The American Journal of Surgery 221 (2021) 256–260

Contents lists available at ScienceDirect

The American Journal of Surgery

journal homepage: www.americanjournalofsurgery.com

Featured Article

# How learning preferences and teaching styles influence effectiveness of surgical educators☆

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ARTICLE INFO

*Article history:*
Received 13 May 2020
Received in revised form
3 August 2020
Accepted 19 August 2020

*Keywords:*
Educator
Learning
Teaching
Preference

ABSTRACT

*Background:* Effective surgical educators have specific attributes and learner-relationships. Our aim was to determine how intrinsic learning preferences and teaching styles affect surgical educator effectiveness.

*Methods:* We determined i) learning preferences ii) teaching styles and iii) self-assessment of teaching skills for all general surgery attendings. All general surgical residents in our program completed teaching evaluations of attendings.

*Results:* Multimodal was the most common learning preference (20/28). Although the multimodal learning preference appears to be associated with more effective educators than kinesthetic learning preferences, the difference was not statistically significant (80.0% versus 66.7%, $p = 0.43$). Attendings with Teaching Style 5 were more likely to have a lower "professional attitude towards residents" score on SETQ assessment by residents (OR 0.33 (0.11, 0.96), $p = 0.04$). Attendings rated their own "communication of goals" ($p < 0.001$), "evaluation of residents" ($p = 0.04$) and "overall teaching performance" ($p = 0.01$) per STEQ domains as significantly lower than the resident's assessment of these cofactors.

*Conclusion:* Identification of factors intrinsic to surgical educators with high effectiveness is important for faculty development. Completion of a teaching style self-assessment by attendings could improve effectiveness.



## Introduction

Effective surgical educators are able to translate teaching into experiential learning.[1] While a laudable goal, "effectiveness" is poorly understood and seldomly studied. Understanding what traits are characteristic of effective surgical educators may facilitate development and enhancement of these qualities with the goal of improving surgical education for our residents. A previously conducted grounded theory analysis performed at our institution identified attitudes, beliefs and cognitions that senior general surgery residents believe are important qualities in effective surgical educators.[2] The majority of residents felt that effective surgical educators possessed an "intrinsic" factor. This intrinsic factor was described as independent from other characteristics of effective educators such as personality, bond with resident and experience.[2]

While such intrinsic factors are not well described, attributes such as the learning preferences and teaching styles of surgical educators may contribute to their effectiveness.[3] For example, if a teacher has a particular learning style, they may consciously or unconsciously teach in a similar style. Perhaps the perceived effectiveness is further diminished when the teacher's and learner's learning styles are discordant.

Little is known about the teaching and learning preferences among surgeons and how they influence effectiveness as an educator. Tools exist to determine teaching style and learning preferences which can provide insight to targeted development of effectiveness in healthcare teaching.[4–6] Our aim was to determine if a surgical educator's learning preferences and teaching styles are associated with their teaching effectiveness.

☆ Accepted for presentation at Surgical Education Week, Seattle, April 28- May 2 2020, meeting cancelled due to COVID-19

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https://doi.org/10.1016/j.amjsurg.2020.08.028
0002-9610/

## Methods

All general surgery residents and attendings at our urban, tertiary academic institution were included in the study. The study was approved by the institutional review board. To assess attending learning preferences and teaching styles, attending participants completed assessments including: the Fleming VARK learning styles inventory (learning preferences) and Staffordshire Evaluation of Teaching Style (teaching style). To assess faculty teaching effectiveness, attendings assessed their own teaching skills using the System for Evaluation of Teaching Qualities (SETQ) and residents completed a SETQ evaluation for attendings for the 2018–2019 academic year.

### *Learning preferences*

The Fleming VARK learning styles inventory is a tool to assess learning preferences, originally described in 1992, and is based on four sensory modalities used for learning information.[6] These modalities are Visual (V, "preference for graphic representation of information"), Aural (A, "preference for information that is heard or spoken"), Read/Write (R, "preference for information displayed as words") and Kinesthetic (K, "perceptual preference related to the use of experience and practice [simulated or real]"). The tool is a 16 question tool which gives a score for each of the four modalities and an overall preference.

