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A Comparison of Web-Based and Small-Group Palliative and End-of-Life Care Curricula: A Quasi-Randomized Controlled Study at One Institution

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Abstract

Purpose
Few studies have compared the effect of Web-based eLearning versus small-group learning on medical student outcomes. Palliative and end-of-life (PEOL) education is ideal for this comparison, given uneven access to PEOL experts and content nationally.

Method
In 2010, the authors enrolled all third-year medical students at the University of California, Davis School of Medicine into a quasi-randomized controlled trial of Web-based interactive education (eDoctoring) compared with small-group education (Doctoring) on PEOL clinical content over two months. Students participated in three 3-hour PEOL sessions with similar content. Outcomes included a 24-item PEOL-specific self-efficacy scale with three domains (diagnosis/treatment [Cronbach alpha = 0.92; CI: 0.91–0.93], communication/prognosis [alpha = 0.95; CI: 0.93–0.96], and social impact/self-care [alpha = 0.91; CI: 0.88–0.92]); 8 knowledge items; 10 curricular advantage/disadvantages; and curricular satisfaction (both students and faculty).

Results
Students were randomly assigned to Web-based eDoctoring (n = 48) or small-group Doctoring (n = 71) curricula. Self-efficacy and knowledge improved equivalently between groups (e.g., prognosis self-efficacy, 19%; knowledge, 10%–42%). Student and faculty ratings of the Web-based eDoctoring curriculum and the small-group Doctoring curriculum were equivalent for most goals, and overall satisfaction was equivalent for each, with a trend toward decreased eDoctoring student satisfaction.

Conclusions
Findings showed equivalent gains in self-efficacy and knowledge between students participating in a Web-based PEOL curriculum in comparison with students learning similar content in a small-group format. Web-based curricula can standardize content presentation when local teaching expertise is limited, but it may lead to decreased user satisfaction.

In health sciences education, both domestically and internationally, there is great debate about the value of eLearning. Some fear changes that would reduce education to impersonal interactions solely on a computer screen, diminishing engagement and customization of learning strategies. Despite these concerns, Web-based and simulation technologies are increasingly used by medical educators to extend their reach, especially for learners with inconsistent access to high-quality medical content on core and specialized topics.[1] Compared with traditional face-to-face learning, eLearning technologies may be cost-effective, give learners control over educational setting and pace, and enable teaching of content where there is no local expertise.[1] If such content is focused and engaging, and access ensured, technology-assisted learning may help positively transform medical education.

How well does eLearning improve learner outcomes compared with other education techniques? Direct comparisons between eLearning and traditional learning strategies have occurred in secondary[2] and higher education,[3] industry,[4] and (less frequently) medical education. Prior research has concluded that technology-assisted learning can improve acquisition of certain types of knowledge (notably, domains demanding abstract conceptualization and reflective observation)[5] but may fail to engage learners—potentially adversely affecting learner ability to obtain other knowledge types.[6]

In most settings, interactive small-group teaching is considered more effective than traditional lecture-based didactic methods.[7–10] A carefully guided small-group session promotes learners to be autonomous and self-directed, contextualizes learning around the development of specific skills, and establishes a social learning environment. If these adult learning principles are appropriately addressed, eLearning technologies may also be effective.[11] Therefore, we sought to examine the impact on medical student outcomes of medical content taught via an eLearning format in comparison with a well-established small-group format at one institution.

For this purpose, we focused on palliative and end-of-life (PEOL) care, a critical issue for many patients who prefer that their end-of-life care shift from disease-directed therapy (with curative intent) to aggressive palliation of physical, emotional, social, and spiritual suffering.[12,13] PEOL care is

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also a well-studied content area, with critical skills well defined for health care practitioners.[14,15]

National programs have addressed the educational needs of PEOL providers, but these programs face resource limitations of faculty and funding, and many depend on highly skilled local educators. In rural and smaller programs, such resources are nearly impossible to obtain, making instruction in PEOL care a good test case to understand eLearning's value in comparison with small-group learning.

