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WEB PAPER

Physician-teacher characteristics associated with learner-centered teaching skills

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Abstract

Background: Academic institutions do not have a way to identify physician-teachers who are proficient in learner-centered teaching.

Aim: To identify physician characteristics associated with being highly learner-centered.

Methods: A cohort of 363 physicians was surveyed. Measured items included personal characteristics, professional characteristics, teaching activities, self-assessed teaching proficiencies and behaviors, and scholarly activities. A learner-centeredness scale was developed using factor analysis. Logistic regression models were used to determine which characteristics were independently associated with scoring highly on the learner-centeredness scale.

Results: Two hundred and ninety-nine physicians responded (82%) of whom 262 (88%) had taught medical learners in the prior 12 months. Six variables combined to form the learner-centeredness scale and the Cronbach Alpha of the scale was 0.73. The eight characteristics independently associated with high learner-centered scores for physician teachers were (i) proficiency in giving lectures or presentations (OR = 5.1, 95% CI: 1.3–19.6), (ii) frequently helping learners identify resources to meet their own needs (OR = 3.7, 95% CI: 1.3–10.3), (iii) proficiency in eliciting feedback from learners (OR = 3.7, 95% CI: 1.7–8.5), (iv) frequently attempting to detect and discuss emotional responses of the learners (OR = 2.9, 95% CI: 1.2–6.9), (v) frequently reflecting on the validity of feedback from the learners (OR = 2.8, 95% CI: 1.1–7.4), (vi) frequently identifying available resources to meet the teacher's learning needs (OR = 2.8, 95% CI: 1.1–7.2), (vii) having given an oral presentation related to education at a national/regional meeting (OR = 2.6, 95% CI: 1.1–6.0), and (viii) frequently letting learners know how different situations affect the teacher (OR = 2.5, 95% CI: 1.1–5.5).

Conclusions: The clinical competence and professional growth of medical learners can be most effectively facilitated by learner-centered educational methods. It may now be possible to identify medical educators who are more learner-centered in their teaching.

Introduction

In addition to knowledge and skill acquisition, a fundamental goal of medical education is the growth and development of medical learners. From the early 1900s, multiple agencies for medical education reform criticized medical curricula for their rigidity, excessive use of lectures, and overemphasis on rote memorization (Ludmerer 1985, 1999; Christakis 1995, p. 706; Ludmerer 2004, p. 1163). Nearly 100 years ago, Sir William Osler noted that "... in the natural method of teaching, the student begins with the patient, continues with the patient, using books and lectures as tools, as a means to an end" (Osler, 1932; Curry et al. 1996, p. 590). Osler and his colleagues recognized the need for more active learning experiences and designed the modern clinical clerkship to focus more on the learner's needs, rather than on the teacher's experiences (Osler 1932; Curry et al. 1996, p. 590; Mclean 2006, p. 68). In 1984, the Association of American Medical Colleges published *Physicians for the Twenty-First Century* (AAMC 1984) in which they concurred with Osler that the "basic clinical clerkship is the optimal setting" for active learning, but noted that modern medical curricula were still passive and mostly teacher-centered. Since then, medical education has continued to progress toward a true learner-centered environment which makes the core experience

Practice points

- Learner-centered medical education, wherein teachers are responsive to the needs of their trainees, makes sense intuitively and has been linked to improved academic performance, learner satisfaction, and the growth and development of medical learners.
- This paper describes a new learner-centeredness scale and the evidence for it's internal structure and content validity. Application of the scale to a large number of active physician-teachers allowed for the identifications of factors that are independently associated with being highly learner-centered.
- Future scholarly work in this area may attempt to determine which faculty development initiatives are most effective in improving physician-teachers' learner-centeredness scores.

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directed self-learning under the close mentorship of dedicated faculty members (Ludmerer 2004, p. 1163; Mclean 2006, p. 68).

