

INTERACTIVE DISTANCE LEARNING IN POST- DOCTORAL ORTHODONTIC EDUCATION

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ABSTRACT

Katherine Pennington Klein: Interactive Distance Learning in Post-Doctoral Orthodontic Education

(Under the Direction of Dr. William R. Proffit)

A series of research projects at the University of North Carolina – Chapel Hill (UNC) have been dedicated to determining the best way to provide distance education to graduate orthodontic programs. Data from early studies by Bednar and Miller et al, determined the most effective and acceptable method for distance learning in post-graduate orthodontic programs was a “blended” experience. This blended approach combines self-preparation through reading assigned articles, watching a recording of an actual interactive seminar on a designated website, and follow up discussion with faculty (either live or distant). In 2008, a grant from the American Association of Orthodontists made it possible to open this experience to all 63 programs in the United States. This master’s thesis consists of two papers: Paper I evaluates the utilization and acceptability of interactive distance learning for orthodontic residents; Paper II investigates problems with interactive distance learning in post-doctoral education and identifies potential solutions.

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CHAPTER I

INTERACTIVE DISTANCE LEARNING FOR ORTHODONTIC RESIDENTS: UTILIZATION AND ACCEPTABILITY

INTRODUCTION

Interactive small group discussions are accepted as the gold standard for the highest levels of graduate education, which includes post-doctoral dental specialty programs.^{1, 2}

Interactive discussions challenge graduate students to think critically about concepts presented in assigned readings. Despite their effectiveness, not all orthodontic programs have the faculty or resources to support this type of small group seminar interaction.³

Sharing resources through distance education has been proposed as an alternative method for graduate orthodontic education.⁴⁻⁷ As with other instruction, interaction is a key component in distance education; researchers and practitioners agree that interaction increases learning satisfaction in distance education courses.^{6, 8, 9}

In order to keep distance education for orthodontic residents as cost-effective as possible while retaining interaction, a “blended” interactive distance learning approach was developed that combines observation of web-based seminars with live follow-up discussion.⁶ Prior studies have assessed the effectiveness of this approach and the findings were positive.¹⁰ Participants in this blended learning project were expected to:

- 1) Read all assigned articles prior to viewing a recorded seminar.
- 2) Watch a 1 to 1 ½ hour recording of an actual interactive seminar on a web site.

- 3) Participate in a 30-minute follow up discussion immediately after watching the recorded seminar with either a faculty member at the participating institution or, via videoconference, with the leader of the web based seminar.

For the 2009-2010 academic year, a grant from the American Association of Orthodontists (AAO) opened access to the blended learning experience to all 63 orthodontic programs in the United States (US). The Canadian schools, also offered access, chose not to participate. The specific aims of this project were to (1) measure programmatic interest in using blended distance learning, (2) determine resident and faculty interest, (3) determine the seminars' perceived usefulness, and (4) elicit feedback regarding future use.

MATERIALS AND METHODS

The protocol for this investigation was reviewed by the Institutional Review Board at UNC and declared exempt under regulations covering education-based research. Twenty-five interactive seminars in four topic sequences (Growth and Development, Advanced Diagnosis/Treatment Planning, Advanced Biomechanics, and Sequellae of Treatment) were recorded from actual classroom sessions at the University of North Carolina (UNC) or the Ohio State University (OSU). As previously described by Miller et al, all recordings were made and processed at UNC.¹⁰ All US orthodontic programs were initially invited to use the educational materials via mail and email; non-responding departments received follow-up phone calls to further increase participation .

Assessment of interest in using blended distance learning in orthodontic residency education was the primary objective of this study. Based on the extent of programmatic use of the educational materials, program interest was categorized as full participation, limited

interest or no interest. Programs were designated as “fully participating” if they requested a registration code, at least some of the seminars were watched, and then a follow up survey was completed. If a program initially requested a registration code but did report either using the seminars or complete a survey, they were classified as having a “limited interest.” If a program did not make any attempt to participate in the project they were classified as having “no interest.”

