

## CLINICAL SCIENCE

# E-learning program for medical students in dermatology

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**INTRODUCTION:** Dermatological disorders are common in medical practice. In medical school, however, the time devoted to teaching dermatology is usually very limited. Therefore, online educational systems have increasingly been used in medical education settings to enhance exposure to dermatology.

**OBJECTIVE:** The present study was designed to develop an e-learning program for medical students in dermatology and evaluate the impact of this program on learning.

**METHODS:** This prospective study included second year medical students at the University of Technology and Science, Salvador, Brazil. All students attended discussion seminars and practical activities, and half of the students had adjunct online seminars (blended learning). Tests were given to all students before and after the courses, and test scores were evaluated.

**RESULTS:** Students who participated in online discussions associated with face-to-face activities (blended learning) had significantly higher posttest scores ( $9.0 \pm 0.8$ ) than those who only participated in classes ( $7.75 \pm 1.8$ ,  $p < 0.01$ ).

**CONCLUSIONS:** The results indicate that an associated online course might improve the learning of medical students in dermatology.

**KEYWORDS:** medical education; distance learning; distance education; internet; undergraduate medical education.

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## INTRODUCTION

In recent years, medical education has undergone several modifications related to pedagogic principles and methods.<sup>1-3</sup> A problem-based, self-directed learning process has replaced traditional teaching in some universities, and students participate in tutorial groups.<sup>3</sup> In medical education, however, the ability to teach visual specialties, such as dermatology, within a restricted time schedule remains challenging.<sup>4</sup>

Published surveys have demonstrated that the amount of time devoted to dermatology in the medical student curriculum represents only 0.24-0.3% of the 4 years of study.<sup>5</sup> Indeed, a survey of several medical schools found that an average medical student receives less than 18 hours of dermatology training during his or her medical education.<sup>6</sup>

The current available time for dermatology training in medical schools in the U.S., European countries (e.g., the U.K.) and Brazil is not proportional to the number of cutaneous diseases that are likely to be encountered in a typical ambulatory care setting.<sup>7,8</sup> It is estimated that 4-7% of office visits by adult and pediatric patients are for dermatological complaints.<sup>4,5,6,9</sup> With respect to the evaluation and treatment of skin disease, many studies have clearly demonstrated that nondermatologists have inferior performances compared with dermatologists.<sup>10</sup>

Because the majority of patients with cutaneous problems are not initially seen by a dermatologist, doctors involved in general care medicine will be expected to deal with an increasing frequency of skin disorders.<sup>7</sup> To improve the dermatological background of future general physicians, new tools should be developed to increase medical students' exposure to dermatology.<sup>7</sup>

Online medical educational systems have shown interesting benefits for learning processes. One attraction of online methods is that learners have the opportunity to share information and learn collaboratively without having to physically be present in a group.<sup>11</sup> These new formats, however, have been poorly investigated, and there are some

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doubts about whether they are superior to traditional teaching methods.<sup>12,13</sup>

E-learning has several advantages, including the ability to access materials at any time in almost any place, which also permits interactive web seminars and conferences with participants who may be located far away from one another.<sup>14</sup>

The objective of the present study was to develop a e-learning program in dermatology, which could be used as an adjunct tool for traditional teaching. In addition, we evaluated the impact of this program on student learning.

## MATERIALS AND METHODS

This prospective study selected students in their second year of medical school at the University of Technology and Science (Salvador, Brazil). None of these students had prior formal exposure to dermatology. The participants were divided into two groups: a control group and an online group. Students in second semester of 2009 were included in the control group and took the traditional course and seminars. Those who attended classes in the discipline in the first semester of 2010 took the traditional course and participated in online discussion seminars (online group). The Institutional Review Board approved the study, and informed consent forms were obtained prior to the study from the participants.

Students in the control and online groups received identical evidence-based content, used the same textbook and participated in similar, but not identical, instructional activities. The course had the same duration for both groups. Activities of the control and online groups included face-to-face seminars and patient care. In addition to these activities, students in the online group completed an online program that incorporated educational elements similar to those provided in the classes.

The content addressed by the course included essentials on the physical examination of the skin and the terminology used to describe skin lesion morphology, skin physiology and anatomy. We reviewed practice guidelines, textbooks and primary journal articles to develop an evidence-based, e-learning module for each topic.

An e-learning environment was prepared using the open-source Moodle learning management system.<sup>15</sup> The e-learning module included a twelve-week course that was developed simultaneously with face-to-face activities. A new text, video and online discussion forum, which addressed the same content as the face-to-face activities, was available each week. In addition to face-to-face communication, students in the online group could receive feedback with the discussion boards or by sending direct messages to the course tutor.

Data consisted of a precourse and a postcourse examination score in each group.

After identifying the information and skills to be learned, multiple-choice questions were written in accordance with the National Board of Medical Examiners recommendations<sup>16</sup> to assess knowledge, combined comprehension and application, and problem-solving ability. The exam content covered the course objectives. Each exam had 20 questions, and the final score ranged from 0 to 10.

Although the content was the same for the precourse and postcourse exams, the questions were slightly different;

however, the exam questions were identical for the control and online groups.

Two independent dermatology experts evaluated the content of the 2 exams, and the pre- and postcourse scores were compared. According to the normality test, we applied a paired *t* test or Wilcoxon signed-rank test for intragroup comparisons and a *t* test or Mann-Whitney test for intergroup comparisons.

