.9%)

Faculty grouped by institution differed in years of experience as well as whether they were fellowship trained generally and, for 22 surveys, trained specifically in pediatric anesthesiology and pain management (ANOVA,  $P = .001$  and  $.007$  and  $\chi^2$ ,  $P < .001$  and  $= .016$ , respectively)

## Figures continued

*Table 2. Likert-type Portion of Survey*

No.	Question	Strongly Agree or Agree (%)	Strongly Disagree or Disagree (%)	Neither (%)	Category
A1	I use the pre-operative phone call as an opportunity for resident education.	74.6	8.3	17.1	Engagement and Responsibility
A2	It is sufficient for the resident to leave a voice mail or e-mail with our cases for the next day without having a discussion.	11.8	61	27.2	Engagement and Responsibility
A3	It is my responsibility to initiate teaching in the operating room while working with the residents.	78.5	7.4	14.1	Engagement and Responsibility
A4	It is the resident's responsibility to ask for intra-operative teaching while working with me.	46.4	25.4	28.2	Engagement and Responsibility
A5	I have mini-lectures/didactics I provide to my residents while working with them in the OR.	67.6	16.6	15.8	Preparation
A6	I have references that I provide to my residents while working with them in the OR.	60.1	17.1	22.8	Preparation
A7	I enjoy teaching residents in the operating room.	85.6	3.5	10.9	Enjoyment
A8	Teaching residents in the operating room is burdensome.	10.9	68.4	20.7	Enjoyment
A9	I do not teach in the operating room.	1.7	92.5	5.8	Engagement and Responsibility
A10	Our department has a daily curriculum for intraoperative teaching topics that I can use to guide my teaching.	17.1	60.5	22.4	Environmental
A11	I feel my teaching is adequate in the quality of teaching I provide.	58.5	14.8	26.7	Self-Efficacy in Teaching.
A12	I would like to improve my teaching skills.	76.8	4.8	18.4	Engagement and Responsibility
A13	I would attend faculty development seminars to become a more effective clinical teacher.	72	11.3	16.7	Engagement and Responsibility
A14	The majority of my clinical teaching occurs during induction and emergence.	13.1	62.3	24.6	Engagement and Responsibility
A15	I make it a point to go into the OR during the maintenance phase of the anesthetic to teach my resident.	81.1	4.8	14.1	Engagement and Responsibility
B1	I do not have enough time to provide intra-operative teaching to my residents.	34.2	33.3	32.5	Engagement and Responsibility
B2	I am covering multiple rooms and cannot focus on the resident.	38.6	30.7	30.7	Engagement and Responsibility
B3	The emphasis on efficiency precludes resident education.	37.1	37.5	25.4	Environmental
B4	I feel like I have nothing to teach the residents.	4.3	89	6.7	Self-Efficacy in Teaching
B5	The residents are not receptive to my teaching.	8.7	70.6	20.7	Resident
B6	The residents do not seem interested in clinical teaching.	9.6	74.7	15.7	Resident
B7	I feel pressure from OR personnel to keep the day moving.	60.1	20.6	19.3	Environmental
B8	My institution provides seminars for faculty development in clinical teaching.	38.9	32.8	28.3	Engagement and Responsibility
B9	My chair does not support or encourage intraoperative teaching.	5.7	76.8	17.5	Environmental