Faculty and residents were surveyed after viewing the recorded seminars. The surveys were developed through consultation with experts in survey design and based on previously published research. Participants were emailed surveys through SurveyMonkey, an online distribution software. To encourage candid feedback, e-mail addresses were not linked with individual responses. Perceptions regarding recorded seminars, reading materials, technology and post-seminar discussions were measured on a 7-point Likert scale (1 = strongly disagree and 7 = strongly agree).

RESULTS

Interest

Just over half (n=33, 52%) of the 63 US graduate orthodontic programs fully participated in this project. Ten (16%) registered for participation but did not use the teaching materials, and 20 (32%) never responded to repeated invitations to participate.

Of the 256 residents and 42 faculty who participated, 80% of the residents and 83% of the faculty completed the surveys that provided feedback on their experience. Participants included first, second and third year residents, with 39% in their second year. 80% were required by faculty to view selected seminars. A majority of (55%) residents were in

programs lasting 33 months or more. A Fisher's exact test showed there was no relationship between the length of the program and level of participation ($p=0.55$).

Selection and Use of Recorded Interactive Seminars

Most (66%) residents reported watching the recorded seminars with their classmates and professor during the day. Many residents (29%) reported not reading any articles before watching the recorded seminar; only 14% read all articles in-depth (Figure 1).

Twenty-nine percent of program faculty required residents to view all components of the Growth and Development sequence, and 23% required viewing of the Sequelae of Treatment sequence. The majority of programs did not require residents to watch all components of a sequence. Residents reported that they most frequently watched seminars about Growth and Development (83%) and Biomechanics (39%).

Post Seminar Discussions

The majority of residents (73%) participated in discussions with faculty regarding content in the recorded seminars viewed online. Seminar-related discussions were led by either faculty members from participating programs, the author of the seminar (Dr. Proffit, Dr. Fields, etc.) or a combination of both. Eighty percent of residents participated in a live discussion about the content of the seminars with their own faculty member. An equal number of residents had post-seminar discussions led by the author of the seminar (9%), or participated in a combination of discussions led by the author of the seminar and by their own faculty member (9%). Timing of these discussions varied (Figure 2).

Perceptions

Faculty and resident perceptions of the learning experience are graphically represented in Figure 3. Both residents and faculty were generally positive. However,

faculty rated the experience on average as more enjoyable and effective than did the residents. The faculty were also more positive about using the materials again in the future. More faculty than residents thought the recorded seminars were too slowly paced. Both were close to neutral as to whether residents were able to learn the materials from the recorded interactive seminars as well as they do in a traditional classroom. Forty-seven percent of faculty strongly agreed that seminar content was appropriate for residents. The majority of faculty (56%) agreed that using distance learning would lessen faculty burden. The post-seminar discussions were rated highly positively by both faculty and residents.

Perceptions of the technology as rated are shown in Figure 4. Residents strongly agreed they were not distracted from learning because of the technology. Both faculty and residents agreed that the video clarity was acceptable, but the faculty were less positive about the sound quality. Both groups strongly agreed that having the capability to stop, rewind and skip through sections of the seminar was beneficial to the learning experience, and also strongly agreed that more extensive visual aids to supplement the discussion between the seminar leader and the live participants would be beneficial.

Statistically significant differences existed, on average, between resident's perceptions of the quality of learning materials based on how well they prepared prior to participating in the recorded interactive seminars (Figure 5). Prepared residents reported a greater ability to learn from the seminars ($p=0.0014$) than those who did not read, and also were more enthusiastic about the chance of using similar seminars again in the future ($p=0.0025$). Additionally, residents who read all articles in depth thought distance seminars were more enjoyable ($p=0.0004$) and more effective ($p=0.0028$) than those who did not read. Residents who skimmed some of the articles did not find the seminars to be any more

enjoyable or effective than residents who simply did not read. As teachers have known for some time, students who took the time to prepare for the seminars and complete at least some of the readings thought that the learning materials were more enjoyable, more effective, felt they had a greater ability to learn from the seminars, and were more likely to use them again in the future.

