Medical education

Can an Internet-based system assist with administration and distance learning for third- and fourth-year rural clinical rotations?

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This article describes the experience of the West Virginia School of Osteopathic Medicine during the past 5 years in using Internet technology to communicate with osteopathic medical students on remote, community-based clinical rotations. Federal funding initially supported creation of a new Internet-based system to connect students on their rural family medicine rotations. Accomplishments during and after federal funding include development of systems for remote submission and student access to feedback about clinical sites; on-line access to rotation objectives, policies, housing information, maps, and affiliated internship opportunities; access to medical journals and texts; secured access to rotation grades and rotation schedules; on-line reading lists for family medicine and pediatrics rotations; and Internet-based test administration. Remaining challenges include identification or development of interactive learning materials; development of test banks; flawless administration of Web-based examinations; and finding the right balance between patient care-based learning and didactics.

(Key words: medical education; technology; distance learning; community-based education)

To what extent can an Internet-based system assist with administration and distance learning for third- and fourth-year rural clinical rotations? This article describes the experience of the West Virginia School of Osteopathic Medicine (WVSOM) during the past 5 years in using Internet technology to communicate with clinical students on remote rotations. Federal funding supported purchase of equipment and hiring of a full-time programmer from July 1997 through June 2000 to establish an Internet-based system for students on rural family medicine rotations. This article describes the success both under that grant and for the first 15 months after federal funding terminated, as the project was expanded to other rotations. Technologic accomplishments and remaining challenges are outlined.

Background

While several factors are believed to contribute to the high proportion of WVSOM graduates entering rural primary care,1,2 the clinical curriculum’s emphasis on rural primary care is regarded by program faculty as a major reason for this success. The clinical curriculum emphasizes primary care, with 4.5 months of clinical family medicine. Fewer than 10% of preceptors for students required rotations are full-time academicians. The remaining clinical precepting is by a cadre of adjunct faculty, mostly in West Virginia but nationwide, who are carefully selected and developed as faculty and whose performance is monitored by full-time faculty and staff. Many of these preceptors are in rural areas; most notably, for the family medicine 1 (FM 1) and family medicine 3 (FM 3) rotations, 73% of rotation sites in 2000-2001 were outside metropolitan statistical area designations. Many of these primary care rotations are with preceptors who participate in the West Virginia Rural Health Education Partnerships program,3 which offers special emphasis on interdisciplinary education and community service.

Need for the project

The WVSOM model of rural, community-based education creates the challenge of maintaining close communication with clinical students, most of whom are away from campus on clinical rotations. Site visits were made throughout the year to all required rotations, monthly mailings were sent to students, and students communicated with campus by phone or mail. However, students still indicated that they desired more efficient and effective communication with the Office of Clinical Education and the faculty.

Move toward use of technology

In the early 1990s, WVSOM’s leadership realized that technology would help overcome the barriers involved with distance education and started to computerize. In spring 1995, the Office of Clinical Education developed a proposal to the dean that all third-year students be required to purchase a laptop computer for use on clinical rotations. In fall 1996,
WVSOM submitted a successful grant application to the Public Health Service, Health Resources and Services Administration (HRSA), Department of Health and Human Services, for predoctoral training in family medicine. Federal funds were received in July 1997 to facilitate access by osteopathic medical students on third- and fourth-year rotations to the WVSOM faculty and administration and to learning resources. The following describes accomplishments and problems, first within that funding period and then during the 15 months after federal funding ended.

**Accomplishments and challenges**

**Original grant period**

Allaire Cold Fusion (Macromedia Inc, San Francisco, Calif) was used to create WVSOM’s clinical education Web page ([http://clined.wvsom.edu/](http://clined.wvsom.edu/)), which provides links for the functions outlined below.

