

Dent Clin N Am 46 (2002) 589-604

THE DENTAL CLINICS OF NORTH AMERICA

# Continuing dental education on the World Wide Web

Lynn A. Johnson, PhD

Educational Methodology and Instructional Technology, Department of Oral Pathology, Radiology and Medicine, University of Iowa, Iowa City, IA 52242-1001, USA

# Background

Continuing dental education (CDE) is a requirement for dental practitioners in 44 states and for dental hygienists in 46 states [1]. These requirements can be fulfilled in various ways, including attending lectures, reading journal articles, listening to an audiotape, viewing a videotape, and completing a course on the World Wide Web (Web) [2,3]. Despite the need and value of CDE there are associated costs. The office is shut down, but the ongoing overhead remains in addition to travel and the expenses of the course. Finally, there is the inconvenience of time spent away from home [4]. CDE courses offered on the Web have the advantage of being completed at the practitioner's convenience and paid for (using a credit card over a secure connection) using an available computer and Internet connection, without the costs of closing the office and travel. Increased and convenient access combined with reduced costs may explain the growth in Web CDE. One company that offers Web CDE reports a quadrupling of Web CDE users in 2001, and another company reports averaging more than 3 million session hits each month.

Even with this tremendous growth, Web CDE remains embryonic and has room for improvement. A survey of 157 Web CDE courses offered by 32 providers using 34 criteria found that Web CDE courses are difficult to locate and are generally of substandard quality [5]. Although Internet-based education ideally can solve the problem of ease of access to recent and relevant information at a reduced cost, the issue of locating high-quality instructional products remains [6]. These issues of locating Web CDE

Reprints can be obtained on the University of Iowa, Educational Methodology and Instructional Technology Web site (www.uiowa.edu/~emit).

E-mail address: Lynn\_Johnson@iowa.edu (L.A. Johnson).

courses and their varying quality are addressed in this article along with a summary of emerging Web CDE technologies.

#### Locating Web-based continuing dental education

## Search engines

When looking for a Web CDE course, most practitioners use either a Web search engine (eg, Google [7] or AllTheWeb [8]) or a directory sponsored by a dental organization or company. In preparing this article, three Web searches were conducted using the advanced search features of the top five ranked search engines [9] to locate a Web CDE course on dental implants. Table 1 contains the resulting "hits" for each search. The first search, "Continuing dental education," which was broad based and was intended to provide an overview of Web CDE, produced results too numerous to be useful. The addition of dental implants to the second search, "Dental implants continuing dental education," dramatically decreased the number of hits. The results, however, tended to list traditional lecture courses rather than online courses. Scattered throughout were Web sites with information about dental implants that also had continuing education offerings but not a Web course on dental implants. Finally, adding the desired type of course to the third search, "World Wide Web dental implants continuing dental education," helped to narrow the search once more. Once again, the results were so mixed that it was difficult to find a Web CDE course on dental implants.

As the searches increased in specificity, the results decreased in number. It was still difficult to find a Web CDE course on dental implants, however, because the Web sites are not labeled with standardized "metadata" that allow search engines to search and check for content that suits the practitioner. The concept of metadata applied to health care information on the Internet is not new [10]. Metadata can be provided on two levels: the

Search engine	Search hits (all the words)		
	Continuing dental education	Dental implants continuing dental education	World Wide Web dental implants continuing dental education
Google	186,000	5690	697
AllTheWeb	96,809	4824	897
Lycos	96,506	47,776	854
Yahoo	45	1	576 <sup>a</sup>
Northern Light	69,598	5421	1318

Table 1 World Wide Web search results

<sup>a</sup> The District of Columbia and Puerto Rico also have continuing education requirements for dentists and dental hygienists.

authors can describe the content and context of the information, and users can request expanded information from third party rating services. Users also can customize their browser to filter out any information that does not meet their quality requirements or interests. Because both types of metadata (authors' and third parties') can be indexed by search engines, this approach helps users find appropriate high-quality information. The poor results of this search demonstrate that the developers of Web sites are not indexing their course using metadata so that the search engines can find the sites, however.

The second method of finding Web CDE courses is through the use of directories. Many professional associations have listings of traditional CDE courses, but few list Web CDE courses. These associations tend to be organizations that also offer Web CDE. Table 2 contains a partial list of the professional organizations whose Web sites list Web CDE courses. Several dental education institutions also offer and list Web CDE courses, which can be found at the Web site Internet Dentistry Resources [11].