DISCUSSION

Use of distance learning

The distance learning project carried out during the last four years was endorsed and funded by the AAO as one way to deal with a lack of full-time faculty in orthodontic residency programs. This report is essentially a peer review of the method that was determined from that project to be the most cost-effective way to structure interactive distance learning for orthodontic residency programs.

Faculty at the participating programs cited a variety of reasons for using distance learning (Figure 6). Interestingly, only 23% said they did not have enough faculty resources to cover basic needs, which does not support the initial hypothesis that resources were compromising the educational effectiveness of programs. Almost two-thirds of faculty determined that diversity of opinion was the primary reason for choosing to use the distance learning material. This data supports recent findings from E-learning literature, reporting that students and faculty do not see distance learning as replacing traditional instructor-led training, but as a complement to it.⁶ Interestingly, programs of longer duration (33 months or more) were more likely to participate in this evaluation and more likely to require residents to fully participate in the seminars. Perhaps this is because three year programs provide

greater opportunities and have more flexibility to integrate additional educational opportunities into existing curricula.¹¹

Residents at participating programs had the opportunity to watch any of the seminars, whether or not they were assigned to do so. The seminars most frequently viewed by residents focused on the more “academic/didactic” topics (Growth and Development, Biomechanics), with less use of seminars in Diagnosis/Treatment Planning and Sequelae of Orthodontic Treatment. This may reflect a lack of faculty available to teach these more “academic subjects” and a perceived need to supplement their existing knowledge. Over 90% of the residents said they planned to take the ABO examination and most (71%) agreed that they planned to use the recorded seminars to help prepare for it.

Factors affecting interest in interactive distance learning

The ten programs that initially expressed interest in interactive distance learning but then dropped out cited various reasons for not following through with the program such as: concern that seminars would not engage residents, logistical hurdles such as “our class is (scheduled for) only 50 minutes,” technological difficulties such as “the university bars us from adding or downloading programs onto our computer,” and the feeling that “we are really busy and just never got around to it.” These real and perceived barriers match previous research findings explaining why distance learning has not been more fully embraced in dental education. The literature cites inadequate computer skills, lack of faculty desire to change their curriculum, lack of funding, unwillingness among individuals and institutions to share ideas and teaching materials, the fear of losing programmatic control over didactic curriculum, and poorly designed educational materials as reasons for slow implementation of distance learning in dental schools.^{4,5} Unfortunately, some dental

educators lack an understanding of the capabilities of distance education, are unaware of how to creatively use these materials, and are reluctant to embrace change. Adopting E-learning and its related technology requires an investment in faculty time and resources.⁶ Some surveyed faculty did not seem ready to make this commitment.

One faculty member did not want to use the seminars for fear that “the current American student often does not prepare, and to engage their minds they must believe that they will be called on next. Watching presentations tends to allow some to fall asleep physically and/or mentally... (However,) I actually find the seminars good for me to review materials and concepts!” The blended approach to distance education does allow residents to watch the recorded seminars without the pressure of answering a question, but the intent is that they will be challenged to interact with faculty to discuss concepts further after viewing the recording. One resident stated, “The live discussions following the seminars were very helpful--both to make sure I understood key points and concepts, and they kept me motivated to do all of the work for each session.”

Although a great deal of evidence exists showing no significant differences between distance learning and traditional classroom instruction, there remains significant differences in the way online learning experiences are perceived.¹² Multiple studies have shown that E-learners demonstrate increased content retention, resulting in better achievement of knowledge, skills and attitudes because they have control over the content. Giving adult learners control over the content via distance education materials takes advantage of the finding in adult learning theory that “learning is a deeply personal experience: we learn because we want to learn.”⁶ One can only hope that by the time the learners are orthodontic residents, adult learning theory is applicable.