Remote submission and student access to feedback on clinical sites—Before computerization, students had completed a paper “site evaluation and abbreviated log” form on each rotation, and (after review by the clinical education leadership) a copy of this form was placed in a file in the Office of Clinical Education, where students selecting sites could review them to better understand the learning environment, scope and volume of patients, etc. Students now submit this material electronically. Their submissions are immediately reviewed by clinical education staff, and any necessary follow-up action is promptly taken. Students are able to access feedback from other students electronically, allowing them to (for example) check feedback from fellow students on senior rotation sites without having to physically return to the school.

Online access to rotation objectives, policies, housing information, maps, and forms—The entire “rotation manual” was placed on-line, including general policies that are revised annually. Housing information can be updated immediately, making the on-line manual much more current than the previous, printed version.

Information about “Mountain State OPTI” internship and residency opportunities—Internship and residency information can be accessed via the clinical education Web page, and the necessary applications can be generated on-line.

Access for students and preceptors to medical journals and text databases through the institution’s medical library—In addition to the on-line materials available to the general public, library subscriptions were made to additional on-line full-text journals and textbooks.

Electronic generation of pictured student identification cards and immunization records—These have been helpful to students because they can print and mail materials to elective sites who need proof of immunization.

Listing of all preceptors and sites and contact information—Students can look up potential preceptors by name, location, or specialty, as well as obtain addresses and phone numbers to allow personal contact with the trainers.

Enhanced communication between students and WVSOM faculty/staff, and among students—Although students and faculty had e-mail before the grant, creation of the clinical education Web page led to enhanced use of e-mail as the preferred mechanism of communication between students and staff and among students. This made contact more efficient and greatly reduced “telephone tag.”

Evaluation of pages created during the funding period—The Class of 2001 was the first class required to have laptop computers for clinical rotations and to use the clinical education Web page to submit site evaluations and logs. In spring 2000, after their first year of experience with this project, members of this class were asked to complete a survey regarding computer use (45 of 66, or 69%, responded). Students were asked, “Overall, has the clinical education’s computer-based network been helpful to your clinical education experience?” Ninety-eight percent of those who responded indicated that the network was “very helpful” or “somewhat helpful,” and only one student indicated preference for the previous, paper-based system.

In addition, immediately before graduation, seniors from the Class of 2001 completed a questionnaire that included a section on use of technology. Responses are included in the Table. These responses indicate that 91% of graduates agreed or strongly agreed that they were confident about their ability to use personal computers to retrieve information and communicate with peers. Faculty members interpret the results as supporting continued use of information technology for the clinical program.

**After termination of grant funding**

Web-based test administration—The initial grant application promised a “pilot test” of an Internet-based examination for the FM 1 rotation, and this was completed during the funding period. However, at the time the pilot test was created, commercially available software was not found to be satisfactory, so an in-house examination administration system was created by the programmer, using Cold Fusion software. Item analysis and reporting capability of this program was not satisfactory.

In 2000, the Web-based version of LXRT (Applied Measurement Professionals, Lenexa, Kan) system became available and was adopted for Internet administration of clinical examinations. For the FM 1 rotation in June 2001 through July 2001, an Internet based pre- and posttest was administered to all 75 students, with surprisingly few difficulties. Those difficulties that did arise fell into three categories. The first was operator error. Because the students had to
Table
Items Related to the Clinical Education Web Page, Taken From Graduating Senior Exit Interviews, May 2001.
Fifty-five (86%) of 64 Class of 2001 Graduates Responded