In this quasi-randomized, open assignment educational study, we compared a Web-based interactive curriculum (eDoctoring) with an equivalent small-group interactive curriculum (Doctoring) for PEOL content for third-year medical students. We hypothesized that the Web-based curriculum would result in at least equivalent changes in attitude (self-efficacy), content knowledge, and satisfaction when compared with a traditional small-group curriculum.

Method

In 2005, our team began development of an extensive interactive Web-based PEOL curriculum called "eDoctoring." We are in the process of seeking publication of the details of this content development; briefly, the curriculum was developed with over 20 content/process experts over several years and implemented with over 1,000 medical students and residents across the United States and abroad. The eDoctoring curriculum consists of over 30 PEOL cases and tutorials in an electronic portfolio. eDoctoring showcases sequential trigger videos unveiling a clinical case, with clinical/social/ethical content, embedded question/answers, and areas for reflection. We compared the impact of the Web-based eDoctoring format with a small-group interactive curriculum ("Doctoring")[16] covering the same content amongst third-year medical students at one academic institution. Impact was measured by changes in learner self-efficacy (primary outcome) and measures of program utility (participant satisfaction [student and faculty] and perceived advantages/disadvantages). We did not obtain students' consent for this curricular evaluation, and our institutional review board approved this study.

Design

We conducted a quasi-randomized educational study of third-year medical students, undertaken during the summer quarter of 2010, at the University of California, Davis School of Medicine (UC Davis).

Participants

All 119 third-year medical students at UC Davis participated in the yearlong Doctoring III PEOL course (Doctoring). A subset of students was randomized to additionally participate in eDoctoring.

The Doctoring course

The Doctoring course comprises 26 small-group sessions focusing on core communication and epidemiologic and social topics in medicine (such as discussions around palliative care and medical test utility). Students are assigned presession reading materials and work with the same faculty throughout the year. Each Doctoring afternoon starts with a one-hour faculty development session, during which all faculty review content, key controversies, and learning objectives. The three-hour student small-group session begins with a 30-minute "check-in" (social normalization/professional development) and then case discussions. Discussions are fueled by trigger videos and student interactions with a standardized patient (SP) portraying a patient role. SPs are trained actors who provide a consistent context to facilitate discussions. Students and faculty tackle clinical dilemmas together, exploring aspects of each multifaceted case.

Randomization

An assistant in the dean's office, uninvolved with the conduct of this study, assigned at random all Doctoring students to 1 of 12 groups, balancing gender and ethnicity without attention to other personal characteristics (i.e., blocked design). Doctoring groups had between seven and nine students each, two faculty (physician and nonphysician), and met on either Tuesday or Thursday afternoons throughout their third year of clinical work. Faculty for 6 Doctoring groups were available to meet during summer quarter, and thus those groups (which happened to have the most students) were assigned to the control curricula; the other 6 groups were assigned to the intervention eDoctoring curricula. During the two-month study period, students met during their usual Doctoring times in their usual small groups.

Intervention: eDoctoring Web-based curriculum

After in-person orientation, eDoctoring students participated in three eDoctoring sessions instead of the Doctoring curriculum on the same topics. After their standard check-in, students completed one eDoctoring case and one tutorial without faculty input. For the first eDoctoring session, students completed one case and tutorial in their classroom, with program staff available to answer technical/navigation questions. For the second and third sessions, students met together for check-in and completed eDoctoring material on their own schedule before their next standard session. Program staff and faculty tracked eDoctoring participation. To pass, students were required to obtain an electronic "certificate of completion" after completing the eDoctoring cases and tutorials within one month of assignment. Web-based cases and tutorials took 30 to 60 minutes each to complete.

Curricular content

All students covered similar content in three separate sessions. For both groups, clinical cases involved social, communication, and ethical content surrounding breast cancer in a homeless patient (pain control, social justice, communication, pain management, and access to care), addressing familial needs of a pediatric patient who had just drowned (giving bad news, role and objectives of family meetings, discontinuation of life support, organ donation, family discord), and leukemia in an older patient (surrogate decision making, end-of-life wishes, patient's requests for physician-assisted suicide, understanding depression/grief, pain control, and hospice care). All cases had three to five trigger videos (two to six minutes long) of critical doctor–patient–family interactions highlighting sentinel PEOL issues. Tutorials involved specific medical content on pain management and hospice care.

