Evaluation of a Web-based Family Medicine Case Library for Self-directed Learning in a Third-year Clerkship

Jay B. Morrow, DVM, MPH; Dan Sepdham, MD; Laura Snell, MPH; Carolyn Lindeman; Alison Dobbie, MD

Background and Objectives: Web-based cases are well accepted by medical students and enable faculty to deliver equivalent educational experiences to all students. A 2009 literature search revealed no study investigating student use patterns of Web-based case libraries for self-directed learning. We investigated third-year students’ use of a Web-based case program for self-directed learning in a family medicine clerkship. Methods: We analyzed Design A Case usage patterns of 210 medical students during academic year 2008–2009. We compared board score differences between these students and those from the previous 5 years who did not use Design A Case. We analyzed data from a 13-item survey, administered to a subgroup of 85 students, about the strengths, weaknesses, and acceptability of the program. Results: Students completed, on average, four cases, which was beyond the requirement of three. They reported that the content was highly relevant to cases they saw in clinic. Almost 75% preferred the self-directed Web-based learning over didactics, and most (64%) felt they learned more electronically. Use of the cases was associated with equivalent Board scores versus didactic lectures. Conclusions: In our setting, self-directed learning using a Web-based case program was highly acceptable to students. Web-based cases may provide an option for family medicine educators who wish to deliver equivalent educational experiences across sites.

Web-based case learning programs can enhance the teaching and learning environment within family medicine clerkships in several ways. First, Web-based cases can promote an equivalent educational experience across sites, as required by the Liaison Committee on Medical Education (LCME). Second, faculty can assign Web-based cases exposing students to important clinical material out of season (eg, respiratory syncytial virus during the summer months). Third, Web-based case delivery may decrease faculty time and resources required to deliver traditional lectures. Finally, access to a case study bank allows students to choose their learning topics, thus encouraging self-directed adult learning.

Clerkship students have been shown to be highly receptive to computer-assisted learning. In addition, Web-based cases have increased medical students’ test scores when studied in relationship to specific topics. In recent years, Web-based case learning tools have also become increasingly sophisticated. Recent features include user contribution and feedback (Casepedia), digitized virtual slide collections (Slide2Go), spaced education e-mails on urology topics, interaction with virtual neurology patients (ICON), a family medicine personal education portal (Navigator), a case-based series in population-oriented prevention (C-POP), and radiology applications with animations and simulations.

Despite these advances, few studies have explored student interaction with cases and generated evaluation data to improve educational effectiveness. Integrating case studies into the curriculum has been associated with increased student satisfaction provided these cases were a replacement for other activities and not additional tasks.

To date, no studies have addressed student use patterns in Web-based case self-directed learning programs. In our study, we investigated third-year...
students’ use of a Web-based case library for self-directed learning in a family medicine clerkship.

Methods

We conducted a cross-sectional study of third-year clerkship students during academic year 2008–2009 to evaluate their use patterns of Web-based cases in a self-directed learning program. Our institutional review board granted exempt educational approval.

Settings and Subjects

University of Texas (UT) Southwestern Medical Center at Dallas is a 4-year state medical school with more than 200 students per year and a required 4-week family medicine clerkship in the third year. The clerkship has eight geographically separated rotation sites. Two sites are more than 60 miles away.

Educational Intervention

We used the Web-based case library Design A Case (www.designacase.org) developed by clerkship faculty from the University of Texas Medical Branch at Galveston (UTMB). This resource enables faculty from any participating institution to submit clinical case studies for peer review at UTMB and to access cases already in the bank. The case library currently contains 52 peer-reviewed primary care cases. These case materials have proven acceptable to students\(^1\) and have been associated with increased scores on the National Board of Medical Examiners (NBME).\(^13\) Our institution was offered free use of the case library as part of a UT System cooperative agreement. This study’s authors have no proprietary interest in Design A Case.

The Web-based learning program is hosted by UTMB. The program includes an administrative database that allows clerkship directors, administrators, and faculty to track student progress throughout the rotation. Faculty can view when students access cases, the number and nature of cases chosen, students’ case responses, and the time spent on each case.

Study Description

During academic year 2008–2009, all 210 third-year students were required to complete three Web-based cases of their choice over the 4-week clerkship. Completion of all three cases accounted for 2% (2 of 100 points) of the final course grade. The self-directed learning assignment replaced 3 hours of traditional didactics that had been consistent over the past 5 years. Students still met for faculty-led didactics on three out of four Friday afternoons.