<table>
<thead>
<tr>
<th>On clinical rotations</th>
<th>SA (%)</th>
<th>A (%)</th>
<th>N (%)</th>
<th>D (%)</th>
<th>SD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am confident about my ability to use personal computers to retrieve information and communicate with peers.</td>
<td>60</td>
<td>31</td>
<td>5</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>I frequently used e-mail.</td>
<td>51</td>
<td>36</td>
<td>2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>I frequently used information technology (computers) during my clinical years.</td>
<td>36</td>
<td>42</td>
<td>7</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>I frequently used the WVSOM Clinical Education Web Site.</td>
<td>35</td>
<td>38</td>
<td>5</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>I frequently accessed reference and learning materials on the Internet.</td>
<td>31</td>
<td>38</td>
<td>13</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>I found it easy to communicate with the clinical education staff/administration.</td>
<td>18</td>
<td>38</td>
<td>20</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>I found it easy to get information about rotation schedules.</td>
<td>16</td>
<td>67</td>
<td>9</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>I was confident that I accomplished most of the rotation objectives.</td>
<td>15</td>
<td>43</td>
<td>28</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>I found it easy to communicate with other WVSOM students.</td>
<td>13</td>
<td>47</td>
<td>20</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>I found it easy to obtain information about rotation content and objectives.</td>
<td>9</td>
<td>51</td>
<td>18</td>
<td>16</td>
<td>5</td>
</tr>
</tbody>
</table>

*SA = Strongly agree; A = Agree; N = Neutral or do not have an opinion; D = Disagree; SD = Strongly disagree.
log into the secure internal pages of the Web site and then to the test itself, two different passwords were required. Some students entered the wrong passwords and were either prevented from advancing to the test page or were denied access to the test. The second difficulty was that if an Internet browser was not used for a specified period, it “timed out” and broke the connection to the test page, disconnecting the student. This occurred when an attending interrupted a student in the middle of the test to discuss a patient. The third difficulty was the unidentified interruption. There were very few of these, but they did occur and disconnected a few students in the middle of the test. For this rotation, all students ultimately completed the examination successfully, but some did so only after additional communication with campus.

Beginning with the Pediatrics 1 rotation in August 2001, a postrotation test is administered to the six to eight students taking this rotation each month. The “unidentified interruption” difficulty is still present. Efforts are being made with the software manufacturer to try to identify potential causes of these interruptions and prevent them.

During this pilot phase, taking the test is required, but grades are not yet otherwise used as part of the rotation grade.

Family medicine rotations—Third- and fourth-year students on their family medicine rotations draw heavily on computer technology. All third- and fourth-year students communicate with the school and faculty via e-mail. Students use computers to access Web resources (such as their training manual), network computer-based resources at rural training sites, access learning resources from the school’s Web site, and take their pre- and posttests in family medicine on-line. Feedback on the test performance is available to students immediately.

In the past, it has been difficult for the family medicine faculty to develop up-to-date reading lists for the students because students were constantly on the move. Sometimes they would need to make last-minute changes in their rotation schedules and mail might not reach them in time for them to complete the new readings. Faculty members now have the ability to post reading assignments on the Web and update them immediately. Furthermore, in the past, assigned articles were sometimes difficult to obtain at remote locations. Faculty now work to ensure that any assignments not from the student’s textbook are available over the Internet.

One challenge has been to raise all members of the family medicine faculty to a high level of computer competence. Bringing clinical faculty together for computer training was extremely difficult due to clinic, hospital, and academic responsibilities. Finding computer support staff that could instruct at a basic level was also difficult. These problems were solved when WVSOM was awarded a separate, “academic units” HRSA grant that provided for the employment of an education/computer specialist who established one-on-one and small group learning sessions on a weekly basis with the family medicine faculty.

Pediatrics rotation—In the past 15 months, an extensive reading list has been developed for Pediatrics 1. The list is directed primarily toward office-based general pediatric topics and is made available to students on rotation via the Web page. The full textbook is also available via M D Consult, an on-line service to which the school has subscribed. In an effort to assess student retention of the material, a Web-based test has been developed. Although the testing process is in its infancy, it is receiving many positive comments from present and past students.

James R. Stookey, D.O., Preceptorship—Preceptors for the James R. Stookey, D.O., Preceptorships agree to provide students the experience of performing osteopathic manipulative treatment (O M T) on average a minimum of five patients weekly during the month rotation. They also allow their names to be distributed to osteopathic students and schools via printed and electronic media for the purpose of increasing the pool of physician role models who integrate O M T into their practice of osteopathic medicine. Self-nominations are being solicited at national meetings and professional journals. New preceptors will be evaluated using standard procedures for appointing new WVSOM adjunct faculty. We intend to make the list available to other osteopathic medical schools as soon as it contains a satisfactory number of qualified preceptors. We are excited by this new addition to our program. A Web page allowing self-nomination can be accessed at http://www.wvsom.edu/Forms/PreceptorFrm.htm.