## Figures continued

*Table 2. Likert-type Portion of Survey*

No.	Question	Strongly Agree or Agree (%)	Strongly Disagree or Disagree (%)	Neither (%)	Category
B10	The anesthesiology board runner does not support time for teaching.	17.1	50	32.9	Environmental
C1	I know what formative feedback is.	41.7	36.5	21.8	Engagement and Responsibility
C2	I know what summative feedback is.	39.2	40.5	20.3	Engagement and Responsibility
C3	I simply forget to provide formative feedback at the end of the day.	23.9	38.3	37.8	Engagement and Responsibility
C4	I do not have time to provide feedback at the end of my day.	23.1	48.7	28.2	Engagement and Responsibility
C5	I do not know how to effectively deliver formative feedback.	31.7	33.9	34.4	Engagement and Responsibility
C6	I worry about the repercussions of providing negative feedback on my teaching evaluations.	52.2	36.1	11.7	Environmental
C7	The residents are not receptive to the feedback that I give.	13.1	46.1	40.8	Resident
C8	I do not feel supported by my department leadership to give formative feedback.	17.4	49.6	33	Environmental
C9	I offer formative feedback to the resident on a daily basis	30	33.5	36.5	Engagement and Responsibility
C10	I only offer formative feedback to the resident when there is a deficiency.	23.4	40	36.6	Engagement and Responsibility

**No.** = Number; **Demo** = Demographics.

Likert-type scale options were “Strongly Agree,” “Agree,” “Neither Agree Nor Disagree,” “Disagree,” and “Strongly Disagree”; the column labeled “Agree” indicates the percent of respondents that “Strongly Agree” or “Agree,” and the labeled “Disagree” column indicates the percent that “Strongly Disagree” or “Disagree.”

## Figures continued

Table 3. Non-Likert Portion of the Survey

No.	Question	Options (results)
A16	How many minutes per day do you spend, on average, teaching your resident in the OR?	a. 0 minutes (1.3%) b. 1–15 minutes (10.1%) c. 16–30 minutes (29.8%) d. 31–45 minutes (22.8%) e. 46–60 minutes (20.2%) f. More than 60 minutes (15.8%)
D1	I am on faculty at _____.	a. Massachusetts General Hospital (15.7%) b. University of Michigan (21.8%) c. University of Pennsylvania (31.9%) d. University of Texas Southwestern Medical Center (30.6%)
D2	I have _____ years' experience as an attending anesthesiologist.	a. < 5 (26.5%) b. 5–10 (25.7%) c. 10–15 (13.0%) d. 15–20 (9.1%) e. > 20 (25.2%)
D3	For the following questions, please indicate, on average, the number of days/week you participate in the described activity: <ul style="list-style-type: none"> <li>• Clinical work (operating room, ICU, wards)</li> <li>• In the operating room with residents and/or fellows</li> <li>• Outside the operating room with residents and/or fellows (ICU/wards)</li> <li>• Nonclinical work</li> </ul>	(free text entry)
D4	I am fellowship trained in (select all that apply):	a. Pediatric anesthesiology (33.9%) b. Cardiac anesthesiology (15.2%) c. Critical care medicine (15.7%) d. Pain medicine (8.7%) e. OB anesthesiology (3.9%) f. Regional anesthesiology (1.7%) g. Other (anesthesiology) (7.0%) h. Other (nonanesthesiology) (3.9%) i. I am not fellowship trained. (25.7%)

No. = Question number.

Question D4, some faculty have completed multiple fellowships.