Because today's medical professionals have limited time for teaching (Curry et al. 1996, pp. 592–593), this valuable resource needs to be managed efficiently and effectively. Learner-centeredness requires a change from the traditional teacher-centered approach to a mutual teacher-learner effort. Learner-centered teaching has been shown to result in improved academic performance, personal satisfaction, and accelerated personal growth of medical learners (Pinsky & Irby 1997, p. 974; Burack et al. 1999, pp. 51–52; Kern et al. 2001, p. 98). Medical learners who are taught using learner-centered approaches have better teaching skills and more positive attitudes toward teaching and learning (Spickard et al. 1996, p. 477; Pinsky & Irby 1997, p. 976; Robins et al. 1997, p. 135; Tolsgaard et al. 2007, p. 553). As such, many faculty development programs have emphasized learner-centered attributes and skills as valuable goals for the proficient physician teacher (Gordon & Levinson 1990, p.106; Skeff et al. 1997, p. 253; Cole et al. 2001, p. 474; Clark et al. 2004, p. 210).

In this study, we created a composite learner-centered teaching variable, or learner-centeredness scale, to identify characteristics of physician teachers that are associated with high levels of proficiency in learner-centered teaching skills.

Methods

Study design

We conducted a cross-sectional study of physicians who are part of our faculty development database to measure constructs related to their teaching behaviors, approaches, and self-assessed proficiencies.

Study participants

The physicians in the database either (i) had participated in the Johns Hopkins Faculty Development Program (FDP) between 1987 and 2000 or (ii) had been named by an FDP participant as a control at the time of their participation in the program that was similar to them in terms of gender, age, and job description. The physicians were widely spread across the country. Because the goal of this study was not to assess the impact of the FDP program, all physician teachers were treated equivalently in the analyses.

Survey development and data collection

A fifteen-page survey that was developed to assess the long-term outcomes of the Johns Hopkins FDP was mailed to 363 physicians in July 2002 (Knight et al. 2005). The survey was iteratively revised based on a systematic review of the literature and the feedback from local experts in medical education theory and research. This process, coupled with the expertise of the research team, contribute to the content validity. Pilot testing assessed the clarity and relevance of each question. Responses were in the form of short answers, yes-or-no, four and five-point Likert scales, and percentage of effort. The questions were organized by themes into the following categories: personal and career characteristics; scholarship; education enjoyment; working with others; desirable teaching behaviors; teaching proficiency; and feedback. Six questions were specifically developed to ask about behaviors that are related to and are integral components of learner-centered teaching methods based on published literature (Gordon & Levinson 1990, p. 108; Curry 1996, p. 594; Ludmerer 2004, p. 1164;).

Non-responders were encouraged to participate through reminder postcards and repeat mailings of the questionnaires. Respondents were mailed a copy of the 6th edition of *Principles of Ambulatory Medicine* (Barker et al. 2003). The study was approved by the Johns Hopkins Institutional Review Board.

Data analysis

Only responses from active physician teachers (those who indicated that they had taught medical learners in the prior 12 months) were analysed. We examined frequency of responses looking for irregularities in their distribution. For continuous variables, we checked distributions and descriptive statistics for evidence of skewness, outliers, and non-normality. Categorical variables were recoded and analysed as proportions.

Factor analysis was performed to assess the six questions related to learner-centeredness, hereafter referred to as the 'learner-centeredness scale'. Candidate variables were examined for sufficient variation. We also assessed the mean sampling adequacy of all items. We examined two rotations: Promax and Varimax. We first examined a Scree plot to visually determine the number of factors with Eigen values over 1. The two rotations provided a single factor solution. Cronbach's Alpha was used to quantify the internal consistency of the factor. Item to total correlations were examined to assess the extent to which each item contributed to the overall reliability of the factor. Alphas were examined sequentially deleting each item and the alpha for the factor did not increase with the deletion of any item.