#### Continuing dental education course directories

At the writing of this article, the Academy of General Dentistry [12] offered four courses for a total of 5 credit hours. Their Web site states that they intend to add one new course each month. Their Web site did include a listing of courses offered by other providers, but they were indexed by state, which made it difficult to find Web CDE courses.

Fartial list of web continuing dental education courses and listings			
Name	World Wide Web address		
Professional organizations			
American Academy of General Dentistry	http://www.agd.org/cde/onlinece/index.html		
American Dental Association	http://www.ada.org/members/ed/ce/ce/ index.html		
American Dental Hygienists' Association	http://www.adha.org/continuing_education/		
Dental Colleges	see http://www.temple.edu/dentistry/amia/ resources/ for listing.		
Companies			
ArcMesa Educators	http://www.arcmesa.com/		
Colgate Professional.com	http://www.colgateprofessional.com/colpro/ colgateprofessional.class/jsp/index.jsp		
Crest Dental ResourceNet (Procter and Gamble)	http://www.dentalcare.com/drn.htm		
Dental Continuing Ed.com	http://www.dentalcontinuinged.com		
Dental Globe	http://www.dentalglobe.com/ce.html		
DentalXChange	http://www/dentalxchange.com/ce/ce.jsp		
Foundations in Continuing Education	http://www.fica.com		
Rdental.com	http://www.rdental.com/		

Table 2 Partial list of Wah continuing dental education courses and listings

The American Dental Association (ADA) [13] traditionally has produced a printed CDE directory and currently offers a Web-based service that lists 6 months of nationwide CDE course offerings [14] entitled "Continuing Education Course Listing." This catalog includes three computer-based course types (online, online participation, and online self-study) and the Internetbased self-study format. Potentially, this directory may be the best place to locate Web CDE courses; however, currently it still needs refinement.

The search for a Web CDE course on dental implants proved successful by entering the following search criteria:

- Subject area: implants
- Designed for: dentists
- Course type: online participation

Changing the field entitled "self-study format" from "all" to "Internetbased" yielded only courses associated with the annual meeting of the American Academy of Implant Dentistry. This indicates a need for refinement of the search engine and of the criteria that are used to register a course.

A discussion with ADA personnel revealed that the continuing education course listing is undergoing extensive revisions to increase the number of CDE providers who participate in their course listing service and improving its search engine. Although any provider recognized by the continuing education recognition program [15] can list its courses in the ADA continuing education course listing, currently approximately 50% of continuing education recognition program providers do so (T. Krause, MEd, personal communication, 2001). At the writing of this article, the portion of the Web site in which CDE providers listed information was undergoing revision. Once that is completed, the user site will be redesigned.

#### Instructional quality

#### State of continuing dental education course quality

Distance education research indicates that techniques such as Web CDE are equally effective as traditional methods [16,17]. Studies that compared traditional classroom instruction with distance education found that remote participants are more motivated and self-directed and show higher achievement than participants who receive traditional instruction [18–20]. It must be noted, however, that the dropout rate is higher for distance education [21]. Distance education researchers agree that the key to effective distance education is to make it highly interactive [22]. Research in traditional continuing educational settings has shown that merely providing research findings is unlikely to be effective in modifying health practitioners' behavior and prompting them to adopt new techniques. An effective dissemination

experience must involve interaction with credible opinion leaders and peers [23,24], which hints at the direction that effective Web CDE may need to go.

A review of Web CDE courses revealed a great variation in quality [5]. Courses tend to present textual information supported by a few still images and graphics to illustrate a point. Almost no video was used. Measured against the study's index of instructional quality, the courses were generally of poor educational quality with limited interactivity. Most for-credit courses contained self-assessment questions, but only one third of the courses scored the questions online, and feedback to the authors was limited. The relationship between credit hours and course length varied. Although Internet-based CDE courses may provide a method for keeping current with advances in dentistry, currently most online courses do not meet even minimal instructional quality standards. Recently the ADA continuing education recognition program guidelines were expanded to include "Standard XV. Electronically Mediated Distance Learning" [15]. The criteria address issues that surround security, technical assistance, and facilitation of interaction. The continuing education recognition program should be commended for "setting the bar" to encourage CDE provider quality. The next step is to "raise the bar" to measure individual course quality.