### *Teaching styles*

The Staffordshire Evaluation of Teaching Style is a 24 question tool with 4 questions pertaining to each of the 6 'teaching styles'.[7] The educator's score is calculated based on the responses to questions for each of the six styles (1- the flexible and all round adaptable teacher, 2- the students centred, sensitive teacher, 3- the official curriculum teacher, 4- the straight facts no nonsense teacher, 5- the big conference teacher, and 6-the one off teacher, definitions in Table 1).

### *Teaching effectiveness*

The SETQ is a validated tool initially developed for assessment of teaching of anesthesia faculty, that has been adapted for use by surgeons.[8,9] The tool requires self- and resident-assessment of each attending and comprises 26 questions in five predetermined domains (learning climate, professional attitude towards residents, communication of goals, evaluation of residents and feedback).

### *Statistical analysis*

The distribution of the SETQ data were reported as median and interquartile range (IQR) for continuous variables for all responses. Responses were categorized into 7 categories: A. Learning climate; B. Professional attitude towards residents; C. Communication of goals; D. Evaluation of residents; E. Feedback; F. This surgeon is a specialist role model (Attendings did not do this question); and G. Overall teaching performance of this surgeon. Differences between the residents' evaluation and attendings' self-evaluation were determined by Kruskal Wallis test. The fitting of each response within its category was determined by the "factor loading", which ranged from 0 to 1. Higher factor loading indicates a better fit of the response, within the evaluated construct.[8] The corrected item–total scale correlation of each item was calculated to determine the consistency and reliability of a scale.[10] The Cronbach's internal consistency reliability coefficient

**Table 1**
Association between teaching style and SETQ assessment of attendings by residents.

| Staffordshire Evaluation of Teaching Style (SETQ)[7] | Domain of the SETQ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Learning Climate | | Professional attitude towards residents | | Communication of goals | | Evaluation of residents | | Feedback | | Overall teaching performance | |
| | *OR (95% CI)* | *p-value* | *OR (95% CI)* | *p-value* | *OR (95% CI)* | *p-value* | *OR (95% CI)* | *p-value* | *OR (95% CI)* | *p-value* | *OR (95% CI)* | *p-value* |
| **1. The all-round flexible and adaptable teacher.** "This teacher can use lots of different skills, can teach both peers and juniors, and is very aware of the whole environment in relation to teaching and the learners" | 0.59 (0.22, 1.60) | 0.30 | 1.20 (0.72, 2.02) | 0.49 | 1.06 (0.64, 1.76) | 0.81 | 0.30 (0.07, 1.29) | 0.11 | 0.61 (0.25, 1.49) | 0.28 | 0.66 (0.28, 1.56) | 0.35 |
| **2. The student-centred, sensitive teacher.** "This teacher is very student-centred, teaches in small groups, with emotions to the fore, using role play and drama, and is not comfortable doing straight presentations" | 0.32 (0.08, 1.27) | 0.11 | 1.08 (0.62, 1.86) | 0.78 | 0.90 (0.61, 1.34) | 0.62 | 0.26 (0.04, 1.81) | 0.17 | 0.87 (0.51, 1.46) | 0.60 | 0.60 (0.29, 1.26) | 0.18 |
| **3. The official curriculum teacher.** "This teacher is very well prepared as a teacher, accredited, aware of and teaches to the formal curriculum and follows external targets for teaching" | 6.80 (0.72, 64.70) | 0.10 | 2.30 (0.91, 5.81) | 0.08 | 1.22 (0.64, 2.30) | 0.55 | 5.42 (0.29, 101.30) | 0.26 | 1.85 (0.60, 5.68) | 0.28 | 2.77 (0.72, 10.60) | 0.14 |
| **4. The straight facts no nonsense teacher.** "This teacher likes to teach the clear facts, with straight talking, concentrating on specific skills, and much prefers not to be involved with multi-professional teaching and learning." | 0.63 (0.25, 1.55) | 0.31 | 0.72 (0.41, 1.27) | 0.26 | 0.74 (0.47, 1.17) | 0.20 | 0.64 (0.22, 1.89) | 0.42 | 1.08 (0.51, 2.31) | 0.84 | 0.94 (0.44, 2.02) | 0.88 |
| **5. The big conference teacher.** "This teacher likes nothing better than to stand up in front of a big audience but not sitting in groups or one to one teaching" | 0.86 (0.24, 3.00) | 0.81 | 0.33 (0.11, 0.96) | 0.04 | 0.90 (0.44, 1.83) | 0.77 | 2.01 (0.39, 10.20) | 0.40 | 0.93 (0.29, 2.97) | 0.91 | 0.75 (0.24, 2.34) | 0.62 |
| **6. The one-off teacher.** "This teacher likes to deliver small self-contained bits of teaching, on a one to one basis, with no props to help and no follow up." | 16.63 (0.67, 411.16) | 0.09 | 1.27 (0.56, 2.90) | 0.57 | 1.31 (0.73, 2.35) | 0.36 | 34.65 (0.45, 2664.65) | 0.11 | 2.26 (0.85, 6.03) | 0.10 | 5.44 (0.97, 30.39) | 0.054 |