Control: Doctoring small-group curriculum

After check-in, the Doctoring groups viewed the same trigger videos as

eDoctoring groups, then had group discussions moderated by session faculty. One eDoctoring video was replaced with a live SP interaction and presented the same problem depicted in the eDoctoring video. Students and faculty moderators could at any time call a "time-out" and solicit input from the other student observers.[10,17,18] The small-group students completed each session's case during class, although the eDoctoring tutorial content was made available offline.

Outcome measures

All students completed an online pretest before their first Doctoring session and posttest after their last Doctoring class. The tests were 27 self-efficacy questions written with input from PEOL content experts, pilot tested with fourth-year medical students, and refined for clarity. Pre–post outcome measures included 27 self-efficacy items, in which learners rated their confidence in specific PEOL skills ("not" confident = 1 to "extremely" confident = 4). Self-efficacy is an intermediate measure shown to improve performance/outcomes amongst people with similar knowledge.[19] Students also answered six single-best-answer knowledge questions directly related to the curriculum (pain control [two questions], hospice, ethics, teamwork, acute dying, communication) and two control questions not explicitly addressed in the curriculum (ethics, prognosis). After participation, students answered the question "How satisfied were you with the curriculum, overall?" (with 1 = "not at all satisfied" to 5 = "very satisfied"). eDoctoring students and faculty also reported their perceptions about whether the Web-based learning format was "worse" (= −1), "the same" (= 0), or "better" (= 1) than the small-group curricular format in 10 areas, and also shared their perceptions of the curriculum in open-ended comments at the end of the Web-based survey. eDoctoring faculty also rated the relative ability of eDoctoring (versus Doctoring) to teach facts and concepts, depict challenging cases, and standardize learning. Faculty shared their viewpoints about the value of eDoctoring cases (1 = not at all valuable, 2 = somewhat, 3 = moderately, 4 = highly valuable).

Analysis

Using principal-component analysis on pretest items (395 responses from a separate statewide student assessment), we dropped 3 self-efficacy items with factor loading less than 0.7 (final factor loading range: 0.7–0.9), for a final 24 items in three skill domains. Self-efficacy scale internal consistency [Cronbach alpha] for diagnosis and treatment skills (8 items) was 0.92 (confidence interval [CI]: 0.91–0.93), for patient communication and prognosis skills (9 items) was 0.95 (CI: 0.93–0.96), and for social impact and self-care skills (6 items) was 0.91 (CI: 0.88–0.92). We compared pre–post self-efficacy for domain scales (paired *t* tests) and sum of knowledge questions ("correct"). Item data for the self-efficacy and knowledge domains are presented as a "gain" score, without bivariate comparison to prevent errors from multiple comparisons. For curricular viewpoints, we considered average scores of 1.8 to 2.2 to indicate that both formats are "about the same," 1 to 1.7 to indicate Doctoring small-group curricula as "better," and 2.3 to 3.0 to indicate eDoctoring Web-based curricula as "better." Student responses were analyzed by group assignment, using chi-square test for knowledge and paired *t* tests for self-efficacy (items and scales) with SPSS version 19.0.1 (IBM Corp., Armonk, New York).

Results

Participants

One hundred nineteen students participated in two groups, over eight weeks for three sessions (Figure 1). Forty-eight students were assigned to six Web-based eDoctoring groups, and 71 students to six Doctoring small groups. After students whose posttests were invalid or who dropped out of the courses were excluded, participants were 47 eDoctoring students and 62 Doctoring students. Forty-seven (43%) students were male, and roughly balanced between groups in career interest. Sixty-six (61%) had been personally affected by a friend or family member with a life-threatening disease (Table 1). Twelve eDoctoring faculty from six small groups completed the postcurricular questions.