# Determining course quality: guidelines for the design of educational software

Educators from all communities, including dentistry, have called for the development of high-quality educational and continuing educational programs [25–27]. In September 1995, the Consortium for Clinical Information Systems of the American Dental Education Association (ADEA) (then the Association of Dental Schools) recommended to the ADEA and the ADA that standards be developed for the design of instructional software in dentistry. As a result, Working Group 5 (Educational Software and Research Systems) was established as part of the Accredited Standards Committee Medical Devices (ASC MD 156) Task Group on Dental Informatics. The task group has evolved into the ADA-sponsored Standards Committee on Dental Informatics [28], accredited by the American National Standards Institute (ANSI), which is developing several standards for information technology in dentistry [29,30]. The Working Group on Educational Software Systems [31] wrote initial guidelines to help course designers develop high-quality instructional materials. These guidelines have been available for public comment for more than 2 years by the Standards Committee on Dental Informatics via the Web site (http://www.temple.edu/dentistry/ di/edswstd/) and have undergone a subsequent revision. At the publication of this article version 1.2 is available for comment. During Fall 2001, the guidelines were recommended as a standard.

An article that summarizes these standards has been published in English [6] and German [32], and it forms the basis of the Instructional Computing

in Dentistry Competition sponsored by the ADEA [33,34] in which more than 30 products developed in institutions in North America were entered. In Spring 2001, the guidelines were reviewed and augmented in a working meeting of DentEdEvolves [35], a European consortium of dental schools. Although these guidelines are summarized briefly, the reader is encouraged to go to the Web site for a detailed examination.

The guidelines consist of nine categories: (1) "Pedagogical Issues" addresses aspects such as appropriate use of the computer, user control, motivation, user interaction, and appropriateness of multimedia. (2) "Subject Matter" covers content-related issues such as goals and objectives, content emphasis, and organization and sequence. (3) "Language, Grammar, and Format" includes reading level, terminology, spelling, grammar, punctuation, and layout. (4) "Surface Features" addresses esthetics, look and feel, presentation modes, and user input. (5) "Assessment" discusses how to assess learning outcomes, user demonstration of outcomes, and feedback. (6) "Invisible Functions" addresses record keeping, security and accessibility, and unseen features. (7) "Off-line Materials" covers manuals and workbooks. (8) "Evaluation" addresses the formative and summative evaluation. (9) "Other" discusses criteria that are not associated with one of the other eight categories.

# Pedagogical issues

Pedagogy is the foundation of any instructional project. Pedagogy assists the developer in matching appropriate methods to instructional objectives that address the needs of the audience. Pedagogical issues such as appropriate use of the computer, appropriateness of the methodology, student practice, lesson length, and mastery level all require consideration. Where possible, educational software should adapt to the learner's skills and knowledge. Interaction is a valuable tool for motivating users and reinforcing learning content. When appropriate the interaction should allow the user to control the pace, navigate randomly, and bookmark completed modules. The media (eg, audio, video, graphics, animations) should be appropriate for the content. For instance, video clips should illustrate processes.

#### Subject matter

The subject matter or content should support the goals and objectives for the chosen audience. It should be relevant, accurate, verified, complete, and well organized. Content should emphasize the new and unfamiliar while building on common basic knowledge. A clear and logical organization and sequence should support understanding. References should support the content.

#### Language, grammar, and format

Language and grammar characterize the educational content. The reading level should be audience and content specific and avoid cultural bias. Technical terms should be defined unless the audience can be expected to be familiar with them. Grammar, spelling, and punctuation should follow accepted conventions.

# Surface features

Screen layout should take advantage of the uniqueness of the computer and not replicate print publishing concepts. Text characteristics, such as font and font size, should enhance readability. Learner controls, such as buttons and menus, should be clear. Input devices, such as mouse, keyboard, and voice, should be the most appropriate devices for the task. Context-sensitive and comprehensive online help can assist users in mastering the operations of a program. Navigation should be clear and prevent confusion.

## Assessment

Assessment should reinforce the content or evaluate the learner's understanding. Whenever possible, the user should perform a task to reinforce content. Assessment should be relevant to the content and objectives. Feedback should be provided in response to an answer or task completion. Feedback format and content should match the assessment.

## Invisible functions

Invisible functions are program functions that are not seen when operating a program. They should acquire and present data accurately and automatically, control access to data, and monitor users who are starting and exiting the program.