We report on all students’ case usage from July 2008 through June 2009. Our evaluation of student use patterns in the self-directed learning program included (1) content of the top 10 most and least chosen cases, (2) whether case choice varied by time of academic year (early versus late students), (3) students’ rationale for choosing (or not choosing) individual cases, (4) students’ opinions of the strengths and weaknesses of this self-directed, case-based learning versus a traditional didactic schedule, and (5) whether Web-based case learning impacted Board scores (using historical controls).

To investigate points 1–3, we analyzed data on all students (n=210) using the system’s database management system. Following their shelf exams, we invited all students to complete a survey about the cases. For points 4 and 5, we analyzed a convenience sample of survey data from a subgroup of consenting students (n=85). It included the students’ evaluation of the Web-based cases; we report the online survey responses of a subgroup of consenting students. In the final clerkship week, consenting students completed an online evaluation of the cases and the self-directed learning experience. Students were sent an e-mail link to a secure, SSL-enabled, electronic survey.

Survey Description

Three authors designed a 13-item survey using input from a student focus group and a 2008 literature review. We elicited responses via a 5-point Likert scale from “Strongly Agree” to “Strongly Disagree” for each item. Six items concerned case selection rationale, and seven elicited students’ opinions of the strengths and weaknesses of the Web-based cases. The survey items are displayed in Tables 1 and 2. To encourage participation, the survey instructions reminded students that their data was secured, de-identified, and non-traceable back to them individually. To ensure case completion, we withheld clerkship grades pending completion of the three required cases.

Data Analysis

Statistical Analysis. We used SPSS v.17.0 for all statistical analyses. We evaluated student case selection by extracting data from the system database and performing frequency analyses. Identification of the most- and least-chosen cases was based on all cases completed by students. For the survey data analysis of students’ case selection rationales and Web-based case evaluations, the categories of “Strongly Agree” and “Agree” were collapsed into one group representing agreement. Our electronic survey software automatically tabulated students’ response frequencies on the strengths and weaknesses of the self-directed learning experience.

To investigate any association between student rotation and case choice, we categorized student rotations 1–6 as early and 7–12 as late rotations. We performed chi-square analyses on the dichotomous rotation categories (early versus late) with each completed case. We performed a one-way ANOVA analysis to test the hypothesis that students’ annual board scores from
Results

Case Access Patterns

Of 210 students in academic year 2008–2009, 205 (98%) completed all three required Web-based cases. The total number of student logins to the Web-based case system was 744. Average case completion time was 50 minutes. We excluded 122 (16%) logins exceeding 4 hours from our time analysis. We did not use a timeout limit, and some students recorded login times measured in days.

Content of Top 10 Most and Least Chosen Cases

Students selected and completed 50 of 52 cases in the case library. The total number of cases completed by 210 students was 843, an average of four cases per student (versus the required three cases). The top 10 most and least chosen cases are shown in Table 3.

Case Choice by Time of Academic Year

Of the 50 cases completed by students, three were chosen more often by late academic year students (rotations 7–12) versus early academic year students (rotations 1–6). These cases were Adult Cough ($P=.05$), Annual Physical Exam ($P=.05$), and Knee Pain ($P=.007$).

Students’ Rationale for Choosing (or Not Choosing) Cases

Students applied rationales beyond random selection in choosing cases. Of the 210 third-year students for whom completion of the cases was mandatory, 85 consented to include their survey data for analysis (response rate 40%). The top three reported reasons for choosing cases were to expand students’ general medical knowledge (n=74, 87%), practice managing conditions not encountered during the rotation (n=55, 65%), and reinforce learning about conditions they

Table 1
Case Selection Rationale of Students

<table>
<thead>
<tr>
<th>Rationale</th>
<th>Strongly Agree n (%)</th>
<th>Agree n (%)</th>
<th>Disagree n (%)</th>
<th>Strongly Disagree n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I wanted to expand my knowledge of this area/condition.</td>
<td>50 (59)</td>
<td>24 (28)</td>
<td>5 (6)</td>
<td>6 (7)</td>
</tr>
<tr>
<td>I wanted to practice managing conditions I had not seen during the rotation.</td>
<td>28 (33)</td>
<td>27 (32)</td>
<td>12 (14)</td>
<td>18 (21)</td>
</tr>
<tr>
<td>I wanted to reinforce my knowledge about conditions I saw during the rotation.</td>
<td>26 (31)</td>
<td>28 (33)</td>
<td>19 (22)</td>
<td>12 (14)</td>
</tr>
<tr>
<td>I thought the cases would be easy.</td>
<td>7 (8)</td>
<td>21 (25)</td>
<td>27 (32)</td>
<td>30 (35)</td>
</tr>
<tr>
<td>I thought the cases would be short.</td>
<td>10 (12)</td>
<td>15 (17)</td>
<td>27 (32)</td>
<td>33 (39)</td>
</tr>
<tr>
<td>I selected the cases randomly.</td>
<td>4 (5)</td>
<td>20 (23)</td>
<td>24 (28)</td>
<td>37 (44)</td>
</tr>
</tbody>
</table>

