Surgical Education

Using spaced education to teach interns about teaching skills

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\begin{abstract}
\textbf{BACKGROUND:} Despite limited preparation and knowledge base, surgical interns have important teaching responsibilities. Nevertheless, few faculty development programs are aimed at interns.

\textbf{METHODS:} Succinct teaching skill content was electronically distributed over time (spaced education) to interns in academic year 2010/2011. The interns in the previous year served as historic controls. Electronic surveys were distributed for program evaluation.

\textbf{RESULTS:} Fifteen of 24 (62.5\%) interns and 35 of 49 (71.4\%) students responded to the surveys in academic year 2009/2010 and 16 of 27 (59.3\%) interns and 38 of 52 (73\%) students responded in academic year 2010/2011. Surveys showed improved attitudes toward teaching by interns as well as a higher estimation of interns’ teaching skills as rated by students for those interns who received the spaced education program.

\textbf{CONCLUSIONS:} Using spaced education to improve interns’ teaching skills is a potentially powerful intervention that improves interns’ enthusiasm for teaching and teaching effectiveness. The changes are mirrored in students’ ratings of interns’ teaching skills and interns’ attitudes toward teaching.

\end{abstract}

It has been estimated that 20\% to 40\% of what medical students learn is based on teaching by residents.\textsuperscript{1–4} The teaching delivered by residents, predominantly focused on aspects of clinical care including technical skills and patient management,\textsuperscript{5,6} is often unique and complementary to teaching by attending staff\textsuperscript{2} and well received by medical students.\textsuperscript{1,4,6–8} Interns may be contributing proportionally less teaching,\textsuperscript{2} but students particularly appreciate that interns, being closest to their own experience, bring concepts to the student level successfully.\textsuperscript{2}

Despite residents’ important teaching roles and their extensive exposure to modeling of teaching, concerns have been raised that residents are thrust at the frontline of teaching with little or inadequate formal preparation.\textsuperscript{2,3,9} To avoid this, residents should be instructed regarding teaching and the development of teaching skills. This instruction should be time efficient\textsuperscript{3,7} and give residents access to the content they should teach\textsuperscript{1} as well as the skills they need to teach effectively.\textsuperscript{10} Given the time constraints residents face, spaced education (SE) may be a viable mechanism by which to provide this information. SE is a conceptual educational framework that relies on the delivery of succinct pieces of information related to a specific content area spaced out over time. The rational behind spacing out and repeating content over time is that it enhances learning efficiency and retention when compared with delivering a single educational bolus in the form of a lecture.\textsuperscript{11–14}
Previous work at this institution that used SE for faculty development has shown that the methodology can be used to increase frequency and improve the usefulness of feedback provided by surgical residents to students. However, a related project that used the methodology to deliver teaching advice more broadly to members of the entire surgical faculty showed no change in ratings of teaching behavior. The discrepancy in findings between these studies is interesting. We inferred that SE used as a faculty development tool to enhance teaching may not be a useful intervention for experienced teachers but may be more appropriate for novice teachers (ie, interns). With this study, we aimed to test the hypothesis that delivering teaching-related content in this fashion may be a viable training mode for novice teachers. The study’s specific goal was to determine if SE could be used to improve interns’ attitudes toward teaching and their teaching skills beyond feedback frequency.

Methods

The study was submitted to the Harvard Medical School Institutional Review Board, Boston, MA, and was exempt from further review.

Participants

The study was a historic control study. The interns and medical students in academic year 2009/2010 served as the control group for interns and medical students in academic year 2010/2011. All surgical interns including categorical, designated, and undesignated preliminary interns working in the Brigham and Women’s Hospital Department of Surgery, Boston, MA, were sent the teaching-related content during academic year 2010/2011. All interns and all medical students who participated in the 3rd-year core surgery clerkship at the hospital during the same academic years were recruited via e-mail to participate in the survey portion of the study. E-mails were sent to the interns’ hospital e-mail addresses and students’ medical school e-mail addresses. After the initial e-mail asking interns and students to complete the surveys, 4 reminder e-mails were sent out over the course of 3 weeks. Participation in survey completion was voluntary for interns and students. There were no intern- or student-specific exclusion criteria.