## Figures continued

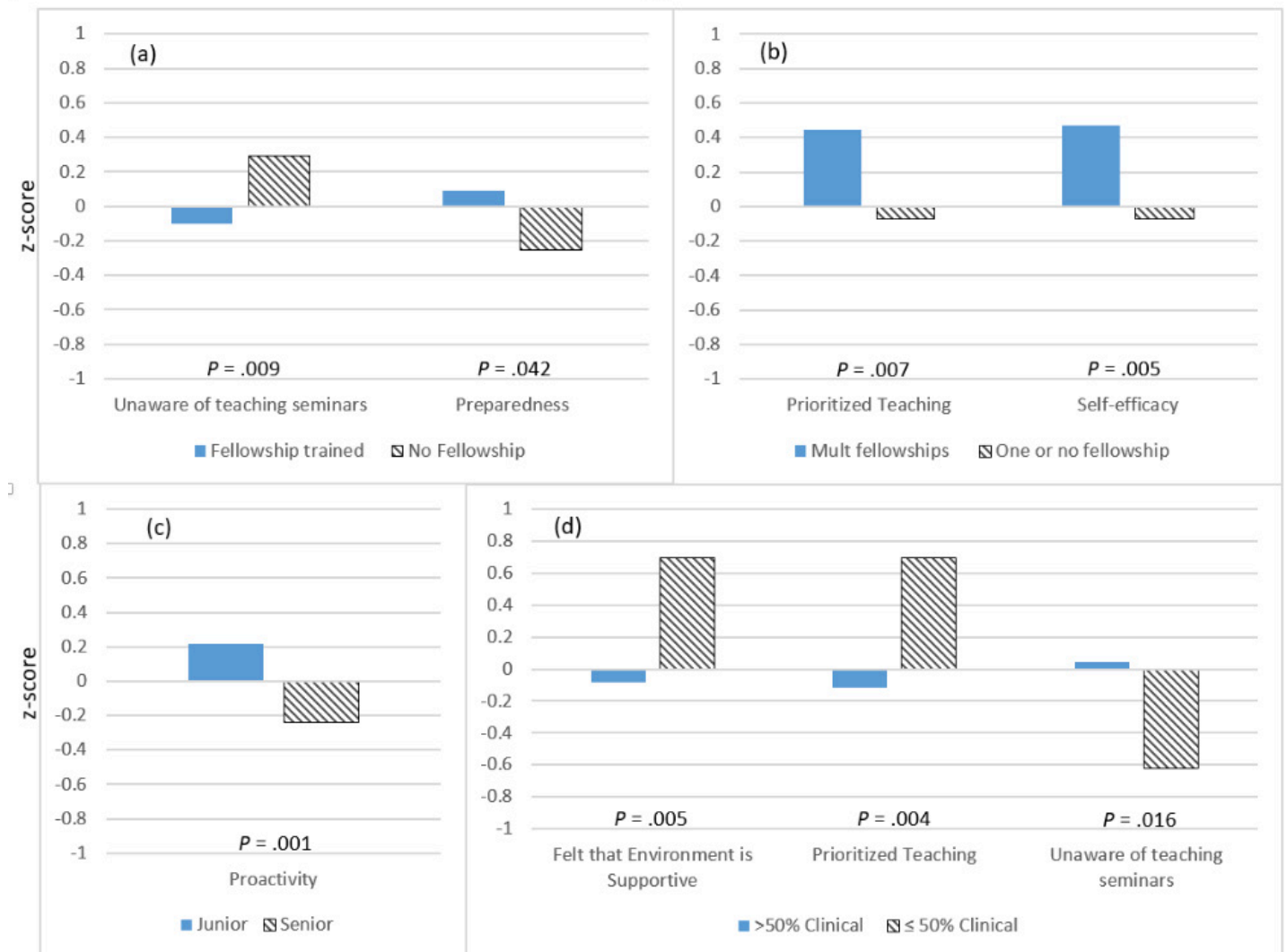
**Table 4.** Categories of Questions and Principal Component Analysis

Category	Definition	Question Numbers	Principal Components	Cronbach $\alpha$	Institutional Differences (ANOVA, <i>P</i> -value)
Environmental	Questions that relate to faculty perceptions of production pressure, departmental and OR leadership's effect on teaching and feedback	A10	1: The environment is, broadly speaking, supporting of teaching and feedback	0.702	0.004
			2: "All business," indicating feeling that production pressure impairs teaching, but the respondent feels no environmental barriers to providing feedback.	N/A	0.005
			3: Leadership support teaching, including provision of a daily curriculum for teaching	N/A	0.004
Resident	Questions that relate to faculty perceptions of resident receptiveness to teaching and feedback	B5, B6 C7	1	N/A	0.714
Responsibility/engagement	Questions that relate to faculty's perceptions of where responsibility lies for teaching and feedback; to prioritization of teaching and feedback, as compared to other responsibilities; and to knowledge and professional development of teaching and feedback.	A1-A4, A9, A12-A15 B1, B2, B8 C1-C5, C9, C10	1: Making teaching a priority	0.782	0.261
			2: Taking a proactive approach toward teaching	0.646	0.191
			3: Unaware of definition of "formative" and "summative" feedback	N/A	0.043
			4: No seminars for teaching at institution	N/A	<0.001
			5: No time to teach	N/A	0.814
			6: Faculty take responsibility for teaching	N/A	0.013
			7: Prioritizing judgment/feedback over teaching	N/A	0.109
Enjoyment	Faculty enjoy teaching	A7, A8	1	N/A	.493
Self-efficacy in teaching	Faculty feel that their teaching is of adequate quality	A11, B4	1	N/A	0.019
Preparedness	Faculty have prepared for teaching (mini-lectures or references)	A5, A6	1	N/A	0.116
Time spent teaching	Dichotomized to > 30 minutes or $\leq$ 30 minutes	A16	N/A	N/A	0.116