The learner-centeredness scale was explored as a continuous variable with linear regression, and categorically (in both three category [low, medium, and high] and dichotomized [divided at the median into high versus low] versions) with logistic regression. In looking at the data in these three different ways, the magnitude and direction of the associations of the independent variables with the learner-centeredness scale was the same in all versions. Thus, for ease of presentation, the data is presented in this manuscript using the high versus low dichotomized version of the learner-centeredness scale. This dichotomized version was also selected because it produced the narrowest confidence intervals in the regressions that included multiple variables – due to larger numbers in each group.

Logistic regression was used to produce unadjusted odds ratios (with 95 percent confidence intervals) to characterize the association of each individual variable (questions from the survey) with the likelihood of scoring high on the learner-centeredness scale.

Multivariable logistic-regression models were then used to identify independent associations between individual variables and 'high' versus 'low' learner-centeredness. In the first stage, we constructed seven domain-specific multivariate models corresponding to areas of inquiry in the questionnaire. These models consisted of all variables that were associated with the dependent variable (high learner-centeredness score) in the bivariate analysis at $p<0.1$. In the second stage, variables that were significantly associated with high learner-centeredness status in the domain-specific models were included in a study-wide multivariable model. In all model building, we applied a user-defined stepwise approach evaluating the change in model chi-square with the addition of each variable. To assess the goodness of fit, we applied the Hosmer-Lemeshow method based on deciles of risk (Hosmer & Lemeshow 1989). Variables included in all models were checked for collinearity. Data were analysed using STATA 8.0 (STATA Corp., College Station, Texas).

Results

Response rate and characteristics of respondents

Surveys were completed by 299 of 363 physicians contacted, for a response rate of 82%. There was no difference between responders and non-responders for gender ($p=0.79$) and a small difference in mean age (42.3 vs. 41.6 years, $p=0.001$). Among the 299 respondents, 262 (88%) had taught medical learners during the 12 months prior to being surveyed. Characteristics of the study participants are shown in Table 1.

Table 1. Characteristics of 262 Responding Physician Teachers.

Demographics	Respondents ($N=262$)*
Male, *n* (%)	155 (61)
Age in years, mean (SD)	42 (6)
Non-Hispanic White, *n* (%)	208 (84)
Living with spouse/significant other, *n* (%)	207 (84)
Professional characteristics	
Past participation in Johns Hopkins FDP, *n* (%)	178 (68)
General Internal Medicine/Geriatrics, *n* (%)	197 (82)
Currently has a medical school faculty appointment, *n* (%)	207 (82)
Instructor/Assistant Professor, *n*(%)	147 (56)
Total work hours by percentage in the past year:	
Clinical effort, mean% (SD)	49 (31)
Teaching, mean% (SD)	16 (15)
Research, mean% (SD)	15 (24)
Non-educational administration, mean% (SD)	10 (19)
Educational program development, mean% (SD)	6 (11)
Taught medical students in past year, *n* (%)	206 (81)
Taught residents in past year, *n* (%)	210 (83)
Scholarly activity	
Ever authored a scholarly publication, *n* (%)	195 (77)
Ever authored a scholarly publication related to education, *n* (%)	70 (28)

*Numbers may not total actual percentage due to item non-response.

Learner-centeredness scale

Factor analysis identified six questions from the original survey assessing learner-centeredness. All six variables clustered together to form a single factor, the "learner-centeredness scale". No variables were eliminated based on poor factor loadings. The Cronbach's Alpha for the feedback scale is 0.73, suggesting that the internal reliability of the factor analysis is acceptable (Table 2). On the learner-centeredness scale, presented in Figure 1, the lowest possible score is 0 and the highest is 24. Of the 262 active physician teachers, 252 completed all six questions that comprise the scale. The scale's median score was 18 with a range of 6–24. In dividing the physician cohort by the learner-centeredness scale at the median, 126 physicians (50%) were designated as "low" scorers because they scored equal to or below the median, and 126 physicians (50%) were classified as "high" scorers, scoring greater than the median value.