Interventions

Twenty-nine brief statements (Table 1) about providing feedback, learning, and teaching skills in general and teaching to the goals of the surgery clerkship, which were written and edited by the investigators as previously described, were used as the content to be distributed. Generally, each statement contained a guideline and an illustrative example (eg, “Learning is more likely to occur when there is a real need-to-know factor. Therefore, use patients on the service to teach the student about disease presentation, pathophysiology, or management”). The content was sent to all the interns in academic year 2010/2011. Content was delivered weekly and in random order to the interns’ hospital e-mail addresses. Every intern received the same content. Content was sent from the hospital e-mail address of 1 of the authors (L.I.M.P.). Each statement was delivered once before any content was repeated. In this fashion, each intern received the SE content at least twice over the course of the academic year.

Outcome measures

Outcome measures were interns’ and students’ responses to a survey adapted from a previously used survey designed to evaluate residents’ performance as teachers. The survey items shown in Table 2 asked about the perception of the role of teaching in interns’ careers and career development (Q1–3), the assessment of interns’ teaching skills (Q4–6), opinions about the efficacy of different teaching approaches (Q7–8), and the institutional value of teaching (Q9). Responses were sought on a 5-point Likert scale anchored by “strongly agree” to “strongly disagree” or “poor” to “excellent” depending on the question.

All interns were asked to describe any prior teaching experience. Interns in academic year 2010/2011 were also asked to evaluate the usefulness of the program. Students were asked to estimate how much of their overall learning came from teaching by interns, to rate the overall quality of teaching delivered by interns, and to list the 3 most important things they had learned from interns with whom they had worked. Demographic information was collected for both interns and students. Interns and students who volunteered to participate were sent the appropriate surveys for completion between March and June 2010 for academic year 2009/2010 and between March and June 2011 for academic year 2010/2011.

Analysis

Demographic information was compared using the Student t test for age and the Fisher exact test for categoric data (ie, sex and prior teaching experience). Intern and student responses were coded ordinally (ie, 1 = “strongly agree” to 5 = “strongly disagree”). Students’ ratings of teaching were also coded ordinally, with 1 indicating “poor” and 5 “excellent.” The Fisher exact test was used to test for significant differences by year between responses. For graphic representation of differences in proportions, the data were recoded to group together 1 and 2 (agree) and 3, 4, and 5 (disagree). For students’ ratings of teaching quality, the data were recoded to group together 1 and 2 (ie, “fair” or worse) and 3, 4, and 5 (ie, “average” or better). An alpha of 0.05 was used as a cutoff for significance for all tests. Qualitative responses to the question about teaching experience, program feedback,
Table 1  SE content

I. Feedback

1. Give feedback based on agreed upon goals. For example, “We had agreed to discuss your presentation skills and I wanted to let you know that your presentation this morning was well-organized.”
2. Tell the student that you are about to give feedback so they recognize it as such. For example, “Let me give you some feedback on the progress note you wrote today.”
3. Initiate feedback by asking the student to assess his or her own performance. For example, “Tell me first how you felt about this presentation.”
4. When giving feedback, start with the positive before introducing suggestions for improvement. For example, “When taking the patient’s history your approach was kind and reassuring. However, you missed some key elements of the history of present illness.”
5. Keep feedback focused and avoid trying to accomplish too much at once. For example, “Let me give you some feedback regarding your assessment of this patient.”
6. When giving negative feedback, include a plan to correct the problem. For example, “You contaminated yourself when trying to insert the Foley catheter because you did not set up the procedure correctly before you started. Watch me do one and once I’ve finished list the steps required to set up for Foley catheter placement. You can try again after that.”
7. When giving feedback, give specifics. For example, “When you were taking the patient’s history, you sat down next to the bed and asked open-ended questions. This allowed the student to feel comfortable and you to get a complete history without missing important details.”
8. Use feedback to provide the student with information about his or her performance that they can use to improve future performance. For example, “To make the presentation easier to follow, organize it by systems next time.”
9. Give positive feedback to motivate the student to continue to show good behaviors and skills. For example, “The way you use follow-up questions to better understand the chief complaint is excellent. Keep it up.”
10. Do not use compliments or flattery as a substitute for feedback. For example, do not just say “Nice job” or “You did great.”
11. After you have provided feedback, ask the student if the feedback was clear and helpful. For example, “Do you have any questions about what I just said?”
12. Give feedback promptly following an observation of the student’s behavior.