(alpha) was calculated to check the internal consistency of the scales.[11] The association between residents' evaluation and attendings' self-evaluation was determined by the Kendall's rank order correlation coefficient τ (tau).[12] The distribution of the SETQ responses on the Likert scale was presented by the bar chart. The correlation between residents' evaluation and attendings' self-evaluation in each category was also presented using the scatter plot. The effectiveness of between multimodal and kinesthetic learning preferences (represented as the proportion of "Agree" and "Strongly agree" rating by the residences) was compared using the Fishers' test. Multivariable logistic regression was used to explore the association between attendings' teaching style and overall learning preference with the attendings' performance based on the residents' evaluation. Adjusted odds ratio (OR) and 95% confidence intervals (95% CI) were reported. All the analyses were performed on Stata version 16.1 (StataCorp LLC, College Station, TX, USA). A p value of <0.05 was considered statistically significant.

## Results

A total of 29 (PGY1 n = 7, PGY2 n = 6, PGY3 n = 6, PGY4 n = 6, and PGY5 n = 4) residents completed SETQ evaluations for attendings they worked with in the 2018–2019 academic year. All 29 attendings in the Department of Surgery completed the SETQ and teaching styles tools, one faculty member did not complete the VARK.

### *Learning preferences*

The most common attending learning preference was multimodal (20/28). Six had kinesthetic learning preference (2 = mild, 3 = strong and 1 = very strong). The remaining 2 attendings had either a strong aural ($n = 1$) or mild visual ($n = 1$) learning preference. Compared with the kinesthetic learning preference, the multimodal learning preference appears to have a higher proportion of the rating "Agree" or "Strongly agree" by the residence (80.0% versus 66.7%). However, these proportions were not statistically significant (p = 0.43).

### *Teaching styles*

When examining the association between resident SETQ (evaluation of the faculty's effectiveness) and faculty teaching style, those educators with Style 5 teaching style were more likely to have a lower "professional attitude towards residents" score [OR 0.33 (0.11, 0.96), p = 0.04]. Table 1. A number of other associations were seen that did not approach significance: Style 6 with associated with a higher "overall teaching performance" [OR 5.44 (0.97, 30.39) p = 0.054)] and "learning climate" scores [OR 16.63 (0.67, 411.16, p = 0.09] while Style 3 was associated with a higher "professional attitude towards residents" score [OR 2.30 (0.91, 5.81), p = 0.08].

### *Teaching effectiveness*

A comparison of resident and faculty self-assessment of teaching quality is shown in Tables 2 and 3. Faculty self-evaluations were significantly lower for the SETQ domains "communication of goals", "evaluation of residents" and "overall teaching performance" when compared to the resident's assessment of their performance. Fig. 1. The resident PGY level did not influence the SETQ rating given to faculty. The seniority of faculty did not affect their SETQ self-assessment rating, when junior faculty were defined as those in practice for ten years or less and senior faculty as those in practice for more than ten years.[13]

