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Design and Effectiveness of a Computer-Based Continuing Education Program for Orthodontists

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ABSTRACT

The design of computer-based continuing education for health professionals is an important consideration for Internet delivery because the size of graphic files greatly affects the speed with which information is delivered. Orthodontists who had indicated an interest in computer-based continuing education were shown via CD-ROM either a dynamic version of a computer continuing education program (with transitions and animations to liven up the content) or a plain version (identical content except that the transitions and animations were omitted). The program provided new information about superelastic arch wires for the initial stage of orthodontic treatment. For both versions, over 90% of the viewers thought the program was well done and provided useful information. Six of the orthodontists who received the dynamic version felt that the animations were distracting rather than helpful; only one who received the plain version felt that it was lifeless. A follow-up questionnaire showed that two-thirds of those who viewed the program had subsequently reviewed the performance data for the initial wire they were using and 20% had changed it, so the computer program was effective in changing clinical behavior. Those who saw the plain version also were more likely to have changed their clinical procedures. For Internet delivery of information to highly motivated professionals, it appears that transitions and animations are not necessary and may be more likely to decrease than increase the effectiveness of the teaching material.

KEY WORDS: Orthodontic continuing education, Internet delivery.

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INTRODUCTION Return to TOC

It is already feasible to provide continuing education directly to individuals via a computer in their office or home. As computer capabilities and connections increase, it seems clear that this method will become more important for orthodontic continuing education. Much remains to be learned, however, about the most effective way to structure and deliver teaching materials for this purpose.

Educational research suggests that dynamic graphics, or animation, can provide several advantages in a computer-based instructional lesson.[1] These include increasing the motivation of the learners, enhancing the learner's attention, and helping learners focus on relevant

aspects of the lesson. The overall results for the influence of dynamic graphics on learning are mixed. Of 22 studies of dynamic graphics in computer-based lessons in public schools, only 11 indicated a positive or facilitating effect.[2] Hansen et al[3] suggest that this stems from a lack of attention to the instructional approach, not from a flaw in the animations themselves, but it seems clear that dynamic graphics are more effective for some audiences than others.[4] It is likely that highly motivated individuals who seek to maintain and extend their professional skills would react differently to teaching materials than, for instance, would a typical college class.[5,6] What works in one setting may not be the best approach in another.

This paper describes our recent effort to evaluate the following:

1. The interest of a group of practicing orthodontists in receiving computer-based continuing education delivered directly to them and their ability to use this material in the context of their computer equipment and experience.

2. Their reaction to educational materials delivered with and without the dynamic graphics (colorful transitions and animations) usually included in such programs.

3. The extent to which material of this type would change their behavior in clinical practice.

MATERIALS AND METHODS Return to TOC

A continuing education module was developed to provide information on current clinical procedures in the first stage of comprehensive orthodontic treatment (alignment). The content emphasized new information about wires and procedures in initial alignment that was not included in the orthodontic curriculum of more than 10 years ago. The focus of the program was on the application of superelastic wires in initial alignment, the great variability between laboratory data and advertising claims for performance of currently available wires, and the fallacy of using rectangular superelastic wires initially because of their inability to deliver useful torsional force. A presentation was developed in Authorware 5.0 in 2 versions that were identical in content but different in that one included transition effects and decorative graphics (the dynamic version), whereas the other did not (the plain version). The program was supplied on a CD-ROM with all executable files internally packaged so that the viewers required no other software loaded on their computers to view the presentation. Nothing was written to their computer's hard drive that had to be uninstalled or deleted after completing the modules.