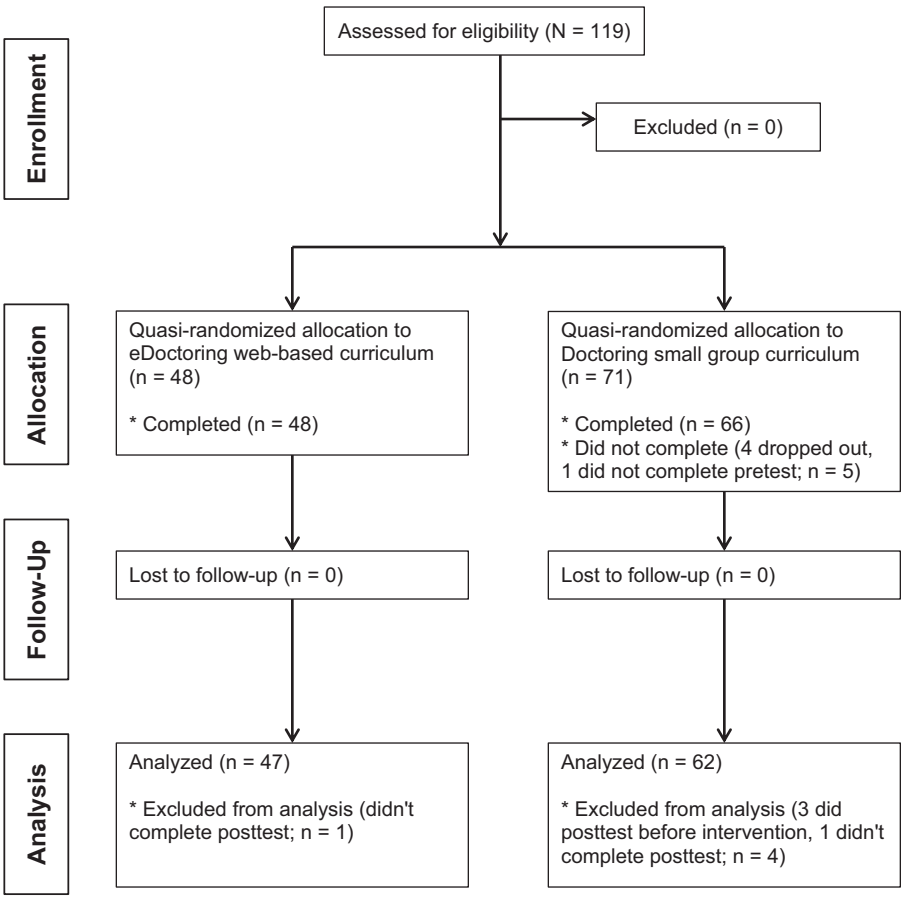

Figure 1 Subjects flow diagram, from a comparison study of medical student outcomes for small-group versus eLearning curricula on palliative and end-of-life care, University of California, Davis School of Medicine, 2010.

Table 1

Characteristics of Third-Year Medical Students Who Participated in Either a Web-Based (eDoctoring) or Small-Group (Doctoring) Curriculum Covering the Same Palliative/End-of-Life Care Content, From a Comparison Study of Medical Student Outcomes, University of California, Davis School of Medicine, 2010[a]

Characteristic	No. (%) of participants in eDoctoring Web-based curriculum (N = 47)	No. (%) of participants in Doctoring small-group curriculum (N = 62)
Gender		
Female	26 (55)	36 (58)
Male	21 (45)	26 (42)
Race/ethnicity		
American Indian or Alaska Native	0 (0)	1 (2)
Asian, Native Hawaiian, or other Pacific Islander	9 (19)	29 (47)
African, Black, or African American	0 (0)	4 (7)
Caucasian	25 (53)	24 (39)
Hispanic	6 (13)	4 (7)
More than one race	2 (4)	0 (0)
Unknown	2 (4)	0 (0)
Other	3 (6)	0 (0)
Specialty area of interest		
Emergency medicine	7 (15)	3 (5)
Family medicine	13 (28)	9 (15)
Surgery	5 (11)	15 (24)
Internal medicine	9 (19)	8 (13)
Pediatrics	4 (9)	7 (11)
Psychiatry	1 (2)	3 (5)
Ob-gyn	2 (4)	2 (3)
Other	2 (4)	3 (5)
Undecided	4 (9)	13 (21)
Reports being personally affected by friend or family member with a life-threatening disease		
Have not known–a little affected	18 (38)	25 (40)
Somewhat affected	8 (17)	16 (26)
Significantly affected–major influence	21 (45)	21 (34)