#### Offline materials

Offline materials can include manuals, handbooks, and even supplementary material on separate Web sites. Manuals should follow standard conventions, such as a table of contents, an index, and clearly marked sections. Installation descriptions and operation should be clear about all requirements and steps. Program content should be summarized, and the manual should make appropriate recommendations for curriculum integration if applicable.

# Evaluation

Formative evaluation is the assessment of a software program in the course of its development. Summative evaluation is the assessment of a software program at the conclusion of its development.

# Other

The "other" section is a category for items that do not have a clear relationship to any of the other sections or represent developmental criteria.

#### A quality course review

One workday was spent reviewing the courses of Web CDE providers that would allow courses to be completed without payment. The guidelines were used to identify the strengths and weakness of specific courses. These guidelines are summarized to allow practitioners to begin to identify what a high-quality Web CDE course consists of.

## Pedagogical issues

For all of the courses reviewed, this was the greatest weakness. Many courses with good content consisted merely of screen after screen of text, whereas numerous other courses included text screens supplemented by images. Multiple screens of text interspersed with occasional images do not use the interactive strength of the Web and have no pedagogical advantage over books. The only advantage is a cost savings in printing and mailing of the instructional materials. One site offered online lectures that consisted of the videotape of the lecturer and their slides. That is the same format that would be encountered in the traditional setting. The only advantage is the location of the course: at home. There is an extensive and appropriate use of images, but little video was found even when it would be appropriate (ie, to demonstrate a clinical procedure). On a positive note, the courses tended to have a great deal of user control. Two good examples of user control are given. One is a course offered on the Crest Dental ResourceNet [36] and the other is course offered by DentalXChange [37].

For all courses, both sites use a consistent user interface that allows full access to the entire Web site at all times. For Crest Dental ResourceNet accessing this interface is accomplished by using the left toolbar, whereas DentalXChange uses the top toolbar. Each also gives the user easy access to every course module from any place in the instruction. Crest Dental ResourceNet does this through the use of previous, next, and menu buttons, and DentalXChange uses screen numbers above the content.

#### Subject matter

Most sites currently organize their course offerings by audience (ie, dental assistants, dental hygienists, dentists), and each has separate course listings. Objectives and short biographies of the authors frequently are given. References are becoming common, and some sites, such as Crest Dental Resource-Net, link to references instead of providing a list. DentalXChange gave biographic information on the author of each course, and the Crest Dental ResourceNet has a peer review process that is being practiced and is in the process of being published on their Web site. It consists of a review by internal editors and anonymous peer review by independent content experts. Revisions are then made to the courses.

Copyright laws seem to be adhered to strictly at all times. Many sites call on well-known experts to author the course. This practice helps to ensure that accurate information is portrayed and encourages solid organization and sequence. Personal conversations revealed that the Crest Dental ResourceNet [40] and DentalXChange [41] sites have their courses reviewed by experts, but the review criteria are not documented on the course Web sites.

# Language, grammar, and format

Continuing dental education providers seem to use professional editors to check for proper spelling, grammar, and punctuation. The use of audio to help with pronunciation of terms when new strategies or concepts are being taught would help many sites. This is information that would be found in a traditional lecture CDE course that easily could be added to Web CDE courses. It is rare that a computer does not have sound capability, and sound files are transported easily over phone lines.

#### Surface features

The esthetics and "look and feel" of many sites show that teams of highly skilled Web professionals are producing the courses. The screens in Figs. 1 and 2 are esthetic and uncluttered. Both sites "chunk" information to avoid excessive scrolling. Many sites use images to give examples of a concept, but few use video, even when it would be appropriate, such as to demonstrate a new clinical procedure. As seen in Fig. 2, DentalXChange clearly demonstrates at all times the number of screens on a topic and shows the current screen number in bold. This means that users always know where they are and how much material remains. The industry has evolved so that each provider is developing consistent forms of user input so that users can concentrate on the information and not on operating the site.

#### Assessment

Whereas most forms of assessment consist of multiple-choice questions at the end of a lesson, some providers are experimenting with innovative and expanded forms of assessment. For example, DentalXChange has a large course (20 credits) on ethics entitled "Professional Ethics in Dentistry." It ends with a written examination that is e-mailed to the author for grading. That examination includes an analysis and evaluation of an ethical situation that a dentist might actually encounter. This type of assessment encourages the practitioner to apply the information contained in the instruction at a higher cognitive level than multiple-choice questions would allow. It also allows the instructor to give more individualized feedback.