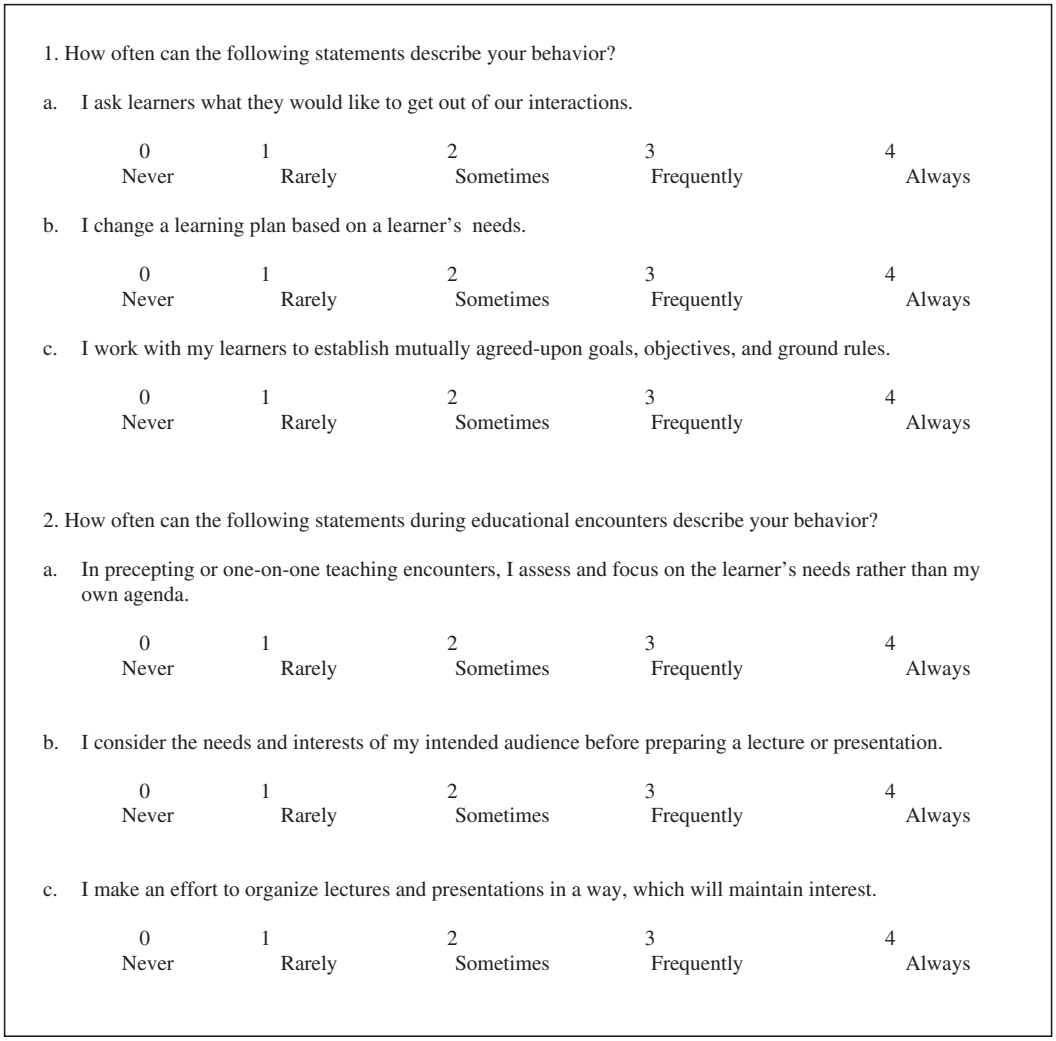
Differences between physician teachers by scores on the learner-centeredness scale

The question that was most strongly associated with being a high-scorer on the learner-centeredness scale in bivariate analysis addressed the behavior of frequently attempting to detect and discuss emotional responses of the learners (OR = 5.5, 95% CI 3.0–10.2), Table 3. Within each of the seven domains, four to eleven variables were significantly different between the high-scorers and the low-scorers, all of

Table 2. Responding teaching physicians' assessments of themselves with respect to the questions from the survey instrument related to learner-centeredness ($n=252$)*.