Table 2
Case Evaluations by Students

<table>
<thead>
<tr>
<th>Rationale</th>
<th>Strongly Agree n (%)</th>
<th>Agree n (%)</th>
<th>Disagree n (%)</th>
<th>Strongly Disagree n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I had sufficient time to complete the cases during the rotation.</td>
<td>60 (70)</td>
<td>22 (26)</td>
<td>2 (2)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>I found the Web cases relevant to real-life cases I see in clinic.</td>
<td>46 (54)</td>
<td>32 (37)</td>
<td>3 (4)</td>
<td>4 (5)</td>
</tr>
<tr>
<td>The content of the cases was what I expected, based on the case titles.</td>
<td>34 (40)</td>
<td>37 (44)</td>
<td>12 (14)</td>
<td>2 (2)</td>
</tr>
<tr>
<td>I preferred the self-directed learning Web case format compared to lectures.</td>
<td>34 (40)</td>
<td>28 (33)</td>
<td>16 (19)</td>
<td>7 (8)</td>
</tr>
<tr>
<td>I learned more by completing Web-based cases compared to lectures.</td>
<td>27 (32)</td>
<td>27 (32)</td>
<td>21 (24)</td>
<td>10 (12)</td>
</tr>
<tr>
<td>I directly applied case concepts to improve my clinical care of patients.</td>
<td>20 (23)</td>
<td>34 (40)</td>
<td>21 (25)</td>
<td>10 (12)</td>
</tr>
<tr>
<td>The cases were too easy for my learning level at this point in my education.</td>
<td>7 (8)</td>
<td>18 (21)</td>
<td>45 (53)</td>
<td>15 (18)</td>
</tr>
</tbody>
</table>
did encounter (n=54, 64%). Approximately 30% of students reported choosing cases because they believed they would be easy or short, and only 28% chose some cases randomly. Table 1 summarizes students’ case selection rationale.

Student Evaluations of Web-based Cases

More than 95% of students reported having sufficient time to complete three cases during the rotation. Over 90% found the content relevant to cases they saw in clinic. More than 80% agreed or strongly agreed that the case titles accurately reflected the content. Almost 75% of responding students preferred the self-directed Web-based learning over traditional didactics, and most (64%) felt they learned more electronically. Only 29% of students found the cases to be not sufficiently challenging for their level of education. A small minority of respondents (12%) strongly disagreed that they learned more electronically. Students’ Web-based evaluations are summarized in Table 2.

Association With Board Scores

A one-way ANOVA analysis of students’ National Board of Medical Examiners (NBME) examination scores in academic year 2008–2009 (using Web-based cases) compared with each of the 5 previous years (no Web-based cases) revealed no statistically significant differences. Students scored equally well using either Web-based cases or traditional lectures.

Discussion

In our setting, we demonstrated successful integration of an interactive, Web-based case learning program into family medicine clerkship didactics. Almost all students completed the required three cases. In fact, students completed on average four cases, more than was required for credit. This suggests that students found the cases useful beyond a mechanism for gaining grade points. In addition, students selected 50 of 52 cases in the bank. Both of these findings suggest that the content of the library was of interest to students.

Students’ top 10 selected cases were all biomedical in content. Three of the four least selected cases concerned cultural competence. This finding reflects common experience among clerkship faculty that students may value cultural competence teaching less than biomedical content.15,16 Even though cultural competency case titles were not selected by students, the Web-based case library we used weaves these concepts into many of their cases in other categories.

We demonstrated an association between time in academic year (early versus late rotations) and case choice. Reasons for the different choices are unclear, but case selection may be impacted by students’ previous or upcoming rotations.