When completing a multiple-choice assessment, DentalXChange and Crest Dental ResourceNet immediately inform the user if the answer is correct and allow repetition of the question until the right answer is given. If the answer is correct, the user proceeds to the next question. Crest Dental ResourceNet also allows an assessment preview.

#### Contents - Periodontitis as a Risk Factor for Cardiovascular Disease



#### Periodontitis as a Risk Factor for Cardiovascular Disease

Numerous studies have examined the relationship between periodontitis and CVD using various designs including case-control, cross-sectional, and longitudinal. The strongest evidence is derived from prospective, longitudinal studies, however, the others also make a valuable contribution to our knowledge base. Matilla et al. (1989) used the Total Dental Index, which combines information about caries, periodontitis (probing depth), pericoronitis and periapical disease, and reported a significant association with acute myocardial infarction.<sup>2</sup> This association was confirmed in a follow-up prospective study.<sup>3</sup> Syrjanen (1989), in a similar study, reported a significant association with cerebrovascular accident.<sup>4</sup> DeStefano (1993) reported that either periodontitis or being edentulous had a relative risk of about 1.72 for coronary heart disease in younger males (25-49) and more than 2.0 for total mortality.<sup>5</sup> Paunio et al. (1993) showed that the number of missing teeth was associated with an almost twofold greater prevalence of ischemic heart disease.<sup>6</sup> Beck et al. (1996) found that the incidence odds ratio for coronary heart disease was 1.5, 1.9 for fatal coronary heart disease, and 2.8 for stroke.<sup>7</sup> Levels of bone loss were measured and severity of periodontitis correlated with increased occurrence of CVD. Loesche and Lopatin (1998) found that decreased frequency of oral hygiene was associated with stroke and visiting a dentist or hygienist at least once a year was associated with not having a stroke.<sup>8</sup>



Joshipura et al. (1996) used a questionnaire to determine the presence of periodontitis and found no relationship with coronary heart disease.<sup>9</sup> When the number of missing teeth was combined with periodontitis, however, a relative risk of 1.67 was obtained for men with 10 or fewer teeth. Since the reporting of missing teeth is considered more reliable than periodontitis, this may explain the differences between this and other studies.

Roos et al. (1999) examined the relationship between hypertension and periodontitis.<sup>10</sup> They reported that the odds ratio for systolic hypertension was 2.0 but only 1.33 for diastolic and neither were statistically significant. The mean age of the group studied was 40 and the authors commented that a study of older patients might show a stronger association.

Clearly the literature strongly supports the relationship between periodontitis and CVD. The evidence is strong enough that it is incumbent upon the dental profession to advise patients to treat low level periodontal infections that may hasten progression of CVD by mechanisms that will be discussed.

#### http://www.dentalcare.com/soap/ce19/prcc02.htm

Fig. 1. Sample screen from one of Procter and Gamble's Crest Dental ResourceNet courses. (At the time of writing, Crest Dental ResourceNet consisted of 50 individual courses. Most courses were for 2 hours of credit, but some would earn awards of as many as 5 hours of credit.) (*From* Greenwell H. Periodontitis as a risk factor for cardiovascular disease. Available at: http:// www.dentalcare.com/drn.html. Accessed July 14, 2001 [38]).

dentalxchange.com - Continuing Education - Continuing Education



The dentist will determine what radiographs are needed for diagnosis. For a new patient, or a patient with extensive dental disease, the dentist may request a full mouth series of radiographs. When the patient has less extensive needs, the dentist will request only selected periapicals in the areas of concern.

This course presents, in detail, the technique for exposing maxillary periapical radiographs for a full mouth survey (Figure 3A). As discussed in a previous module, a full mouth survey of radiographs consists of from 18-20 films: 14-16 periapicals and 4 bitewings. The exact number of periapicals will vary according to the size of film used and the composition of tooth images projected on the radiograph. For adult patients, the posterior periapical radiographs are made using #2 size films placed horizontally. The anterior teeth can be imaged using #1 or #2 size films placed vertically (Figure 3B). Using a size #1 receptor for anterior projections permits more comfortable receptor placement.

https://www.dentalxchange.com/ce/course.jsp?courseid=1168

Fig. 2. Sample screen from one of DentalXChange's continuing education online courses. At the time of writing, DentalXChange continuing education online offered more than 200 courses for a total of more than 600 hours of credit. (*From* Spohn E, Simmons A, Hardison D. Expose periapical radiographs for the mandibular arch. Available at: http://www.dentalxchange.com/login/s.svl. Accessed August 13, 2001 [39]).