Areas of physician self-assessment	Factor Analysis†	mean score ±sd ‡	Cronbach's α
Factor: Learner-centeredness Scale			0.73
Frequency of making an effort to organize lectures and presentations in a way which will maintain learner's interest.	0.81	3.7 ± 0.5	
Frequency of considering the needs and interests of the intended audience before preparing a lecture or presentation.	0.75	3.7 ± 0.5	
Frequency of asking learners what they would like to get out of teaching interactions.	0.71	2.7 ± 0.9	
Frequency of working with learners to establish mutually agreed-upon goals, objectives, and ground rules.	0.64	2.8 ± 0.8	
Frequency of changing a learning plan based upon the learner's needs.	0.53	2.9 ± 0.7	
Frequency of assessing and focusing on the learner's needs rather than one's own agenda during precepting or one-on-one teaching encounters.	0.42	2.8 ± 0.6	

*The self-assessments from ten physician teachers were not included in the factor analysis because they failed to answer all six questions.
†Varimax rotation factor loading values for each item is listed.
‡The mean score for each item is shown. The physician-teachers were asked how frequently they performed the specific behaviors (5-point Likert scale: 0 = never, 1 = rarely, 2 = sometimes, 3 = frequently, 4 = always).



1. How often can the following statements describe your behavior?

a. I ask learners what they would like to get out of our interactions.

0	1	2	3	4
Never	Rarely	Sometimes	Frequently	Always

b. I change a learning plan based on a learner's needs.

0	1	2	3	4
Never	Rarely	Sometimes	Frequently	Always

c. I work with my learners to establish mutually agreed-upon goals, objectives, and ground rules.

0	1	2	3	4
Never	Rarely	Sometimes	Frequently	Always

2. How often can the following statements during educational encounters describe your behavior?

a. In precepting or one-on-one teaching encounters, I assess and focus on the learner's needs rather than my own agenda.

0	1	2	3	4
Never	Rarely	Sometimes	Frequently	Always

b. I consider the needs and interests of my intended audience before preparing a lecture or presentation.

0	1	2	3	4
Never	Rarely	Sometimes	Frequently	Always

c. I make an effort to organize lectures and presentations in a way, which will maintain interest.

0	1	2	3	4
Never	Rarely	Sometimes	Frequently	Always

Figure 1. The learner-centeredness scale (Cronbach's α for the learner-centeredness scale is 0.73).

these were included in domain-specific multivariable models, and some are shown in Table 3. The demographic and professional characteristics described in Table 1 were not associated with differences on the learner-centeredness scale.

The final multivariable model, containing all variables that remained significant in the 7 domain-specific models, identified eight independent predictors of high scores on the learner-centeredness scale: (i) frequently letting learners know how different situations effect the teacher, (ii) having given an oral presentation related to education at a national/regional meeting, (iii) frequently identifying available resources to meet the teacher's learning needs, (iv) frequently reflecting on the validity of feedback from the learners, (v) frequently attempting to detect and discuss emotional responses of the learners, (vi) frequently helping learners identify resources to meet the learner's needs, (vii) proficiency in eliciting feedback from learners, and (viii) proficiency in giving lectures or presentations (Table 4).