The Department of Orthodontics at the University of North Carolina (UNC) is in regular contact with an “alumni and friends” group that consists of approximately 200 graduates of the program and 100 others who have taken an interest in the orthodontic program and supported it in various ways. An initial letter and survey was sent to this group, asking for information about their computer assets, capabilities, and Internet habits and whether they would be interested in evaluating a new educational computer program. Of the 300 surveys mailed, 206 were returned, and 116 orthodontists volunteered to participate in the study. From this volunteer pool, 2 sample groups (n = 42 each) were created by simple random allocation. One group received the dynamic version of the program, the other the plain version. In addition, a third group (n = 39) composed of present faculty and residents and graduates of the last 2 years (1998–1999) was sent a module with both versions for comparison. Each package contained, in addition to the CD-ROM program, a 3.5-inch diskette to which answers to questions were transferred automatically upon exiting the program, for return of information. Response rates for the 3 groups were similar (64%–69%), and the final size (n = 27 or 28) for the 3 groups and the follow-up response rate were almost identical (Table 1). As expected from the composition of the mailing list, most, but not all, of the first 2 groups (80%) were UNC alumni; the others had attended 15 different orthodontic programs.

Feedback from all 3 groups came from 25 questions that were answered before (6) and immediately after (19) viewing the program. The first 6 questions provided demographic and background information about the respondents; the latter 19 focused on their reaction to the program. In addition, a 3-question follow-up questionnaire was sent to the participants 3–4 months later to gain information about changes in behavior in the months after viewing the educational material, with a 90% response rate. These specific questions were whether the orthodontist had evaluated the level of elasticity of the wire used in his or her practice, changed the wire used for initial alignment, or discontinued the use of rectangular initial wires.

RESULTS Return to TOC

Computer capabilities of the orthodontic respondents

Of the 206 practitioners who responded to the initial survey (in early 1999), 167 (81%) had computers both at their office and home (Figure 1). Only 6 (2.9%) did not own a computer at all. Nearly all of the 200 computer owners had both a modem and CD-ROM drive, access to the Internet, and an e-mail address. Although 144 accessed the Internet at least once or twice a week, most had not used dental or orthodontic sites. The age distribution of the respondents was typical of the current aging orthodontic population, with 35% between 45 and 55 years of age and another 30% over 55 years of age. They were, therefore, considerably more computer oriented than the general population in their age range and were likely to use computers more than the average orthodontist.

Evaluations of the teaching module

The respondents viewed both the dynamic and plain versions of the program very favorably. Because the responses for several questions were almost identical for the 3 groups and were heavily skewed toward “strongly agree” or “strongly disagree,” data for the groups for these responses were combined and are shown in Table 2. It is apparent that the great majority of the respondents felt that the module presented useful information in a desirable way.

The immediate responses did vary in interesting ways to 2 questions: whether the transitions and animations of the dynamic version, or their lack in the plain version, detracted from the presentation; and whether opinions about the course topics changed because of viewing this program. As Table 3 shows, 6 (22%) of those who saw the dynamic version felt that the animations and transitions detracted from the quality of the presentation, whereas only 1 of those who viewed only the plain version felt that it was lifeless. The younger group who saw both versions split evenly as to which version they preferred. Those who had been in practice more than 10 years and those who saw the plain version were more likely to change their opinion (Table 4). The plain version, therefore, appeared as acceptable or more acceptable in format, and more effective in changing opinions, than the dynamic version.

Teaching effectiveness and changes in behavior from the educational material

In the development of the survey, extensive pretesting and posttesting was rejected because of the likelihood that practitioners would simply not respond. Because the effectiveness of a continuing education program for health professionals is best demonstrated by the extent to which it changes behavior, the follow-up questions were the main measure of effectiveness (Table 5). Two-thirds of the participants reported that since seeing the program, they had investigated the elastic properties of their initial alignment wire, over 20% had changed it, and 15% had discontinued their previous use of rectangular initial wires.

DISCUSSION Return to TOC

From the perspective of orthodontists and those who teach them, there are 3 major points of interest in these results: (1) computer-based instructional programs can be effective in disseminating new information and putting it in perspective for orthodontic clinicians, at least for those who are interested in computer applications to their work; (2) old orthodontists, unlike old dogs, can be taught new tricks—the participants who were over age 55 were more, not less, likely to change their behavior than the younger participants; and (3) there was no advantage, and perhaps a disadvantage, in using a dynamic version of the program.