#### Invisible functions

Some sites are sophisticated in record keeping. For example, DentalX-Change provides practitioners with a "history" of their work. Practitioners can view the courses they started and whether they have completed them. Most sites that accept credit cards for CDE course payment seem to use high-security measures to protect their users, such as 128-bit secured socket layer. What is not always clear is once the data are gathered, where are they stored and what security measures protect them? Are the data stored on a server at the CDE provider's office or at a Web hosting company? Are firewalls, nonroutable Internet (IP) addressing schemes, and other precautionary measures used? For customers to appreciate fully the safety of their personal information, the author recommends that CDE providers prominently describe their security measures.

#### *Offline materials*

No courses were found with offline materials.

#### Evaluation

No sites actually discussed whether they had conducted formative or summative evaluations. DentalXChange, however, does prompt the user to complete a four-question evaluation of each course, including open-ended comments. This evaluation allows the provider to revise the course and build better quality courses in the future.

# Other

The author used a cable modem operating at 100 megabytes/second to review the courses. All courses operated at acceptable speeds and no plugins were required. Privacy statements and disclaimers are routine on most Web CDE sites.

#### Emerging Web continuing dental education technologies

Three new technologies are currently emerging that will help change the way CDE is delivered: patient simulations, e-books, and IP videoconferencing. Highly interactive patient simulations, such as those developed by Wildfire Simulations, Inc [42], permit practitioners to observe an expert's clinical decision making and procedures, practice them using simulated patients, and receive feedback from the expert. For the first time, CDE participants actually can practice and understand the impact of their decisions on patient care without a live patient. The provider extends the learning experience by including additional reference information and images, providing follow-up communications with the expert, and suggesting the participant's probability

600

of successfully implementing his or her new knowledge correctly through a "success redictor." This complete process of learning, doing, and getting feedback encourages the integration of new skills and procedures into the routine of daily patient care safely and efficiently.

E-books recently have been introduced into a few dental schools [43] by Vital Source Technologies (Raleigh, NC) [44]. For a fee, students get up to 160 text and reference books (including valuable out-of-print books) and curriculum materials on a single DVD with special access software. The DVDs are frequently updated with new books and curriculum materials [45]. As data recording technologies increase in sophistication, a practitioner can access an e-book to investigate a patient question. The session will be automatically recorded and the time counted toward CDE requirements.

The third emerging technology, Internet videoconferencing (also known as IP videoconferencing), will change how traditional group CDE is delivered. IP videoconferencing allows face-to-face interaction with the practitioner [46] except that the instructor and participants can be in numerous disparate locations such as their homes or offices. During a live Internetbased course, the instructor and all of the participants can view the instructor and a participant who electronically signals that he or she has a question or comment.

#### Summary and a look forward

Web CDE is continuously evolving. Improvements are underway to assist practitioners in locating information, but significant improvements must occur to improve instructional quality, practitioners' understanding of course quality before selection, and the type of CDE credit awarded a course.

Some practitioners find that their state board counts Web CDE as "home-study" credits. Because the study is completed at home, this is understandable, especially if the course is totally asynchronous. As courses improve in quality and become more interactive by including synchronous strategies such as "chat" sessions with the author or IP videoconferences with question and answer sessions, state boards might view these courses as more interactive and award them "participatory" credits. Whereas "chat" sessions can be held over phone lines, the more sophisticated interactions of IP videoconferencing require broadband connections. As cable modems and digital subscriber line (DSL) providers increase in quantity and quality, the level of interactivity in Web CDE courses is expected to increase.

Locating CDE courses will improve as metadata standards are established and adopted for use by Web CDE providers. The planned improvements to the ADA continuing education course listings directory combined with the directories of dental schools and other professional organizations will assist with Web CDE course location. Until recently, Web CDE was a translation of traditional classroom strategies and materials of dental education (voice, print, video) to the Web. Using the guidelines for the design of educational software as a yardstick, it is clear that improvements have been made in tracking users' progress through courses, creating a consistent interface, content validity, and other areas. Many courses still lack the interactive design that has proved to enhance learning experiences in other computer-based environments, however, such as CD-ROM. As with all other new instructional strategies, it is not the technology that teaches but the quality of the education behind the instructional product that determines its value [47]. Many course providers have experts complete a subject matter review and make revisions based on those reviews, but no provider has been identified with experts in online learning review courses for instructional strategy, appropriate use of the technology, communication, and other "interactive" issues.