The Cronbach  $\alpha$  was calculated only for components that included 5 or more elements. Differences between sites were tested by ANOVA.

## Figures continued

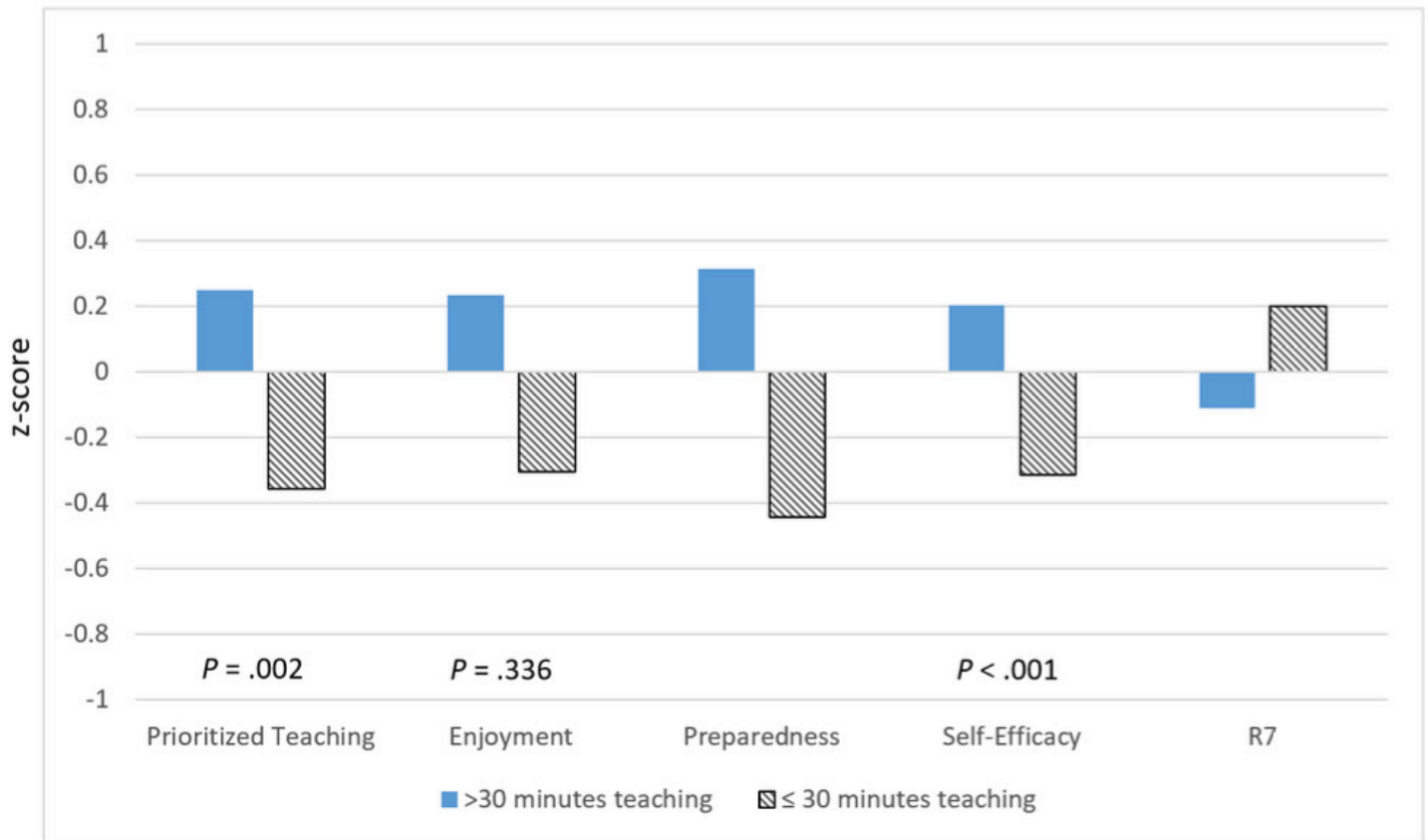
Figure 1. Survey results by demographics.