II. Learning and teaching skills

1. Learning is more likely to occur when the student is active rather than passive. Therefore, encourage students to obtain a history and physical examination on their own and then ask them to present for critique.
2. Learning is more likely to occur when a supportive environment exists. Therefore, make yourself available to the student, orient him/her to the team or the OR, and facilitate communication.
3. Learning is more likely to occur when there is a real “need-to-know” factor. Therefore, use patients on the service to teach the student about disease presentation, pathophysiology, or management.
4. Learning is more likely to occur if the topic is kept focused. Therefore, do not expect to cover the field in every teaching moment but chose and emphasize 1 message.
5. Learning skills are developed through independent work. Therefore, assign your student a learning task and make sure to follow up on the assignment.
6. Learning occurs through role modeling and observation. Therefore, always conduct yourself professionally, use good communication skills, and think out loud to teach clinical reasoning skills and to avoid misconceptions.
7. Learning is more efficient when expectations are clearly set. Therefore, tell your student what you expect him/her to know at the end of his/her time with you.
8. Learning is more likely to occur when the student is cognitively engaged. Therefore, use questions to probe the student’s knowledge and pause long enough to give the student time to process and answer your question.

III. Clerkship goals

1. One goal of our Core Surgery Clerkship is for students to learn about perioperative management of patients, including preoperative risk assessment and postoperative management of pain, diet, and fluid status.
2. One goal of our Core Surgery Clerkship is for students to develop an understanding of the decision-making process related to surgical problems/issues.
3. One goal of our Core Surgery Clerkship is for students to understand the basics of diagnosis and treatment of diseases/problems commonly treated by surgeons such as solid organ tumors, gastrointestinal diseases, and trauma.
4. One goal of our Core Surgery Clerkship is for students to learn to obtain a focused history and physical on a patient with a surgical problem.
and the things medical students learned from interns were reviewed for and grouped by themes and tallied.

**Results**

**Response rates and demographics**

During academic year 2009/2010, 24 interns and 49 students were contacted to participate. During academic year 2010/2011, 27 interns and 52 students were contacted. All interns in academic year 2010/2011 received the SE content. During academic year 2009/2010, 15 (62.5%) residents including 6 (40%) categorical, 6 (40%) designated preliminary, and 3 (20%) undesignated preliminary and 35 (71.4%) students responded to the survey. The average age for interns was 27.9 (standard deviation [SD] = 2.1), and for students it was 26.1 (SD = 2). Seven (46.7%) of the interns and 16 (45.7%) of the students were women. A majority of the interns (ie, 11 [73.3%]) reported having had prior teaching experience; of these, 5 (45.5%) had had prior experience teaching in a medical setting.

During academic year 2010/2011, 16 (59.3%) residents including 5 (31.3%) categorical, 9 (56.2%) designated preliminary, and 2 (12.5%) undesignated preliminary and 38 (73.1%) students responded. The average ages were 29.6 (SD = 2.5) and 26.4 (SD = 2.7) years for interns and students, respectively. Five (31.3%) interns and 20 (52.6%) students were women. Eleven (68.8%) of the interns reported prior teaching experience. Two interns did not specify their experience. The majority of those who specified (ie, 6 [54.5%]) acted as tutors or teaching assistants for nonmedical subjects; 2 (18.2%) had had prior experience teaching in the medical setting. The difference in interns’ ages in academic years 2009/2010 and 2010/2011 was statistically significant (P = .04). No other differences were significant. The data are summarized in Table 3 for interns and Table 4 for students.