The World Wide Web Consortium [48] has developed a set of technical standards called "platform for Internet content selection" [49,50] that enables users to distribute descriptions or ratings across the Internet. Originally developed to support applications that filter pornography, the same technology can enable services to review and rate Web sites with electronic labels. When properly customized, the user's computer will check with the label service and compare Web site labels against the user's specific requirements. The professional organization that uses a standard of quality such as the guidelines for design of educational software to measure courses on a routine basis would provide numerous benefits to the dental profession. Practitioners would know before investing in a course about the quality of the education they will receive. Developers would be motivated to obtain the highest possible rating and increase the quality of their course. Finally, state boards and other professional organizations will have an established "gold standard" by which they can determine if a course should be awarded participatory credit.

In closing, the future will see a blending of electronic lectures being delivered over the Internet with parallel Web resources. Standards will ensure that these courses are of highest possible quality. Participants will receive CDE credit when they submit their answers to online quizzes and research patient questions in e-books and apply this information as they solve online patient simulations.

#### Acknowledgments

To have a clear understanding of the current state of Web CDE, many persons who are committed to high-quality CDE were consulted for their expertise and experience. The author gratefully acknowledges the contributions of James Hull, DDS, from Procter and Gamble; Tina B. Krause, MEd, from ADA CERP; Jamie Sharp, RDH, MS, from the University of Iowa; Bill Wathen, DMD, from DentalXChange; and Barry Wohlgemuth, DDS, from Wildfire Simulations, Inc.

# References

- [1] Continuing Education Requirements of State Dental Boards Dentists and Auxiliaries. Available at: http://www.ada.org/prof/ed/ce/cerp/index.html. Accessed July 31, 2001.
- [2] Course preference study: executive summary and recommendations. Chicago (IL): Academy of General Dentistry; 1995.
- [3] Dental Interactive Simulations Corporation. Marketing plan. Aurora (CO): Dental Interactive Simulations Corporation; 1997.
- [4] Johnson L, Lohman M, Sharp J, Krenz T. Continuing dental education via an interactive video network: course development, implementation, and evaluation. Journal of Educational Media 2000;25:129–40.
- [5] Schleyer T, Johnson L, Pham T. Characteristics of online continuing education courses in dentistry. Quintessence Int 1999;30:755–62.
- [6] Johnson L, Schleyer T. Development of standards for the design of educational software. Quintessence Int 1999;30:763–8.
- [7] Google. Available at: http://www.google.com/. Accessed July 31, 2001.
- [8] All the web: fast search and transfer ASA. Available at: http://www.alltheweb.com/. Accessed August 15, 2001.
- [9] Gowan M, Spanbauer S. Find everything faster. PC World 2001;19:109-16.
- [10] Appleyard RJ, Marlet G. A proposal for using metadata encoding techniques for health care information indexing on the WWW. Proceedings of the American Medical Informatics Association Annual Symposium. Philadelphia: Hanley and Belfus; 1997. p. 905.
- [11] Resources ID. Available at: http://www.temple.edu/dentistry/amia/resources/. Accessed August 4, 2001.
- [12] Academy of General Dentistry. Available at: http://www.agd.org/. Accessed August 18, 2001.
- [13] ADA.org. Available at: http://www.ada.org/. Accessed August 13, 2001.
- [14] Course Listing CE. Available at: http://www.ada.org/members/ed/ce/ce/index.html. Accessed July 20, 2001.
- [15] ADA Continuing Education Recognition Program. Available at: http://www.ada.org/prof/ ed/ce/cerp/index.html. Accessed August 13, 2001.
- [16] Moore MG. Transactional distance and distant learners. Distance Education 1989;10: 141–57.
- [17] Hanson M. Distance education: a review of the literature. 2nd edition. Ames (IA): Iowa State University; 1996.
- [18] Whittington N. Is instructional television educationally effective? A research review. American Journal of Distance Education 1987;1:47–57.
- [19] Souder WE. The effectiveness of traditional vs. satellite delivery in the management of technology Master's degree programs. American Journal of Distance Education 1993;7: 37–53.
- [20] Biner PM, Bink ML, Huffman ML, Dean RS. Personality characteristics differentiating and predicting the achievement of televised-course students and traditional-course students. American Journal of Distance Education 1995;9:46–60.
- [21] Carr S. As distance education comes of age, the challenge is keeping the students. Chronicle of Higher Education 2000;46:39–41.
- [22] Barker BO, Frisbie AG, Patrick KR. Broadening the definition of distance education in light of the new communication technologies. American Journal of Distance Education 1989;3:20–9.
- [23] Sumerai SB, Avorn J. Principles of educational outreach to improve clinical decisionmaking. JAMA 1990;263:549–56.