Discussion

Since the late 19th century, reformers of medical education have recognized the need to help medical learners develop the skill of critical reasoning, the capacity to generalize, the ability to acquire and evaluate information, and the intellectual tools to become lifelong learners (Eitel & Steiner 1999, p. 506; Ludmerer 2004, p. 1163). The challenges in medical education over the centuries have necessitated that medical learners become more active in their educational development, constructing new knowledge and taking a central role in the educational process (Dolmans et al. 2002, p. 173). In learner-centered education, the teacher becomes a resource for learning and challenges the learner to re-examine basic assumptions and values through experiential learning and active engagement (Knowles 1980; Brookfield 1991; Curry et al. 1996, p. 590). The learner moves from dependence on the teacher to independent competence in problem solving (Knowles 1980; Brookfield 1991; Curry et al. 1996, p. 590). While specific curricular strategies have been described to foster such a learning environment in medicine (Curry et al. 1996, p. 591), this paper provides new information at the teacher level; a scale to assess an individual's learner-centeredness and the factors that are associated with being highly learner-centered.

Physician teachers with proficiency in these learner-centered approaches are thought to be the most effective

Table 3. Odds ratios demonstrating associations of select variables with being a learner-centeredness high scorer after categorizing the 252 physician teachers into ''high'' or ''low'' scorers on the learner-centeredness scale.

Characteristic	Unadjusted odds ratios for being a high scorer† (95% confidence interval)
*Personal and Career Characteristics**	
Non-Hispanic White (versus Non-Caucasian)	0.47 (0.23 - 0.97)
Professional/work goals written or reviewed in the last year (versus not)	2.33 (1.36 – 3.99)
''Always'' or ''Frequently'' recognize own areas of weakness and use it as an opportunity for growth (versus less)	3.15 (1.80 – 5.49)
''Always'' or ''Frequently'' identify available resources to meet my own learning needs (versus less)	3.54 (1.91 – 6.55)
*Scholarship**	
Faculty rank at or above Associate Professor (versus below)	1.99 (1.07 – 3.70)
Ever gave an oral presentation related to education at a national/regional meeting (versus not)	2.09 (1.17 – 3.74)
External funds for teaching in past 2 years (versus not)	3.24 (1.22 – 8.61)
*Education Enjoyment**	
Enjoys giving lectures and presentations (versus does not)	1.88 (1.11 – 3.18)
Enjoys mentoring (versus does not)	2.32 (1.37 – 3.92)
*Working with Others**	
''Always'' or ''Frequently'' draw in those who don't participate much when leading small groups (versus less)	3.05 (1.65 – 5.64)
''Always'' or ''Frequently'' elicit input from those who might be affected by my decisions (versus less)	3.81 (1.65 – 8.79)
*Teaching Proficiency**	
Current proficiency ''very good'' or ''excellent'' in giving lectures or presentations (versus less)	3.32 (1.48 – 7.45)
Current proficiency ''very good'' or ''excellent'' in giving feedback to learners (versus less)	3.51 (1.62 – 7.57)
Current proficiency ''very good'' or ''excellent'' in eliciting feedback from learners (versus less)	4.95 (2.77 – 8.83)
*Desirable Teaching Behaviors**	
''Always'' or ''Frequently'' let learners know my limitations as a teacher (versus less)	2.32 (1.39 – 3.87)
''Always'' or ''Frequently'' assess whether my actions as a teacher correspond with my values (versus less)	2.47 (1.47 – 4.15)
''Always'' or ''Frequently'' let learners know how different situations make me feel (versus less)	2.88 (1.72 – 4.82)
''Always'' or ''Frequently'' spend time building supportive relationships with my learners (versus less)	3.21 (1.60 – 6.44)
''Always'' or ''Frequently'' use different educational strategies based upon learning objectives and learners' needs when planning a curriculum (versus less)	3.79 (1.73 – 8.33)
''Always'' or ''Frequently'' express concern and support for my learners when they struggle (versus less)	4.65 (2.19 – 9.88)
''Always'' or ''Frequently'' help learners identify resources to meet their learning needs (versus less)	4.69 (2.27 – 9.67)
''Always'' or ''Frequently'' attempt to detect and discuss emotional responses of my learners (versus less)	5.53 (3.00 – 10.20)
*Feedback**	
''Always'' or ''Frequently'' begin feedback sessions by asking learners to assess their performance (versus less)	2.51 (1.48 – 4.29)
''Always'' or ''Frequently'' focus on specific areas for improvement, rather than generalizations (versus less)	3.66 (2.01 – 6.67)
''Always'' or ''Frequently'' reflect on the validity of feedback after receiving feedback from a learner (versus less)	3.95 (1.95 – 8.01)