Factors that could have affected perceptions

Technological challenges can be very frustrating for learners and affect the perception of the quality of E-learning materials. Although residents strongly agreed they were not distracted from learning because of the technology, to truly advance distance education, maximum effort needs to be placed on reducing technological difficulties. In this study, technological issues were the most frequent topic discussed in the open-ended comment section. In decreasing order, residents and faculty were most concerned with (1) the need for better editing, (2) the need for more frequent visual aids (e.g. PowerPoint slides) throughout the recorded seminars, (3) the slow pace of the seminars, and (4) video/sound quality.

The editing of these seminars was minimal, and the nature of the open-ended comments reflected this. One comment stated, “more slides that emphasized key concepts, and longer camera time on slides would greatly improve these sessions.” One resident suggested, “splitting the video screen so you could see both the presenter AND the presentation” would improve the quality of the video. Some residents felt, “there was no reason to show video of the narrator or residents...it would be better to show meaningful figures that apply to what is being discussed.” It is clear that in the future, more effort should be placed on visually enhancing and more succinctly editing the seminars. Such efforts require adequate staffing and proper video editing equipment.

The advent of high definition TV has raised users’ expectations of image quality,¹³ and a number of open-ended comments were based on the quality of the visual image and sound quality, for example: “the format for learning worked well, although the quality of the visual materials presented was poor, likely due to limitations in bandwidth;” “it looks like it was filmed in 1985;” and “the treat of listening to Dr. Proffit was only partially delivered

because of the sound quality....” One faculty member said, “one must continually monitor the volume on the recording as the presenter and residents are not at the same volume, so you either don't hear the residents or Dr. Fields is a bit loud.” Better image and sound quality are absolutely essential to garner maximum satisfaction from participants.

The recorded seminars were interactive, Socratic-type discussions. Unless residents complete the assigned reading and are adequately prepared for the seminars, watching the recordings will be somewhat uninteresting as the entire discussion is focused around article content. As noted above, the survey data showed that residents who did not prepare for the seminars by reading all of the articles found the experience to be less enjoyable, less effective, and decreased their ability to learn from the seminars. A faculty member said, “I really liked the reading list, and it was necessary to help the residents understand the concepts presented using this Socratic method of teaching...I believe the residents not only benefited from this presentation as a review, but it also acted as a springboard to stimulate interesting discussions.” One resident stated that the interactive distance learning formula was “excellent, but it was a lot more work” than expected. Another commented, “I think the discussion format is the most effective way of learning the material, but at the same time, not the most time-efficient, as there is a lot of dead-time in a discussion, waiting for pauses while people think about what they want to say.”

The difference in the perception of what some residents and faculty thought interactive distance learning would be, versus the reality of the recorded seminars that were not rehearsed, probably affected their acceptance. As residents stated, “I expected a Mosby review type seminar,” and “I need short, concise material to study and not dedicate all that time to a lengthy video...there's just too much material and not enough time.” On the other

hand, many faculty and residents thought that having residents in the video of the recorded seminars was beneficial, and agreed that it was more interesting and a better learning experience to watch the interaction between the residents and faculty on the recorded seminar than it would be to see the faculty lecture alone.

Another factor that may have affected the perception of how the seminars were received was the novelty of the seminar material. One resident said, “As a third year resident, I have already learned about growth and development, so the seminars were not that interesting.” The “newness” of the learning material might have affected interest in the seminars, although many residents appreciated reviewing the material and echoed the sentiment that, “it was a good way to understand and solidify concepts.”

CONCLUSIONS

Just over half (33 programs, 52%) of the US graduate orthodontic programs chose to fully participate in this project. The blended approach to distance learning was judged to be effective and enjoyable; faculty members were somewhat more enthusiastic about the experience than residents. Faculty and residents did not see this approach to learning as replacing traditional instructor-led training, but as a complement to it.

Distance learning works best when faculty are supportive and encourage resident preparation. Most residents were not adequately prepared for the seminars (only 14% read all of the assigned articles in depth), and this impacted their perception of the effectiveness, enjoyability and ability to learn from the experience.