The x-axis in each segment is a dichotomized demographic group, indicating (a) fellowship training (blue) versus no fellowship training (orange); (b) multiple fellowship training (blue) versus single or no fellowship training (orange); (c) <10 years' experience as faculty (blue) versus ≥10 years (orange); (d) faculty whose appointments are more than 50% clinical (blue) versus those who have 50% or less of their appointment as clinical (orange). The y-axis reports the z-score of respondents agreeing with questions in the listed category. Categories tested include responsibility 4 (unawareness of teaching seminars), preparedness, responsibility 1 (prioritized teaching), responsibility 2 (proactivity), and environmental 1 (felt that the environment is supportive). All comparisons were by independent sample t tests; nonsignificant differences were not reported.

## Figures continued

Figure 2. Survey results by time spent teaching.



The y-axis reports the z-score of respondents agreeing with questions in the listed category x-axis shows each category dichotomized into those reporting teaching >30 minutes or those teaching ≤30 minutes. Categories tested include responsibility 1 (prioritized teaching), preparedness, enjoyment, and self-efficacy. All comparisons were by independent sample t tests with  $P < .001$  for each. Responsibility 7 (R7, “prioritizing judgment/feedback over teaching”) also demonstrated a difference,  $P = .022$ . Regressions were performed on the factors with moderate strength correlation, showing an independent association with prioritizing teaching and self-efficacy but not with enjoyment.

## Figures continued

*Supplemental Table 1: Principal factor analysis, loading and correlation coefficient*

Category	Questions Included	Principal Components	Loading	Cronbach $\alpha$
Environmental	A10 B3, B7, B9, B10 C6, C8	1: The environment is, broadly speaking, supporting of teaching and feedback	B3 0.73 B7 0.606 B9 0.615 B10 0.66 C6 0.584 C8 0.623 (34.9% of variance)	0.702
		2: "All business," indicating feeling that production pressure impairs teaching, but they feel no environmental barriers to providing feedback.	B3 -0.402 B7 -0.555 C6 0.462 C8 0.568 (16.8% of variance)	N/A
		3: Leadership support teaching, including through provision of a daily curriculum for teaching	A10 0.774 B9 0.401 B10 0.365 (15.0% of variance)	N/A
Resident	B5, B6	B5, B6 C7	1	N/A

# Figures continued

**Supplemental Table 1: Principal factor analysis, loading and correlation coefficient**

Category	Questions Included	Principal Components	Loading	Cronbach $\alpha$
Responsibility/ engagement	A1-A4, A9, A12-A15 B1,B2, B8 C1-C5, C9, C10	1: Making teaching a priority	A15 0.405 B1 0.624 B2 0.550 C1 0.629 C2 0.635 C3 0.486 C4 0.542 C5 0.682 C9 0.606 C10 0.498 (19.3% of variance)	0.782
		2: Taking a proactive approach toward teaching	A1 0.469 A2 0.416 A9 0.493 A12 0.469 A13 0.711 A15 0.531 (12.2% of variance)	0.646
		3: Unaware of definition of formative and summative feedback)	C1 -0.541 C2 -0.647 (9.9% of variance)	N/A
		4: No seminars for teaching at institution	B8 -0.448 (7.7% of variance)	N/A
		5: No time to teach	B1 -0.435 B2 -0.531 (6.7% of variance)	N/A
		6: Faculty take responsibility for teaching	A1 0.488 A4 0.521 A14 -0.404 (6.5% of variance)	N/A
		7: Prioritizing judgment/feedback over teaching	A3 -0.597 C10 0.461 (5.3% of variance)	N/A
Enjoyment	A7, A8	1	(74.2% of variance)	N/A
Self-efficacy in teaching	A11, B4	1	(68.7% of variance)	N/A
Preparedness	A5, A6	1	(72.9% of variance)	N/A
Time spent teaching	A16	N/A	N/A	N/A