*These seven categories correspond to areas of inquiry in the questionnaire.
†By comparing the responses of the low scorers (≤18; those below the median) and the high scorers (>18; those above the median), variables were identified that were associated with being a high scorer on the learner-centeredness scale.

educators (Irby et al. 1987, pp. 5–6; Brookfield 1991; Irby 1994, p. 336; Orlander et al. 1994, p. 18; Feins et al. 1996, p. 1201; Wilkerson & Irby 1998, p. 390). Learner-centered teaching demonstrates a teacher's respect for learners' capacity to identify their own goals and to attain them (Wilkerson & Irby 1998, p. 388; Gunderman et al. 2003, p. 16; Wolpaw et al. 2003, p. 894; Ludmerer 2004, p. 1164). Learner-centered educators are believed to be more confident, experienced teachers who are genuinely committed to the needs of their learners (Irby 1987, p. 4; 1994, p. 333; Pinsky & Irby 1997, p. 976; Pinsky et al. 1998, p. 209). Many faculty development programs dedicated to improving participants' teaching proficiency encourage physician to enhance their learner-centered teaching skills (Skeff et al. 1997, p. 257; Cole et al. 2001, p. 471; Clark et al. 2004, p. 210;). This new learner-centeredness scale may allow for the identification of the physician-teachers who are in need of such training.

Thayer's book 50 Strategies for Experiential Learning emphasizes the importance of soliciting feedback from others (Thayer 1976). Variables related to eliciting feedback about one's teaching figured prominently in the multivariate analysis, comprising 2 of 8 variables that were independently

Table 4. Characteristics that are independently associated with being a high scorer on the 'learner-centeredness scale' ($n = 252$).

Characteristic	Adjusted odds ratios for being a high scorer* (95% confidence interval)
''Always'' or ''Frequently'' let learners know how different situations make me feel (versus less)	2.51 (1.16 – 5.45)
Ever gave an oral presentation related to education at a national/regional meeting (versus not)	2.60 (1.12 – 6.03)
''Always'' or ''Frequently'' identify available resources to meet my own learning needs (versus less)	2.77 (1.07 – 7.19)
''Always'' or ''Frequently'' reflect on the validity of feedback after receiving feedback from a learner (versus less)	2.77 (1.03 – 7.44)
''Always'' or ''Frequently'' attempt to detect and discuss emotional responses of my learners (versus less)	2.91 (1.22 – 6.92)
''Always'' or ''Frequently'' help learners identify resources to meet their learning needs (versus less)	3.66 (1.30 – 10.31)
Current proficiency ''very good'' or ''excellent'' in eliciting feedback from learners (versus less)	3.74 (1.65 – 8.48)
Current proficiency ''very good'' or ''excellent'' in giving lectures or presentations (versus less)	5.08 (1.32 – 19.58)

*Variables that were significantly associated ($p < 0.05$) with high learner-centeredness in the domain-specific models were included in this multivariable model.

associated with scoring highly on the learner-centeredness scale. This finding is not surprising and, in fact, contributes to the internal structure validity evidence of the new scale because one cannot possibly be learner-centered without soliciting learners' feedback about one's teaching effectiveness. We believe that this data may be telling us that teachers who are interested in eliciting and using feedback for their own development are committed to learner-centered educational principles.