The participants in this study were a highly self-selected group; they were more computer oriented than many practitioners and certainly not typical of the general orthodontic community. It is quite likely that they rated the instructional material more highly than a typical continuing course audience would have, and it is possible that they were more likely to change their behavior after seeing it. Because no skill was needed to view the program, we suspect that the material would have been effective with any group of clinicians who were motivated to view it. Those who are less comfortable with computers are less likely to view material in a computer format.[7] If teaching materials were widely distributed as CD-ROMs or over the Internet, some people would be left out simply because they were unwilling to view the material on a computer screen. This almost surely is truer of older than younger individuals.

The age of our respondents did affect their response to this module: those whose training occurred within the last 10 years were less likely to think the information was new and less likely to change what they were doing because of it. Almost all with less than 10 years' experience were UNC graduates who had been exposed to this material during their training, so that is not surprising. However, it was impressive that the older orthodontists were as willing as they appeared to be to change aspects of their clinical practice. Those over 55 were not different from their younger colleagues in this respect. Participation in continuing education courses tends to decrease toward the end of one's career. Perhaps individually delivered programs would be a more effective way for older practitioners to remain up to date—or perhaps only those who remained interested in professional advances, such as computer applications to practice, would be motivated to participate even if travel to do so became unnecessary. At this point, there is no way to tell.

The orthodontists who viewed them received both versions of the teaching module very well. It is widely felt that transitions and animations to liven up a teaching module for medical and dental students are important in maintaining the interest of the viewers.[8] In this study, these features—which are not part of the teaching program—were more likely to distract the orthodontists than to help them. Those who saw the dynamic version liked it, and the younger group who saw both versions split 50–50 in their preference between the 2 versions. The plain version drew fewer unfavorable comments, however. It also performed at least as well in conveying the information, and better from the perspective of changing behavior.

We suspect that orthodontists, and probably most professionals who are seeking new information to improve their skills, are much more highly motivated to learn than student groups often are. The inherent motivation of the participants may have eliminated any facilitating effects of dynamic graphics, because the topic itself raised their motivation levels and attention. Other studies have indicated that for such groups, dynamic graphics will not enhance and may detract from learning.[9,10] It is an interesting thought that experienced professionals have learned to resist slick multicolor presentations as inherently less credible than plain presentations of data.

This is an important finding relative to the development of new continuing education modules for orthodontists and other health professionals. Internet delivery is faster, easier, and more convenient than producing and distributing CD-ROMs. As Internet access and connection speeds improve, the advantages of Internet delivery will increase. File size is much more of an issue when the Internet is used.

The bigger the file, the slower it will load. The transitions and animations for a dynamic version greatly increase the file size. So if these can be omitted, it will be much more practical to go immediately to Internet delivery than if the extra graphics were needed to obtain satisfactory effectiveness.

We conclude that, for orthodontists who are comfortable with the concept of computer instruction, a high-level computer instructional program can change behavior in a clinical setting. It appears that additional graphics to improve the appearance of the teaching program are unnecessary and perhaps counterproductive. Additional studies are needed to investigate the effectiveness of dynamic graphics that are interactive, under control of the participants, and directly related to the instructional content.

ACKNOWLEDGMENTS

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REFERENCES Return to TOC

1. Park O, Hopkins R. Instructional conditions for using dynamic visual displays. *Instr Sci.* 1993; 21:427–447.

2. Szabo M. Updating our mental models to take advantage of modern communication technology to promote computer-based communication. In: Berge Z, Collins M, eds. *Wired Together: The Online Classroom in K-12.* Peekskill, NJ: Hampton Press; 1997. *Perspectives and Instructional Design*; vol 1.

3. Hansen SR, Narayanan HN, Schrimpsher D. Helping learners visualize and comprehend algorithms. *Interactive Multimedia Electronic J Computer-Enhanced Learning.* 2000; 2:

4. Bergeron B. Technology-enabled education. *Postgrad Med.* 1998; 103:31–34.

5. Knox A. Influences on participation in continuing education. *J Cont Educ Health Prof.* 1990; 10:261–274.

6. Tassone M, Heck C. Motivational orientations of allied health care professionals participating in continuing education. *J Cont Educ Health Prof.* 1997; 17:114–120.