Despite feedback regarding the need for technological improvements of the recorded seminars such as better editing, more frequent slides interspersed throughout the recording, a

quicker pace and improved sound quality, residents and faculty agreed they would like to use this approach to distance learning again in the future.

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CHAPTER II

INTERACTIVE DISTANCE LEARNING IN POST-DOCTORAL EDUCATION: PROBLEMS AND POTENTIAL SOLUTIONS

INTRODUCTION

Virtually all university and dental school administrators agree that E-learning will play an important role in the future of education.¹ Evidence from previous studies indicates that distance education is at least as effective, perhaps more effective in some circumstances, than traditional classroom instruction.²⁻⁴ E-learners often demonstrate increased content retention that results in improved knowledge, skills and attitudes, because they have control over the content. Advancements in E-learning are creating the groundwork for a revolution in graduate medical education by individualizing learning, enhancing learners' interactions with each other, and transforming the role of teachers from disseminators of information to facilitators of self-motivated learning.⁵

In post-doctoral residency programs, interactive small group discussions are accepted as the gold standard for teaching because they challenge residents to think critically about concepts presented in assigned readings.^{2,6} In distance education, it is important not to lose this key interactive component.^{7,8} Based on the results of previous evaluations of interactive distant seminars with orthodontic residents, Miller et al evaluated a "blended" interactive distance learning approach (Figure 7) that combined observation of recorded seminars followed by live follow-up discussion.^{2,9} Using this method with residents at eight other schools, it was shown that distant residents learned at least as much as those physically

present for the seminar, and that the distant faculty and residents found the learning experience quite acceptable although they preferred live interaction.⁹

For the 2009-2010 academic year, a grant from the American Association of Orthodontists (AAO) opened free access to 25 recorded seminars in 4 instructional sequences to all 67 orthodontic programs in the United States and Canada, the only requirement being participation in the evaluation. Drawing on this experience with a broad group of residents and faculty, this paper focuses on problems that are likely to be encountered in the use of blended distance learning in post-doctoral health science education.

ACCEPTABILITY OF INTERACTIVE DISTANCE SEMINARS: WOULD THEY REALLY BE USED?

Orthodontic programs were invited to use the free educational materials via both mail and email, and non-responding departments received follow-up phone calls to increase participation. Just over half (n=33, 52%) of the 63 US graduate orthodontic programs chose to participate in this project; interestingly, none of the Canadian programs did. Ten other American programs (16%) registered for participation but did not use the teaching materials, and 20 (32%) never responded to repeated invitations to participate

At the participating schools, why did faculty and residents use distance learning?

Faculty at the participating programs cited a variety of reasons for using distance learning (Figure 6). Interestingly, although widespread faculty shortages were the main reason this project was conceived, only 23% of participating faculty said they did not have enough faculty resources to cover basic needs. One faculty member stated, “We have enough faculty but we can’t expect the group to be experts on all topics;” another said, “Having the ability to access specialized academicians through distance education is certainly a benefit for

students;” and a third commented that the learning materials were “a very helpful adjunct to our curriculum” and an “excellent reinforcement of concepts taught in our curriculum.” This echoes recent findings from the E-learning literature that students and faculty do not see distance learning as replacing traditional instructor-led training, but as a complement to it.⁵ Another participant cited more global reasons for utilization of learning materials: “As an orthodontic educator for a number of years, I am fully aware of the need for more orthodontic faculty and better quality orthodontic education. I support the concept of distance learning and I believe it should have a significant role in the future of orthodontic education.”

Residents at participating programs had the opportunity to access all of the seminars for viewing, whether or not they were assigned to do so. The seminars most frequently viewed by residents focused on the more academic/didactic topics (Growth and Development, Biomechanics) with less use of seminars in Diagnosis/Treatment Planning and Sequelae of Orthodontic Treatment. This may reflect a lack of faculty available to teach the more “academic sciences” and a perceived need by some residents to supplement their existing knowledge in those areas.