Faculty time/additional staffing—One major limitation to this project has been faculty time to provide leadership. While many members of the WVSOM community have been working part-time on the project, and while a pediatrician (G.H.W.) volunteered to serve as coordinator for the pediatrics rotations, we were unable to identify a single family physician to assume the same role for the family medicine rotations. To help with program administration, the dean and the president have supported creating a new mid-level position, for an administrative staff member with clinical experience (perhaps a nurse practitioner or physician’s assistant) and a background in educational technology, to be recruited and employed to work exclusively on this project.

On-line O M T case studies—To ensure integration of osteopathic principles and practices, an O M T case study is required as part of both the FM 1 and FM 3 rotations. A printable version (not password-protected) of this form is on-line (http://www.wvsom.edu/ClinicalSciences/FacDev/NewCaseStudy.html). We expect that in the next few months this case study will be in an interactive format (to be submitted electronically).

Updating Web pages—No longer having a programmer dedicated to the project has limited our ability to immediately revise older pages written in Cold Fusion software. Newer pages are written in
Identification or development of interactive learning materials—WVSOM has not yet taken advantage of interactive and simulation technology for developing interactive modules for use by clinical education students, though we see doing so as a logical next step in program development.

Development of test banks—The Internet-administered tests are not proctored. Instructions to students regarding the tests include a statement that, “Sharing test items with your classmates, receiving unauthorized help, or looking up answers in a book while taking the test would be ethics violations, subject to academic sanctions, up to and including dismissal.” To date, we have no evidence of a violation of test security; however, we believe that the best way to avoid a problem with lack of test security is to develop an item bank sufficiently large that knowing past test questions would have minimal impact on a student’s score. We currently have 347 test items related to family medicine and 520 items related to pediatrics, and faculty are writing more. It is our hope that we will find other osteopathic schools willing to exchange test questions with us to expand both item pools. Although we intend to eventually use only items in a national board format, not every question currently in our bank meets these criteria. As statistics are maintained on questions from previous use, it will be possible to construct a test of a specified difficulty or to create numerous forms of a test on the same body of knowledge that are of equivalent coverage and difficulty without having the same questions on each test form. However, doing so will take years to develop.

Proper balance of patient care and didactic learning—Students have complained that reading lists are excessive or that the readings detract from clinical learning. We have seen programs where the written test dominated the student’s clinical rotation, and that is certainly not our intention. However, we also know that lack of readings is not an acceptable option, so we are still seeking the best possible balance. We have not yet determined how the written test will be included in the final grade for these rotations.

Discussion

WVSOM’s model of community-based clinical education created the challenge of effective, immediate communication with students on remote rotations. Grant support from HRSA allowed development of an Internet-based system used first with students on rural family medicine rotations and then expanded to pediatrics and other rotations. WVSOM uses this network to enhance communication and educational opportunities during clinical rotations. Students view the changes positively. We believe experience with this network during clinical rotations will reduce the isolation of rural practice, and we hope this experience will develop lifelong learning skills, as has been suggested by other medical educators.5

While this system has reduced the degree to which we are, as Friedman6 suggested, “stuck in time” in our medical education, we have not yet taken full advantage of the interactive capability that the Internet provides. We are excited about these possibilities and are eager to continue development.

Acknowledgment

Most of the activities described in this article were supported by the Health Resources and Services Administration (HRSA) grant for Predoctoral Training in Family Medicine, No. 1-D15-PE-80108. Some additional activities were supported by the HRSA grant for Departments of Family Medicine, No. 1-D32-PE-10224. Portions of this paper were previously presented as posters at professional meetings.

The authors thank John Mooney and Judy Clendenen for their careful review of a draft of this manuscript.

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