## Figures continued

Supplemental Table 1: Principal factor analysis, loading and correlation coefficient

		E 1	E 2	E 3	Res	R 1	R 2	R 3	R 4	R 5	R 6	R 7	Enj	C	P
A16		0.06	-0.02	0.01	0.19	0.37* <0.001	0.16	0.04	-0.10	0.14	-0.08	-0.11	0.30 <0.001	0.43* <0.001	0.25
E 1	0.06		0.00	0.00	0.39* <0.001	0.39* <0.001	-0.11	0.29	-0.10	-0.22	0.17	0.09	0.19	0.12	0.06
E 2	-0.02	0.00		0.00	0.19	0.01	0.09	-0.13	0.10	0.17	0.04	0.04	0.03	0.10	0.09
E 3	0.01	0.00	0.00		-0.07	0.03	0.20	-0.10	0.14	0.09	0.06	-0.04	0.11	0.10	0.02
Res	0.19	0.39* <0.001	0.19	-0.07		0.32* <0.001	0.08	0.20	0.13	-0.06	0.08	-0.01	0.24	0.27	0.09
R 1	0.37* <0.001	0.39* <0.001	0.01	0.03	0.32 <0.001		0.00	0.00	0.00	0.00	0.00	0.00	0.42* <0.001	0.44* <0.001	0.37* <0.001
R 2	0.16	-0.11	0.09	0.20	0.08	0.00		0.00	0.00	0.00	0.00	0.00	0.25	0.19	0.23
R 3	0.04	0.29	-0.13	-0.10	0.20	0.00	0.00		0.00	0.00	0.00	0.00	0.16	0.13	0.03
R 4	-0.10	-0.10	0.10	0.14	0.13	0.00	0.00	0.00		0.00	0.00	0.00	-0.01	-0.04	-0.11
R 5	0.14	-0.22	0.17	0.09	-0.06	0.00	0.00	0.00	0.00		0.00	0.00	0.01	0.18	0.20
R 6	-0.08	0.17	0.04	0.06	0.08	0.00	0.00	0.00	0.00	0.00		0.00	-0.01	-0.08	-0.12
R 7	-0.11	0.09	0.04	-0.04	-0.01	0.00	0.00	0.00	0.00	0.00	0.00		-0.24	-0.12	-0.16
Enj	0.30 <0.001	0.19	0.03	0.11	0.24	0.42* <0.001	0.25	0.16	-0.01	0.01	-0.01	-0.24		0.46* <0.001	0.29
C	0.43* <0.001	0.12	0.10	0.10	0.27	0.44* <0.001	0.19	0.13	-0.04	0.18	-0.08	-0.12	0.46* <0.001		0.33* <0.001
P	0.25	0.06	0.09	0.02	0.09	0.37* <0.001	0.23	0.03	-0.11	0.20	-0.012	-0.016	0.29	0.33* <0.001	

Values reported are Pearson Correlation Coefficient and significance ( $P$  value). Green indicates moderate-strength correlation ( $R \geq 0.30$ ). Abbreviations: A16 = time spent teaching dichotomized; E1-3 = environmental components 1-3; Res = resident component; R1-7 = responsibility component 1-7; Enj = enjoyment component; C = self-efficacy in teaching component; P = preparedness component.

\* Indicates independence of association by linear regression ( $P < .05$ ).