**Table 2**
Comparison between attending self-evaluation and resident evaluation of educator effectiveness.

| Domain of SETQ | Median score (IQR) | | | Factor loadings | | Corrected item-total correlation | |
|---|---|---|---|---|---|---|---|
| | Residents' evaluation (n = 19) | Attendings' self-evaluation (n = 29) | p-value | Residents' evaluation (n = 19) | Attendings' self-evaluation (n = 29) | Residents' evaluation (n = 19) | Attendings' self-evaluation (n = 29) |
| A. Learning Climate | 4.5 (4.0, 4.6) | 4.0 (3.8, 4.2) | 0.06 | – | – | – | – |
| A5. Prepares well for teaching presentations and talks | 4.5 (3.9, 4.7) | 4.0 (4.0, 4.0) | 0.04 | 0.90 | 0.70 | 0.86 | 0.45 |
| B. Professional attitude towards residents | 4.6 (4.4, 4.8) | 4.5 (4.0, 5.0) | 0.81 | – | – | – | – |
| B2. Is respectful towards residents | 4.6 (4.3, 4.8) | 5.0 (4.0, 5.0) | 0.03 | 0.96 | 0.70 | 0.93 | 0.53 |
| B4. Is easily approachable for consultations on the outpatients | 4.6 (4.4, 4.8) | 5.0 (4.0, 5.0) | 0.03 | 0.97 | 0.83 | 0.94 | 0.59 |
| C. Communication of goals | 4.1 (3.6, 4.4) | 3.2 (2.8, 3.6) | <0.001 | – | – | – | – |
| C1. States learning goals clearly | 4.3 (3.8, 4.6) | 3.0 (3.0, 4.0) | <0.001 | 0.99 | 0.78 | 0.98 | 0.59 |
| C2. States relevant goals | 4.3 (3.8, 4.5) | 4.0 (3.0, 4.0) | <0.001 | 0.98 | 0.69 | 0.97 | 0.49 |
| C3. Prioritizes learning goals | 4.3 (4.0, 4.7) | 4.0 (3.0, 4.0) | <0.001 | 0.98 | 0.72 | 0.98 | 0.58 |
| C4. Repeats stated learning goals periodically | 4.3 (3.8, 4.5) | 3.0 (3.0, 4.0) | <0.001 | 0.99 | 0.82 | 0.98 | 0.67 |
| C5. Offers to conduct mini-CEX (clinical examination exercise) regularly | 3.1 (3.0, 3.5) | 2.0 (2.0, 3.0) | <0.001 | 0.61 | 0.74 | 0.50 | 0.60 |
| D. Evaluation of residents | 4.4 (4.1, 4.7) | 4.0 (4.0, 4.2) | 0.04 | – | – | – | – |
| D1. Evaluates resident's specialty knowledge regularly | 4.3 (3.8, 4.6) | 4.0 (4.0, 4.0) | 0.02 | 0.96 | 0.86 | 0.94 | 0.72 |
| D2. Evaluates resident's analytical abilities regularly | 4.5 (4.0, 4.7) | 4.0 (4.0, 4.0) | 0.02 | 0.99 | 0.88 | 0.98 | 0.75 |
| D4. Evaluates residents' medical skills regularly | 4.4 (4.2, 4.8) | 4.0 (4.0, 4.0) | 0.01 | 0.94 | 0.75 | 0.91 | 0.56 |
| E. Feedback | 4.5 (4.0, 4.7) | 4.2 (4.0, 4.5) | 0.11 | – | – | – | – |
| E1. Regularly gives positive feedback to residents | 4.5 (4.1, 4.7) | 4.0 (4.0, 4.0) | 0.01 | 0.95 | 0.45 | 0.93 | 0.28 |
| E3. Explains why residents are incorrect | 4.4 (4.3, 4.7) | 4.0 (4.0, 4.0) | 0.04 | 0.96 | 0.86 | 0.94 | 0.66 |
| F. This surgeon is a specialist role model | 4.5 (4.1, 4.8) | – | – | – | – | – | – |
| G. Overall teaching performance of this surgeon | 4.3 (3.7, 4.8) | 4.0 (3.0, 4.0) | 0.01 | – | – | – | – |