[a]No significant baseline differences between groups.

Self-efficacy

After participation, student self-efficacy improved in both groups in all three skills domains ($P < .001$), without difference between groups before or after participation (Table 2). Overall, students were initially "a little" confident on their skills in PEOL, improving to "moderately" or "very" confident after curricular participation. Although students in both groups consistently reported a one- to two-point increase in posttest self-confidence on a four-point scale (see Supplemental Digital Table 1, http://links.lww.com/ACADMED/A254, which illustrates the details of intervention effect on self-efficacy), small-group students tended to more frequently report being "very" confident after the curriculum; however, these differences were also not statistically significant. Among all students, 20% or more felt "very" confident in only a few areas: addressing needs of patients with advanced or terminal illness, eliciting patient values in creating a care plan, and understanding their personal biases in dealing with difficult/self-abusive patients. Among Doctoring students, 20% felt "very" confident in two additional areas: distinguishing between uncontrolled pain, tolerance, and substance abuse; and initiating discussions about advance directives.

Knowledge

After participation, knowledge of all students improved in content covered by the curriculum (Table 3), with a nonstatistical trend favoring eDoctoring students for number of "correct" answers (11%–42% more "correct" versus 10%–34% for Doctoring students). Students in both groups had no gains (−9 to +2 more "correct" posttest) in questions that were not explicitly covered in the curriculum.

Viewpoints of curricular advantages/disadvantages

Only eDoctoring students and faculty participated in both eDoctoring and Doctoring curricular formats (Table 4). eDoctoring participants reported that eDoctoring could better fit into their schedules (mean = 2.7, range = 0–3). Students felt that the two curricular formats were equivalent for areas such as stimulating self-directed learning, facilitating long-term knowledge retention, and facilitating application of material in practice (means = 1.8–2.2). In response to open-ended questions, students made comments such as: "I feel it was very useful to exhibit the difference in opinion between the authors. This provides the student with more knowledge and assists in considering both sides of the situation," and "Great to [handle] a really emotional situation." As expected, students reported that the Doctoring small groups were better at providing faculty contact and opportunities to practice (mean = 1.0–1.7). A representative student comment was "I would much rather hold my own ethical discussion than watch one."

Faculty felt that the eDoctoring was similar to Doctoring (mean = 2.0) in depicting challenging clinical cases, teaching facts, and teaching general concepts. In addition, faculty felt that eDoctoring was slightly superior to the Doctoring small-group curriculum in standardizing learning for all students (mean = 2.3)

eDoctoring curricular satisfaction

Students rated eDoctoring modules as a valuable addition (mean = 5.3, range = 0–7) to the overall curriculum. Learners felt that some areas (such as refining decision-making skills and addressing ethical issues) were generally equivalent between teaching modalities. As expected, Doctoring students were more likely to

Table 2

Changes in Third-Year Medical Students' Self-Efficacy Before and After eDoctoring and Doctoring Curricular Participation, in Three Domains, From a Comparison Study of Medical Student Outcomes, University of California, Davis School of Medicine, 2010