Three variables independently associated with high scores on the learner-centeredness scale relate to teaching behaviors focused on learners' emotional responses and the teacher's role in empathic guidance. Medical learners are rapidly acculturated into the stresses and emotion-laden experiences that are ubiquitous in the medical profession (Pfeiffer 1983, p. 128; Berman et al. 1990, p. 99; Curry et al. 1996, p. 594). Learner-centered educational processes are thought to be effective in promoting personal and professional growth among trainees (Curry et al. 1996, p. 594; Kern et al. 2001, p. 98; Levine et al. 2006, p. 565; Wright et al. 2006, p. 738;). Learner-centered teaching practices may encourage reflection which should stimulate trainees to think about their evolving professional roles and to identify resources for their ongoing personal growth (Pfeiffer 1983, p. 133; Curry et al. 1996, p. 594).

Several limitations of this study should be considered. First, we relied exclusively on self-assessment and self-report to characterize the respondents. Second, like all cross-sectional studies, our results describe associations between various factors and high levels of learner-centered skills but causality cannot be determined. Third, the learner-centeredness scale was developed from a selected group of questions related to teaching behaviors. This paper provides content validity evidence (a. instrument developed by experts, b. the variables entered into the model not only addressed fundamental elements of learner-centeredness but were also found to be relevant from prior research in this field) (Orlander et al. 1994, p. 20; Feins et al. 1996, p. 1202; Spickard et al. 1996, p. 477; Pinsky & Irby 1997, p. 973; Robins et al. 1997, p. 139; Burack et al. 1999, p. 53) and 'internal structure' validity evidence (factor analysis and Cronbach's alpha attesting to internal reliability) for the learner-centeredness scale (Downing, 2003, p. 832; Beckman et al. 2005, p. 1; Cook & Beckman 2006, p. 166e7). While the scale lacks seamless 'relations to other variables' validity evidence, which is difficult to address because of the lack of a gold standard for assessing learner-centeredness, the differences in theoretically related variables between respondents who scored above and below the median on the learner-centeredness scale can be considered as one manner of substantiation of this category of validity. Fourth, because many of the respondents were formerly associated with the Johns Hopkins University FDP, these results may not be generalizable to other physician teachers. However, there was a consistent pattern of associations of variables with the learner-centeredness scale when separately analyzed for those with and without previous FDP participation. Moreover, 32% of respondents never participated in our FDP, and most of those who did are now far removed from the program – both in terms of their geography and time since participation. Finally, the scale's validity evidence may be strengthened by future triangulation studies, asking learners to rate physician–teachers along these dimensions so as to correlate the self-assessments with learners' evaluations.

Knowing the limitations of this study, we hope to further study the 2 groups of physician-teachers identified as having strong or weak teaching skills associated with proficiency in learner-centered teaching. In order to demonstrate that these refined skills indeed are more effective in teaching medical trainees, it would be interesting to monitor the group of high-scoring physicians through trainee and colleague feedback, since the characteristics in this study were self-reported, and to re-evaluate their skills at future points in time to assess further proficiency or decline in skills. We also would like to assess the impact of learner-centered faculty development programs on the ''low-scorer'' physicians to assess whether teaching skills can be improved through mentorship. Further studies can help to develop and to foster focused skill-development and maintenance programs for physician-teachers.

We believe that proficiency in learner-centered teaching skills promotes efficient and effective learning in medicine.

Learner-centeredness is not only what medical learners desire (Levy 1985, p. 38; Cole et al. 2001, p. 479; Clark et al. 2004, p. 213;) and associate with high quality teaching (Torre et al. 2003, p. 812), but it is also a method of education that promotes independent personal and professional growth of the medical learner (Curry et al. 1996, p. 594; Pinksy et al, 1997, p. 975; Burack et al, 1999, p. 54; Ludmerer 2004, p. 1164). This paper identifies teaching behaviors and proficiencies in teaching physicians that are associated with learner-centeredness. Sir William Osler stated that, "an academic system without the *personal* influence of teachers upon pupils is an Arctic winter (Osler 1932a,b)." Thus, medical training programs that hope to motivate learners and cultivate learner competence may want to devise strategies to expose trainees to adequate numbers of learner-centered physician-teachers.

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Notes on contributors

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