**Table 3**
Comparison between attending self-evaluation and resident evaluation of educator effectiveness.

| Domain of the SETQ | Cronbach's α | | Attendings' evaluation vs. residents' evaluation | |
|---|---|---|---|---|
| | Residents' evaluations | Attendings' self-evaluations | Kendall's τ correlations | p-value |
| A. Learning climate | 0.96 | 0.67 | −0.15 | 0.06 |
| B. Professional attitude towards residents | 0.98 | 0.76 | 0.02 | 0.81 |
| C. Communication of goals | 0.95 | 0.79 | −0.35 | <0.001 |
| D. Evaluation of residents | 0.98 | 0.79 | −0.16 | 0.04 |
| E. Feedback | 0.97 | 0.68 | −0.13 | 0.11 |
| G. Overall teaching performance | 0.99 | 0.80 | −0.19 | 0.01 |

## Discussion

This study assessed the effect of teaching styles and learning preferences on the quality of surgical teaching. In general, we found that most faculty preferred a multimodal learning preference and no single teaching style was associated with enhanced teaching effectiveness.

### *Learning preferences*

Little is known regarding how learning preferences influence effectiveness of surgical educators. Previous work demonstrated some correlation between learning preferences and ABSITE score while others showed varying awareness of faculty and residents learning styles among general surgical resident, using the VARK tools.[14–17] The learning styles of medical students applying to general surgery residency have also been studied and found to be unique.[18] Only one study evaluated learning styles of general surgeons utilizing the Kolb Learning Style Inventory and found no correlation between learning styles of the attending surgeons with their performance as a surgical educator.[19] When learning preferences of attendings at our institution were considered, the majority of our cohort of surgical educators were multimodal in nature (20/28). Most of the remaining educators had a kinesthetic preference of varying strength. This may be expected in surgeons in particular due to the 'doing' nature of the specialty and the strong need for experiential learning in developing operative skills. However, our analysis did not find a significant difference in the effectiveness between multimodal and kinesthetic learning preferences, which is possibly due to the small sample size.

### *Teaching styles*

Attending teaching styles may impact effectiveness of surgical educators. Attendings with a Style 5 preference had lower scores for the "professional attitudes towards surgical residents" domain of the SETQ resident assessment. One possible theory for this finding is that the Style 5 teacher is colloquially described as a "big conference teacher" and "who likes nothing better than to stand up in front of a big audience"; one might expect this type of teacher not to be as learner focused as other teaching styles. The Staffordshire Hexagon[7] is a method by which a visual representation of teaching styles can be plotted. Our data suggested that completion of a teaching style self-assessment such as this hexagon could guide surgical educators by providing insight into their style. It is possible