Self-efficacy domain: "How confident are you about your skills in this area?"	Number of self-efficacy items (scale range)	Mean (SD), eDoctoring Web-based curriculum (N = 45–46)		Mean (SD), Doctoring small-group curriculum (N = 61–63)	
		Pre	Post	Pre	Post
Diagnosis and treatment skills	8 items (8–32 range)	15.0 (3.6)	21.1 (4.4)[a]	14.8 (4.3)	21.6 (4.7)[a]
Patient communication and prognosis skills	9 items (9–36 range)	17.7 (5.7)	25.4 (5.2)[a]	16.8 (6.1)	25.4 (5.1)[a]
Social impact and self-care skills	6 items (6–24 range)	12.9 (3.7)	16.6 (3.2)[a]	12.5 (4.2)	16.9 (3.2)[a]

[a]$P < .001$ for pre–post paired t tests within each group. No significant between-group differences (pre and post). Ratings for each self-efficacy item: 1 = not confident; 2 = a little confident; 3 = moderately confident; 4 = very confident. Each scale was created by adding all items in the self-efficacy domain.

feel that the learning material helped them refine their interviewing skills compared with those in the eLearning group ($P < .0001$ across all modules). There was a nonstatistical trend toward greater mean satisfaction among Doctoring students (mean 5.0–5.3 versus 4.4–4.6 out of 7 for eDoctoring students, $P > 0.05$).

Discussion

To our knowledge, ours is one of the first studies to directly compare medical content taught in an eLearning format with that taught in a small-group format. In this quasi-randomized study comparing students who participated in an interactive Web-based PEOL curriculum (eDoctoring) and students who were presented similar PEOL content in a small-group format (Doctoring), we found no difference between groups in their improvement in PEOL self-efficacy or knowledge. This should ease one of the most important concerns about eLearning: It was not inferior to even a very successful small-group format in these important areas.

Because the small-group setting is so fundamentally different from e-learning, these findings cannot end the debate around the effectiveness of eLearning. Some educators will surely continue to maintain that interpersonal teaching methods (lectures, small groups, and bedside learning) are superior and that there is no substitute for the Socratic method. The interactions among peers

Table 3

Changes in Third-Year Medical Student Knowledge Before and After Doctoring and eDoctoring Curricular Participation, for Material Covered and Not Covered in the Curricula by Improvement in Knowledge (% Delta) Within Groups, From a Comparison Study of Medical Student Outcomes, University of California, Davis School of Medicine, 2010

Material	% Correct, eDoctoring Web-based curriculum (N = 47)			% Correct, Doctoring small-group curriculum (N = 62)		
	Pretest	Posttest	Delta[a]	Pretest	Posttest	Delta[a]
Intervention-related questions (explicitly covered in curricula)						
Increasing pain in this patient with metastatic cancer and hip pain most likely represents:	40	60	+20	34	53	+19
The most appropriate next step in drug treatment would be to discontinue Percocet, and start:	40	51	+11	29	63	+34
Per the Medicare Hospice Benefit, which one of the following hospice admission criteria is *not* required:	28	70	+42	21	32	+11
All of the following must be present to establish that this patient has decision-making capacity *except*:	19	57	+38	31	57	+26
In general, when is a treatment considered futile?	38	68	+30	34	45	+11
How should you advise the parents to approach telling their daughter she has brain cancer?	75	94	+19	79	89	+10
Control questions (not explicitly covered in curricula)						
The single best predictive factor in determining prognosis in patients with metastatic cancer is:	87	85	–2	84	86	+2
Which one of the following statements is closest to the definition of "physician-assisted suicide"?	75	66	–9	68	65	–3

[a]The sum of the % knowledge items correct was not statistically significant at $P = .05$ (paired t test). We present descriptive data without bivariate analysis to prevent errors from multiple comparisons.