7. Sinclair P. The reader's corner. *J Clin Orthod.* 1997; 31:23–41.

8. Lilienfield L, Broering N. Computers as teachers: learning from animations. *Am J Physiol.* 1994; 266:47–54.

9. Stasko J, Badre P, Lewis C. Do algorithm animations assist learning?. In *Proceedings of the INTERCHI '93 Conference.* New York: ACM Press. 1994;61–66.

10. Nappin N, Guzdial M, Realff M, Ludovice P. Balancing usability and learning in an interface. In *Proceedings of the ACM Human Factors in Computing System Conference, (CHI '97).* New York: ACM Press. 1998;479–486.

TABLES Return to TOC

TABLE 1. Response Rates

Item	No. Sent	No. Returned	Response Rate, %
Initial surveys	300	206	68.7
Continuing education modules			
Group 1—dynamic	42	27	64.3
Group 2—plain	42	28 (3 blank)	66.7
Group 3—both	39	27	69.2
Follow-up questionnaire			
Group 1—dynamic	27	24	88.9
Group 2—plain	25	23	92.0

TABLE 2. Combined Intergroup Data from Selected Questions

Statement	Strongly Agree/ Agree	Strongly Disagree/ Disagree	Neutral
Course material will be useful to me in the future.	67	5	7
Time spent viewing this course was worthwhile.	69	4	6
Course material was presented at a satisfactory level of difficulty.	70	3	6
Loading and running the presentation from the CD-ROM went smoothly.[a]	71	6	2
I would be interested in viewing similar presentations on the Internet or on CD-ROM if they were available.	74	1	4
I would recommend this mode of continuing education to my peers.	73	2	4
The course content was valuable.	75	1	3
I prefer cassette tape reviews of journal articles to this mode of continuing education.	5	66	8

[a] Three diskettes were returned blank, meaning that the practitioner did not complete the program without it locking up, etc., before completion (all from the plain group).

TABLE 3. Acceptability of Transitions and Animations

Group	Agree/ Strongly Agree, n (%)	Disagree/ Strongly Disagree, n (%)	Neutral, n (%)
Dynamic[a]	6 (22.2)	16 (59.3)	5 (18.5)
Plain[b]	1 (4.0)	22 (88.0)	2 (8.0)
Both[c]	11 (40.7)	11 (40.7)	5 (18.6)

[a] Statement: "Animations and transitions distracted from the quality of the presentation."
[b] Statement: "The presentation was lifeless."
[c] Statement: "I prefer the presentation with transitions, sounds, and animations."

TABLE 4. Opinion Changes: Postpresentation Question 1 Data[a]

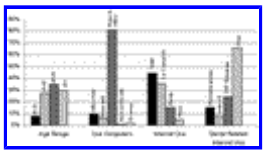
Group	Agree/ Strongly Agree	Disagree/ Strongly Disagree	Neutral
By presentation viewed			
Dynamic	8	15	4
Plain	16	7	2
Both	4	18	5
By time in practice			
0–9 y	7	20	7
10–19 y	9	9	1
20–29 y	10	8	2
>30 y	2	3	1

[a] Statement: My opinions about some of the course topics changed because of reviewing this continuing education presentation.

TABLE 5. Postpresentation Survey

Statement	Yes	No	Not Applicable
Since viewing the presentation, I have evaluated the level of elasticity of the nickel-titanium wire I use for initial alignment.			
Dynamic group	15	9	0
Plain group	14	8	1
Both versions	29	17	1
Since viewing the CE presentation, I have changed the wire I use for initial alignment.			
Dynamic group	4	20	...
Plain group	6	17	...
Both versions	10	37	...
Since viewing the presentation, I have discontinued using rectangular superelastic wires for initial alignment.			
Dynamic group	1	1	21
Plain group	6	2	15
Both versions	7	3	36

FIGURES Return to TOC



Click on thumbnail for full-sized image.

FIGURE 1. Age range and computer use characteristics of orthodontists who responded in 1999 to the initial survey

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