Why did many programs choose not to participate? Although we were unable to contact all non-participating programs, efforts were made to determine why so many did not participate. Various reasons were cited such as: concern that seminars would not engage residents, logistical hurdles such as “our class is only 50 minutes ” (recorded seminars with post-seminar discussion were planned to be about 60 minutes long and 30 minutes of post-seminar discussion was expected, but there was considerable variability in seminar length), technological difficulties such as “the university bars us from adding or downloading programs onto our computer,” and the feeling that “we are really busy and just never got

around to it.” One program said, “We didn’t do it because we could and did teach the selected subjects perfectly well.”

These real and perceived barriers match previous research findings explaining why distance learning has not been more fully embraced in dental education. Reasons for slow implementation of distance learning in dental schools have included a lack of faculty desire to change their curriculum, lack of funding, unwillingness among individuals and institutions to share ideas and teaching materials, the fear of losing programmatic control over didactic curriculum, and poorly designed educational materials.¹ Adopting E-learning and its related technology does require an investment in faculty time and resources, even at programs that are only recipients, not contributors.

PERCEPTIONS OF PARTICIPATING RESIDENTS AND FACULTY

Perceptions of participants in the project were measured using survey instruments that combined statements to be judged on a 7-point Likert scale (7=strongly agree, 1=strongly disagree) and open-ended questions. Of the 256 residents and 42 faculty who participated, 80% of the residents and 83% of the faculty completed the surveys that provided feedback on their experience.

Faculty and resident perceptions of the blended learning experience are graphically represented in Figure 3, and are presented in detail elsewhere by Klein et al.¹⁰ The majority of faculty (79%) and residents (74%) thought this form of distance learning was effective as a teaching tool, 76% of faculty and 71% of residents thought the time spent was worthwhile, and 76% of faculty and 84% of residents said they wanted to use distance learning materials again in the future. Both groups were essentially neutral as to whether residents were able to

learn from the recorded interactive seminars as well as they do in a traditional classroom. Most faculty (82%) agreed that seminar content was appropriate for residents, and 56% of faculty agreed that distance learning could lessen the teaching burden for faculty in the future.

Perceptions of the technology as rated by the Likert scales are shown in Figure 4. Most residents (72%) agreed they were not distracted from learning because of the technology. Both faculty and residents strongly agreed that having the capability to stop, rewind and skip through sections of the seminar was extremely beneficial to the learning experience. Both groups agreed that the video clarity was acceptable, but the faculty were less positive about the sound quality. Most of the residents (82%) and two-thirds (68%) of faculty agreed that more extensive visual aids to supplement the discussion between the seminar leader and the live participants would be beneficial to the learning experience.

PROBLEMS AND POSSIBLE SOLUTIONS

Problems with the blended approach can be summarized under two major headings:

(1) Educational considerations

Lack of resident preparation prior to seminar viewing. Most faculty (82%) thought the reading assignments were appropriate for the objectives of these seminars and agreed that adequate preparation was essential. Although neither faculty nor residents reported there were too many papers to read prior to viewing the recorded seminars, only 14% of the residents said they read all assigned papers in-depth, and 29% reported not reading any of them before watching the recorded seminars. One resident who did not read the papers said, “We were not given reading assignments prior to the lecture, which would have made the

experience better. [These had been sent to their school.] Regardless, it was an enjoyable and beneficial lecture.” There were statistically significant differences in residents’ perceptions of the quality of the learning material based on the depth of their preparation (Figure 5). Residents who did not read any of the articles thought that the seminars were less enjoyable ($p=0.004$) and less effective ($p=0.0028$) than residents who thoroughly read at least some articles. Prepared residents reported a greater ability to learn from the seminars ($p=0.0014$) than those who did not read, and also said they were more likely to use the seminars again in the future ($p=0.0025$).