**Survey results**

**Interns.** In academic year 2009/2010, 10 of 15 (66.7%) interns felt teaching was an important part of their job compared with 15 of 16 (93.8%) in academic year 2010/2011. This difference approached statistical significance (P = .08). Although interns were already predominantly in agreement with the statement that developing teaching skills was an important part of their career development, 12 of 15 (80%) agreed with this statement in academic year 2009/2010. The number (14/16, 87.5%) of interns who agreed with this statement was non-significantly greater in the intervention group (P = 0.65). Similarly, more interns who received the content indicated interest in participating in programs designed to improve their teaching skills.

**Table 1 (continued)**

| 5. One goal of our Core Surgery Clerkship is for students to develop skills in effective written and verbal communication with other professionals such as daily progress notes and consultation requests. |
| 6. One goal of our Core Surgery Clerkship is for students to continue to develop strong communication skills with patients. |
| 7. One goal of our Core Surgery Clerkship is for students to continue in their development of professional behavior (ie, punctuality, reliability, and integrity). |
| 8. One goal of our Core Surgery Clerkship is for students to show basic skills such as Foley catheter or nasogastric tube insertion or sterile technique when performing a dressing change. |

**Table 2** Survey items (as phrased for interns)

| Q1. Teaching of medical students is an important part of my job as a surgical intern. |
| Q2. Development of teaching skills is an important part of my career development. |
| Q3. I would like to participate in programs to improve my teaching. |
| Q4. I clearly communicate my expectations to the medical students. |
| Q5. I am an effective teacher of medical students. |
| Q6. I enjoy teaching medical students. |
| Q7. Role modeling by interns is an effective means of teaching medical students. |
| Q8. Feedback by interns is an effective means of teaching medical students. |
| Q9. My department values teaching of medical students by interns. |

**Table 3** Response rates and demographics for interns

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Respondents, n (%)</td>
<td>15 (62.5)</td>
</tr>
<tr>
<td>Age (SD)*</td>
<td>27.9 (2.1)</td>
</tr>
<tr>
<td>Females, n (%)</td>
<td>7 (46.7)</td>
</tr>
<tr>
<td>Prior teaching</td>
<td></td>
</tr>
<tr>
<td>Experience, n (%)</td>
<td>11 (73.3)</td>
</tr>
<tr>
<td>Medical teaching</td>
<td>-5 (45.5)</td>
</tr>
<tr>
<td>Tutor/teaching assistant</td>
<td>-3 (27.3)</td>
</tr>
<tr>
<td>Sports/activities</td>
<td>-3 (27.3)</td>
</tr>
<tr>
<td>Not specified</td>
<td>-0 (0)</td>
</tr>
</tbody>
</table>

*The difference in age is statistically significant (P = .04).
(ie, 12/16 [75%] vs 10/15 [66.7%]). This difference also was not statistically significant ($P = .7$) (Fig. 1).

When asked to assess their own teaching skills and involvement in teaching, interns indicated more agreement with the statements about their own teaching skills in the year in which the content was distributed. Interns felt more often that they communicated clearly with students (ie, 13/16 [81.3%] in academic year 2010/2011 vs 9/15 [60%] in academic year 2009/2010, $P = .25$), and more thought they were effective teachers of medical students (ie, 12/16 [75%] agreed in academic year 2010/2011 vs 7/15 [46.7%] in academic year 2009/2010, $P = .15$). Although the vast majority of interns (ie, 12/15 [80%]) reported enjoying teaching medical students in academic year 2009/2010, more of the interns who received the content in academic year 2010/2011 reported enjoying teaching medical students (ie, 15/16 [93.8%]). This difference was again not statistically significant ($P = .33$) (Fig. 2).

Starting from an already high rating of the usefulness of both role modeling and the provision of feedback as teaching tools, interns in academic year 2009/2010 and academic year 2010/2011 stayed fairly consistent in their appraisal of these when asked to judge these behaviors’ values as teaching approaches (Fig. 3). Specifically, 12 of 15 (80%) versus 12 of 16 (75%, $P = 1.00$) interns agreed that role modeling was effective, and 11 of 15 (81.3%) versus 13 of 16 (81.3%, $P = .69$) agreed feedback was effective, respectively, in academic years 2009/2010 and 2010/2011.