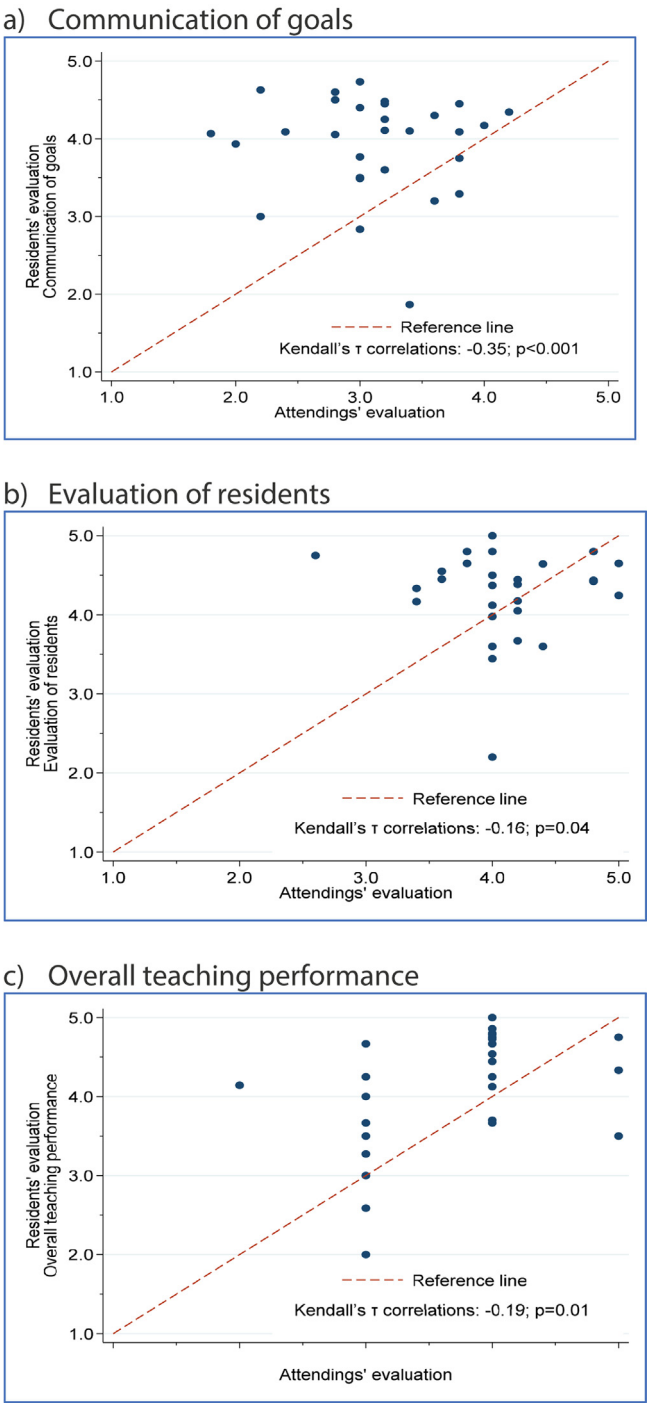


**Fig. 1.** Scatter plots presenting the correlation between residents' evaluation vs. attendings' self-evaluation of effectiveness as an educator.

that, with a multi-institutional effort, we may determine more significant relationships between teaching styles and educator effectiveness. If so, these results could guide faculty development initiatives to foster those teaching styles with a positive correlation to effectiveness.

### *Attending self-assessment*

When assessing teaching effectiveness, our data suggest that faculty are more critical of their skills as educators than residents.

In three domains of the SETQ (communication of goals, evaluation of residents and overall teaching ability), faculty rated themselves significantly lower than did the residents. This is congruent with a previous study of SETQ in surgical residents and faculty,[8] and with self-evaluation in other specialties.[20,21] These previous studies suggest that surgeon self-assessment needs to be combined with external feedback for validation. Our results demonstrate that faculty self-assessment was significantly lower than residents for 4 of the 5 domains related to communication of goals and performance of mini-CEX examinations. This effect was independent of faculty seniority and unlikely related to increased insight into their own performance as educators. Given the importance of recognizing areas of quality improvement, it is perhaps encouraging that faculty self-rank lower providing room for improvement. Although beyond the scope of this study, we postulate that there are likely several components contributing to the faculty's lower self-assessment including humility, not having received formalized feedback, or incomplete understanding of the rating scale. Faculty development endeavors can be tailored based on these findings to improve the quality of resident education in our program.

This study uniquely evaluated perceptions of effectiveness utilizing validated scale. Previous work has investigated the opinion of 'master surgeons'[22] and recipients of the Silver Scalpel Awards (from the Association of Surgeons in Training, UK)[23] regarding effective surgical educator qualities. Recent work at our institution extended this research to include the opinion of senior surgery residents who felt that an "intrinsic" factor played a crucial role in effectiveness as a surgical educator[2] and our current work may help define this factor.

This study has limitations. The relatively small sample size may have precluded us from determining more associations between teaching styles and educator effectiveness. Due to the small sample size of our cohort we selected to use the four classification version of the VARK tool (V, A, R and K). Other iterations of this tool describe two types of multimodal learners (VARK Type One and VARK Type Two), two prong combinations such as V mild, K strong etc. and also sub classification of the primary preference as mild or strong. It would be beneficial to determine whether one of these preferences could contribute to the "intrinsic" factor of an effective educator and we plan future, multi-institutional studies with a larger cohort to ascertain this. Additionally, with regard to learning preferences we should be cautious about extrapolating an effect of educator learning preferences on teaching style or effectiveness.

## Conclusion

Teaching styles likely influences the effectiveness of a surgical educator. Most surgical educators we investigated exhibit multifaceted learning preferences. Future work should be directed at multi institutional analysis to delve further into potential relationships between teaching style and effectiveness of education.

## Funding

None.

## Declaration of competing interest

None.

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