Internal consistency of the pre- and posttest exam reliability was estimated using an item-total correlation (*r* value). This value, which ranged from - 1.00 to + 1.00, represented the Pearson correlation coefficient between individual item score and the individual overall score on all the others items. Higher values indicated that items were well correlated with the total score. When a question had a low item-total correlation (usually *r* <0.30), it was considered an unreliable assessment item.<sup>17</sup>

At the end of the course, the students completed a satisfaction questionnaire-based evaluation. The results of the satisfaction survey were used to improve the e-learning teaching course.

## RESULTS

Forty-four students were included in this study (20 in the control group and 24 in the online group), and all subjects completed the course. Participants in the online and control groups did not differ significantly with regard to age, sex or knowledge prior to the course. The average scores achieved in the pretest exam were  $3.75 \pm 1.16$  and  $3.92 \pm 2.1$  SD for the control and online groups, respectively. There was no statistically significant difference in the pretest exam scores between the two groups (*p* = 0.7).

Although the posttest exam scores significantly improved for both groups (*p* <0.01), the students who participated in the online discussions associated with face-to-face seminars had significantly higher posttest scores than the students who only attended face-to-face discussions ( $9.0 \pm 0.8$  vs.  $7.75 \pm 1.8$ ; *p* <0.01) (Table 1).

Two dermatology experts confirmed the content validity of the two tests. Item-total correlation values had a range of 0.44 to 0.74 in the pretest and 0.38 to 0.77 in the posttest. Internal consistencies (Cronbach's  $\alpha$ ) for the pretest and posttest exams were 0.67 and 0.70, respectively. Although no definitive agreement exists regarding thresholds for Cronbach's  $\alpha$ , it is conventionally accepted among test designers that a lenient Cronbach's  $\alpha$  coefficient  $\geq 0.6$  is satisfactory for exploratory research.

Overall, the online course was highly rated: 90.9% of the students rated the course as very good to excellent in the satisfaction questionnaire.

## DISCUSSION

In general, medical schools have dedicated little time to dermatology training.<sup>6</sup> Our department has a 20-hour

**Table 1 - Pretest and posttest scores of the control and online groups.**

	Pretest	SD	Posttest	SD	p
Control Group	3.75	1.16	7.75*	1.8	<0.05
Online Group	3.92	2.1	9.0*	0.8	<0.05

SD - standard deviation; p - p value. \* *p* <0.01.

dermatology course time, which is comparable to the majority of medical schools worldwide. Curricular revisions have emphasized that case-based, small-group teaching and problem-based learning techniques are useful tools for increasing the learning capacity of medical students. These methods, however, take a long time to achieve satisfactory integration, and new teaching methods should be tested to provide better courses for students.<sup>1,7</sup>

Despite the limited time devoted to dermatology, all medical school graduates are expected to be able to describe the skin and record their findings each time that they see a patient.<sup>1</sup> Faced with this reality, online learning becomes a useful tool for teaching dermatology to medical students. E-learning programs offer several advantages over conventional teaching mechanisms, and they can provide high-quality images at a lower cost. They may also be accessed by students anytime and almost anywhere.<sup>4,6,18</sup> Further advantages of e-learning include interactivity, immediate feedback, and the use of audio and video media.<sup>6,18</sup>

Previous studies of the impact of e-learning content on gains in student knowledge have provided variable results. Although some studies have shown slight improvements in student learning,<sup>22,23</sup> others have shown no significant differences.<sup>6,12,14</sup> In the present study, the pretest scores between the two groups were not significantly different, which indicated the same degree of knowledge before the course. At the end of the course, however, students who took the E-learning course had higher posttest scores than students who took the conventional course alone.

Similar to the present study, a recent randomized controlled trial showed that online programs could produce gains in knowledge compared to effective face-to-face activities.<sup>24</sup>

Despite these favorable results, some disadvantages of distance learning should be considered. Similar to the Fordis et al. study,<sup>24</sup> we found that online facilitation was more challenging than face-to-face teaching for the design, organization, delivery, and engagement of participants in discussion. Another disadvantage of online programs is that they are time consuming, not only for adapting content to e-learning but also for the time that must be devoted to answering students' questions. Prompt feedback is an advantage of the method and important to the students, but is a disadvantage to course instructors as it is time consuming.<sup>25</sup>

Cook also suggested some potential disadvantages of distance learning, including social isolation, lack of individualized instruction, high development and maintenance costs, technical problems and poor instructional design.<sup>26</sup> Some legal and ethical issues must also be considered because the use of images involves consent and copyright considerations.<sup>25</sup>

The present study addressed the use of an online educational program in dermatology, but there were several limitations. Although gains in practical skills are a pivotal issue in clinical practice, the present study only analyzed knowledge gains. Therefore, we could only speculate about the effects of this program on practical skills. In addition, we did not evaluate long-term retention of knowledge because it was not one of the study objectives. Moreover, the limited number of students evaluated represents another potential weakness.

Although studies have not investigated whether the use of online educational programs in dermatology improves learning or whether online education is superior to traditional teaching,<sup>6</sup> our results indicate that the use of a e-learning program associated with a traditional course for medical students provides a way to improve the teaching of dermatology. Further investigation is recommended because e-learning may add benefits to the learning process and can significantly enhance the overall dermatology education provided to medical students.

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