Most students’ evaluations supported the cases as challenging, helpful in augmenting and understanding clinical experiences, and time efficient. Students also reported selecting the cases for sound educational reasons that included expansion of knowledge and managing conditions not seen in clinic.

Shokar and colleagues reported improved NBME scores for family medicine clerkship students using Design A Case.14 In our setting, clerkship students’ NBME scores were equivalent using the Web-based cases versus traditional lectures but with less use of faculty time and resources. These findings of educational equivalency support those of Leong and colleagues.1

Table 3

Case Content Completed by Students (n=210)

<table>
<thead>
<tr>
<th>Case</th>
<th>Category</th>
<th>n (%)</th>
<th>Case</th>
<th>Category</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal pain (adult)</td>
<td>Pain</td>
<td>72 (34)</td>
<td>Family care Ruiz</td>
<td>Cultural competence</td>
<td>1 (0.4)</td>
</tr>
<tr>
<td>Adult Type 2 diabetes</td>
<td>Diabetes</td>
<td>54 (26)</td>
<td>Jackson family</td>
<td>Cultural competence</td>
<td>1 (0.4)</td>
</tr>
<tr>
<td>Rash neck</td>
<td>Diabetes</td>
<td>52 (25)</td>
<td>Washington family</td>
<td>Cultural competence</td>
<td>2 (1)</td>
</tr>
<tr>
<td>Adult cough</td>
<td>Upper respiratory infections</td>
<td>41 (20)</td>
<td>Leg pain (geriatric)</td>
<td>Frailty</td>
<td>2 (1)</td>
</tr>
<tr>
<td>Adult fatigue</td>
<td>Depression/anxiety</td>
<td>35 (17)</td>
<td>Breathing difficulties (adult)</td>
<td>Asthma/chronic obstructive lung disease</td>
<td>4 (2)</td>
</tr>
<tr>
<td>Annual physical exam</td>
<td>Arthritis/arthralgia</td>
<td>33 (16)</td>
<td>New onset diabetes mellitus</td>
<td>Diabetes</td>
<td>5 (2)</td>
</tr>
<tr>
<td>Contraception</td>
<td>Menstrual disorders</td>
<td>32 (15)</td>
<td>Mental status changes</td>
<td>Depression/anxiety</td>
<td>6 (3)</td>
</tr>
<tr>
<td>Chest pain (adult)</td>
<td>Chest pain</td>
<td>31 (15)</td>
<td>Pediatric irritability</td>
<td>Upper respiratory infections</td>
<td>6 (3)</td>
</tr>
<tr>
<td>Suture removal</td>
<td>Domestic violence</td>
<td>23 (11)</td>
<td>Shortness of breath</td>
<td>Chest pain</td>
<td>6 (3)</td>
</tr>
<tr>
<td>Irregular menses</td>
<td>Menstrual disorders</td>
<td>22 (10)</td>
<td>Rheumatoid arthritis (major joint)</td>
<td>Arthritis</td>
<td>7 (3)</td>
</tr>
</tbody>
</table>


10 Most-used Cases

10 Least-used Cases
Limitations

Our study is limited to a single Web-based case program given to clerkship students at a single institution. Also, our evaluation survey response rate of 40% may have limited generalizability to the whole class. Using a Web-based survey tool to evaluate Web-based cases may have introduced selection bias in favor of highly Internet-savvy students who are more likely to rate online learning favorably. However, assuming that a high percentage of medical students are comfortable using the Internet, our study essentially assessed students for self-directed, self-paced learning versus traditional set didactics, not technical Internet proficiency.

Conclusions

Our study adds to the literature by describing students’ use patterns of a Web-based case library. In our setting, self-directed, self-paced learning using Web-based cases was highly acceptable to students. Students voluntarily completed more than the minimum learning activity that was required for credit, a finding seldom reported in the literature. Students achieved equivalent NBME performance in comparison to students who experienced traditional lectures.

We recommend Web-based case learning systems to family medicine educators who wish to efficiently deliver high-quality, peer-reviewed educational content in their home program and across geographically separated sites.

Acknowledgments: We thank Gurjeet Shokar, MD, and Darren Burns for their kind help with implementing the case-based learning system in our curriculum.

The authors have no proprietary interest in Design A Case.

Corresponding Author: Address correspondence to Dr Morrow, University of Texas Southwestern, Department of Family and Community Medicine, 6263 Harry Hines Blvd, Dallas, TX 75390-9067. 214-648-1399. Fax: 214-648-1307. jay.morrow@utsouthwestern.edu.

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