- [24] Stross JK, Hiss RG, Watts CM, Davis WK, MacDonald R. Continuing education in pulmonary-disease for primary-care physicians. Am Rev Respir Dis 1983;127:739–46.
- [25] Steinberg E. Computer-assisted instruction: a synthesis of theory, practice and technology. Hillsdale (NJ): Lawrence Erlbaum Associates, Inc.; 1991.
- [26] Spallek H, Berthold P, Shanley D, Attstrom R. Distance education for dentists: improving the quality of online instruction. American Journal of Distance Education 2000;14:49–59.
- [27] Alessi S, Trollip S. Computer-based instruction: methods and development. 2nd edition. Englewood Cliffs (NJ): Prentice Hall; 1991.
- [28] ADA Standards Administration. Available at: http://www.ada.org/prof/prac/standards/. Accessed August 11, 2001.
- [29] Lapp R. Accredited Standards Committee MD 156 Task Group on Dental Informatics. February 18, 1999, Meeting Minutes. Chicago: American Dental Association; 1999.
- [30] Stanford S. Status report of the American Dental Association's dental informatics activities. Chicago: American Dental Association; 1995.
- [31] Guidelines for the Design of Educational Software. Available at: http://www.temple.edu/ dentistry/di/edswstd/. Accessed August 11, 2001.
- [32] Johnson L, Schleyer T. Entwicklung von normen f
  ür die gestaltung von lernsoftware. Quintessenz 2000;51:1171–9.
- [33] Instructional computing in dentistry competition. Available at: http://research.dentistry. uiowa.edu/techcomp/. Accessed July 31, 2001.
- [34] Schleyer T, Johnson L. Developing a protocol for an educational software competition. Presented at the 2001 American Medical Informatics Association Symposium. Washington, DC, October 26, 2001.
- [35] DentEd evolves. Available at: http://www.dented.org/. Accessed August 1, 2001.
- [36] Crest Dental ResourceNet: Continuing education. Available at: http://www.dentalcare.com/ drn.html. Accessed August 18, 2001.
- [37] DentalXChange. Available at: http://www.dentalxchange.com/ce/ce.jsp. Accessed August 18, 2001.
- [38] Greenwell H. Periodontitis as a risk factor for cardiovascular disease. Available at: http:// www.dentalcare.com/drn.html. Accessed July 14, 2001.
- [39] Spohn E, Simmons A, Hardison D. Expose periapical radiographs for the mandibular arch. Available at: http://www.dentalxchange.com/login/s.svl. Accessed August 13, 2001.
- [40] Hull J. Discussion of Crest dental ResourceNet continuing education site. Personal Communication; 2001.
- [41] Wathen B. Discussion of DentalXChange: CE online web site. Personal Communication; 2001.
- [42] Simulations W. Available at: http://www.wildfiresimulations.com/. Accessed August 15, 2001.
- [43] Baker L. UB dental school's program goes digital. Available at: http://www.buffalo.edu/ news/fast-execute.cgi/article-page.html?article=45870009. Accessed August 13, 2001.
- [44] Book V. Available at: http://www.vitalviewer.com/. Accessed July 20, 2001.
- [45] Boynton RS. You say you want an e-book revolution? Available at: http://www.time.com/ time/digital/magazine/articles/0,4753,58468–1,00.html. Accessed December 2000.
- [46] Uo B. TeleDent: video- and data-conferencing for postgraduate dental training and remote diagnostic support. Bristol: University of Bristol; 2000.
- [47] Clark R. Reconsidering research on learning from media. Review of Educational Research 1983;53:445–59.
- [48] W3C: World wide web consortium. Available at: http://www.w3.org. Accessed August 19, 2001.
- [49] Miller J, Resnick P, Singer D. Rating services and rating systems (and their machinereadable descriptions). World Wide Web Journal 1996;1:22–43.
- [50] Resnick P, Miller J. PICS: internet access controls without censorship. Commun Assoc Comput Mach 1996;39:87–93.