Fifteen of 16 (93.8%) interns confirmed that they had received and read the e-mails. Of these, 14 of 15 (93.3%) interns reported finding the content useful. Nine of 15 (60%) answered the associated open-ended question about the usefulness of the program. Of the respondents, 4 of 9 (44.4%) stated that they appreciated the e-mails as reminders to be involved in medical student education and that the e-mails raised their enthusiasm about teaching. Three of 9 (33.3%) liked that the e-mail contents were concise and therefore easy to remember, and 2 of 9 (22.2%) simply valued receiving education about teaching.

Also, 5 of 15 (33.3%) interns agreed that the Department of Surgery valued teaching of medical students by interns in academic year 2009/2010, whereas more than twice as many (ie, 11/16 [68.8%]) interns who were exposed to the faculty development program in academic year 2010/2011 agreed with this statement (Fig. 4). The difference approached statistical significance ($P = .07$). Subgroup analysis comparing responses given by categorical, designated preliminary, and undesignated preliminary interns suggested that the proportions of responses were similar among the groups, but because of the small sample sizes in the subgroup analysis, statistical tests could not be validly applied to test this observation.

**Students.** In academic year 2009/2010, the modal rating of quality of teaching by interns was “fair,” which was
awarded by 17 of 35 (48.6%) students. A rating of “poor” or “fair” was awarded by 21 of 35 (60%) students. Only 14 of 35 (40%) students thought that interns’ teaching was “average,” “good,” or “excellent.” The ratings provided by students who were taught by interns who received the teaching program in academic year 2010/2011 were higher. In academic year 2010/2011, the modal rating of intern teaching quality was “average,” which was awarded by 11 of 38 (29%) students. In contrast to academic year 2009/2010, a rating of “poor” or “fair” was awarded by 13 of 38 (34.2%) students, and a rating of “average” or better was awarded by 25 of 38 (65.8%) students as shown in Fig. 5. This shift was statistically significant ($P = .04$).

Eight of 35 (22.9%) students in academic year 2009/2010 thought interns valued teaching of medical students as an important part of their job, 10 of 35 (28.6%) felt interns were effective teachers of medical students, and 10 of 35 (28.6%) thought that interns enjoyed teaching medical students. By contrast, in academic year 2010/2011, 16 of 38 (42.1%) students thought interns valued teaching of medical students, 19 of 38 (50%) students thought interns were effective teachers, and 16 of 38 (42.1%) students got the impression interns enjoyed teaching them. The differences in perception of interns’ valuing teaching and interns’ effectiveness as teachers both approached statistical significance ($P = .08$ and $P = .09$, respectively). The difference in the perceived enjoyment of teaching was not statistically significant ($P = .32$). The data are summarized in Fig. 6.

The majority of students in academic year 2009/2010 (ie, 11/35 [31.4%]) estimated that up to 10% of their learning came from interns. In academic year 2010/2011, a similar majority (ie, 12/38 [31.6%]) thought up to 20% came from interns.

In each academic year, 25 students responded to the request to identify the 3 main topic areas in which they learned from interns. In academic year 2009/2010, the topics were the culture of surgery (10/25 responses, 40%), evaluating patients (9/25, 36%), and technical skills (9/25, 36%). In academic year 2010/2011, the 3 main topic areas were the culture of surgery (13/25 responses, 52%), time management (12/25, 48%), and how to manage patients (10/25, 40%). Of note, 4 of 25 (16%) students reported learning nothing from interns in academic year 2009/2010, and 2 of 25 (8%) students reported learning nothing from interns in academic year 2010/2011.

**Comments**

Results from this study suggest that SE is a viable strategy to provide interns with education about teaching to improve their teaching of medical students. Interns’ responses to the survey show more positive views of the value of teaching and its role in their career and career development, self-assessment of their efficacy as teachers and enjoyment of teaching, and the perceived departmental support of the educational mission. Although all of these changes are important and encouraging, an improvement in perceived efficacy alone may be encouraging because it has been shown to lead to greater actual teaching effectiveness.18 The perceived changes are also supported by the students’ higher ratings of teaching quality delivered by
Interns in academic year 2010/2011 compared with the historic controls. Students also rated interns in academic year 2010/2011 to be more effective teachers and to enjoy teaching more. However, despite the promising trends, the study’s differences are small. Only a few reach statistical significance. This is likely because of the relatively small sample size, particularly in the intern cohorts. Therefore, a type II error in this study is possible.