Table 4

Viewpoints of eDoctoring Third-Year Medical Students and Faculty About Advantages and Disadvantages of Web-Based Curricula, Using eDoctoring as an Example, From a Comparison Study of Medical Student Outcomes, University of California, Davis School of Medicine, 2010

In comparison with traditional medical education curricula, how well does this type of interactive Web-based education meet the following goals?[a]	eDoctoring student viewpoints, mean (N = 47)	eDoctoring faculty viewpoints, mean (N = 11)[b]
Fit into your (student) schedule	0.6	0.6
Provide flexibility in time/place for participation	–0.2	0.7
Stimulate self-directed learning	0	–0.1
Facilitate long-term retention of knowledge	–0.1	–0.2
Stimulate self-reflection about your (students') skills	–0.2	–0.5
Help you utilize the content in patient care settings	–0.2	–0.3
Provide opportunities to explore additional content	–0.3	0
Demonstrate good/bad communication strategies	–0.4	–0.3
Engage you (students) in the content	–0.4	–0.5
Provide faculty contact	–0.7	–0.7

[a]Scale: –1 = worse, 0 = about the same, 1 = better.
[b]One of 12 faculty participants did not respond.

and faculty in small groups enable observations of role modeling and real-time questions/answers as issues arise. Others, while perhaps acknowledging these advantages to small-group learning, will nevertheless highlight the separate advantages of eLearning, including consistency of content delivery, convenience, flexibility, addressing topics for which there is no local expertise, and review of content in a "just in time" fashion. Carefully produced eLearning can incorporate adult learning theory practices and promote self-directed learning via interactive questions/answers, "best"/"worst" practice examples, and different endings based on response. Learners can skip content that they already know and spend more time on new content, customized to their schedule. eLearning may be especially useful when faculty resources are scarce, and may supplement faculty-based curricula when faculty are available.

Comments from the Web-based curriculum students clearly indicate that they missed the interactivity between student peers and faculty. When local teaching expertise is available, small-group settings offer an ideal environment in which to match educational content to individual learner needs. However, not everyone has the resources to produce a complicated multithemed course. When teaching resources are scarce, a Web-based format can standardize the delivery of core learning objectives, although perhaps at the cost of decreased user satisfaction.

Our finding that "if you teach it, they will learn" in targeted PEOL domains is consistent with findings from systematic reviews of brief educational interventions.[20,21] Faculty felt that the eLearning format more consistently taught the targeted content. Although small-group faculty received the same curricular materials, individual teachers varied considerably with regard to how discussions proceeded. This individualized content likely benefited certain learners where faculty were expert facilitators, but may also have failed to accomplish core learning objectives for other learners.

This study has several limitations. Students were randomized to balance gender and ethnicity (to optimize small-group interaction), not on the basis of technology fluency or viewpoints. We measured short-term increases in self-efficacy and knowledge, but not long-term knowledge retention or direct skills observation in simulated or patient environments. As prior research indicates that interactive workshops are superior to standard didactics for communication skills, our eDoctoring learners may have overestimated their self-efficacy, and/or the "overconfidence" seen in the small groups may be justified. Notably, increased self-efficacy does not ensure that actual skills are increased, and skills learned in simulation training may not result in improved patient outcomes.[22] We did not assess the baseline learner preferences about engaging with PEOL content in either a small-group or eLearning format. Our assessment of learners' attitudes focused primarily on their confidence to perform PEOL-related tasks and on their satisfaction with each format. To decrease respondent burden, other attitudinal and behavioral outcomes were not evaluated. Although we captured all eDoctoring faculty, we must be careful not to overread the 11 faculty responses when interpreting this study. At this single institution, the small-group Doctoring course ranks very highly among all medical student satisfaction scores. Medical learners at locations without such a well-regarded small-group course may be even more satisfied with a Web-based curriculum.

Even with these limitations, we believe that the results of this study add to the conversation about the value of eLearning, which should no longer be framed as absolutely good or harmful. This study was not designed to measure several important and desirable outcomes (e.g., long-term retention of self-efficacy and knowledge, improved skills and behaviors) and thus should not suggest that eLearning and the small-group setting are simply exchangeable. Although this study offers no evidence (one way or the other) about the effect of eLearning on behaviors, we believe that many skills and behaviors *are* better achieved with more active participation, as evidenced by the student who expressed a desire to participate in an ethical discussion rather than watch one. Nevertheless, when faculty resources are limited, class time is unavailable, and there is limited faculty expertise, carefully designed eLearning can be as effective as small-group learning to achieve the important outcomes of improved self-efficacy and knowledge.

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