The study presented here builds on previous work exploring the potential that SE offers in faculty development regarding teaching.\(^{1,15,16}\) The encouraging findings presented here are timely in today’s 80-hour workweek environment in which residents are still expected to teach while being taught and being steep on the learning curve themselves. A review of resident-as-teacher programs identified only 4 programs specifically geared to interns.\(^7\) We offer the program described here as a low-infrastructure, easily implemented program with a minimal intern time commitment required to make it successful. It combines teaching principles and feedback strategies as well as the goals of the Core Surgery Clerkship at Brigham and Women’s Hospital, satisfying the content demands that a successful program should include teaching advice and highlight the content appropriate for teaching.\(^{1,10}\) Encouragingly, the program was very well received, with over 90% of interns confirming they received the content and found it useful.

Interns are a good target group for educational instruction. Interns usually have the most limited experience teaching, and without good skills they may not be able to seize teaching moments.\(^5\) However, their potential to contribute significantly should be harnessed. They are perceived by medical students to be more approachable,\(^5\) and they are closest to the knowledge base students have, realizing what they need to know.\(^2\) Given all of the potential teachers students encounter during a typical surgery clerkship, it was notable that in our study students reported an increase in the percentage of teaching contributed by interns in the year the interns received the teaching-related content. Each year the type of teaching topics the students identified most frequently certainly seem appropriate for teaching by interns. Therefore, one may assume that the interns had the appropriate content knowledge. The increased teaching seen as a result of the program may suggest that interns are more willing to teach if they feel they know how to teach. Beyond the benefit to students, an additional salutary effect of educating interns about teaching is that teaching can help the interns solidify their own knowledge\(^4\) and also contributes to educating interns toward the Accreditation of Council of Graduate Medical Education competencies practice-based learning and improvement and interpersonal and communication skills.\(^{10}\) When targeting interns, SE offers several advantages. It relies on the psychological principle that educational content delivered repeatedly is acquired more easily and retained better than education content delivered as a large bolus.\(^{11–14}\) In addition to being effective, it is distributed electronically,\(^{19,20}\) and, therefore, it is not tied to physical space, allowing learners to access content at a personally convenient time.\(^{11}\)

Limitations of this study include the small sample size and the fact that the study was conducted in a single department at a single institution. Although all the interns in academic year 2010/2011 were sent the content, we did not achieve 100% participation on the surveys. Therefore, we cannot rule out that either the interns or students who completed the surveys were more intrinsically motivated to provide feedback than those who did not or that the interns who responded were inherently more interested in teaching than those who did not. However, if true, more motivated teachers were likely to respond in both cohorts. Also, although subgroup analysis seemed to suggest that there was little difference between responses given by categorical, designated preliminary, and undesignated preliminary interns, we cannot rule out that having a heterogeneous sample of interns may have biased our results. Additionally, although reports of self-efficacy and students’ assessments of teaching are considered sufficient and adequate program outcome measures,\(^{10}\) additional program outcome measures such as direct observation of teaching by interns should be considered for the future to fully judge the impact of this type of program. Identifying student learning endpoints would also be an effective way to judge this program. Perhaps investigating the topic areas most often taught by interns as identified by students in this study could be targets for future study.

Internship is a significant period of professional growth for young physicians. They begin to learn how to take care of surgical patients, preparing them for their surgical career. As a corollary, internship is also the 1st year in which young doctors assume teaching responsibilities. Providing a teaching program that does not unduly burden the interns during their already charged 1st year in the profession is likely to be beneficial. Using SE is a potentially powerful resident-as-teacher program, and its use satisfies the Liaison Committee on Medical Education requirement that residents are supported in their educational role.\(^{21}\) In summary, the results presented here are promising indicators that computer-based SE may be an appropriate mean to equip interns with the skills to teach medical students.

References