Solution. Interactive distance learning is meant to be an active learning process and not simply a passive, “television watching” experience. Active learning can only be accomplished when participants are prepared. Although post-doctoral students should be motivated enough to complete reading assignments without being “told” by a superior, our findings show that the importance of adequate preparation needs to be further emphasized by local faculty. When it is, our data indicate the experience will be more enjoyable and beneficial to the residents.

Pace of the recorded seminars. The seminars were recordings of actual Socratic-type seminars and were not scripted or practiced by the residents. As such, the recorded seminars were well-guided discussions, but many distant participants thought the pace was too slow. As one resident stated, “I think the discussion format is the most effective way of learning the material, but at the same time, not the most time-efficient, as there is a lot of dead-time in a discussion, waiting for pauses while people think about what they want to say.” Another distant resident said, “Too much time was spent waiting for the resident to walk over to the computer tablet and then draw. The professor should have the necessary diagrams prepared

in order to keep the topic moving.” Despite minor frustration from residents “wanting to know the right answer and (waiting to) listen to people fish for answers,” most faculty and residents thought it was more interesting and a better learning experience to watch the interaction between the residents and faculty on the recorded seminar, than it would be to just see a recorded lecture.

Solution. A difference in what some residents and faculty thought the recordings would be and the reality of the recorded seminars most likely affected their acceptance. One resident “expected a Mosby review type seminar” and was surprised that “[the interactive distance learning experience] was excellent, but it was a lot more work than I thought it would be.” Another resident said, “I need short, concise material to study and not dedicate all that time to a lengthy video...there’s just too much material and not enough time.” The degree of satisfaction with many experiences, of course, relates to how well it matches expectations. It is important for local faculty to help residents understand what they should expect from the recorded seminars.

One of the virtues of seminar teaching also is a weakness: there is no way to know in advance exactly what is going to happen as the discussion develops, so it can’t be tightly scripted, and what is unnecessary discussion for one participant is important for someone else. In a recorded seminar, however, it is important for the seminar leader to ‘keep it moving.’ This can be facilitated by having an outline of the topics that are to be covered for the onsite residents. This does not cue the answers to questions, but rather indicates the overall and transitional direction of the discussion and should serve as a simple aid to keep live participants to keep them from drifting too far from the basic elements of the seminar

and its goals. Presenting important information in a concise time period needs to be accomplished in future production.

Post-seminar discussion. The blended approach to distance education allows residents to watch the recorded seminars without the pressure of answering a question immediately, but the intent is that they will be challenged to interact with faculty to discuss concepts further after viewing the recording. One resident stated, “The live discussions following the seminars were very helpful--both to make sure I understood key points and concepts, and they kept me motivated to do all of the work for each session.” Almost all residents (92%) agreed that participating in live discussions with faculty added to their understanding of the subject. One resident who participated in post-seminar discussions with the author of the seminar said, “I really enjoyed this way of learning and especially liked being able to speak with the professors who taught the course on the video conference after the video had finished.”

Interestingly, only 9% of the distant residents were given the option to participate in a discussion with the leader of the recorded seminar although this was available if requested. There was a \$150 charge for the video conference to do this, and scheduling it could quickly become a problem. In general, the video conference with the original seminar leader was simply judged to be unnecessary. Local faculty felt confident in their own abilities to manage a discussion after viewing the recording.

Solution. The general agreement that the post-seminar discussion is valuable is further evidence that it should be taken seriously as part of this educational approach. Ideally, the group of distant residents should watch the recorded seminar together with a faculty member, and then the discussion should be held either immediately afterward or should begin (by

pausing the recording) whenever a participant (resident or faculty) feels there is a point for further discussion. The data show that this method, which we recommended, was used by approximately two-thirds of the participating schools. We suspect but do not know for sure that the residents who participated in this way got more out of the discussion than those who watched a recording on their own and discussed it later.

Length of the seminars. The recorded seminars and the post-seminar discussion were planned to take about 90 minutes, and several faculty commented, “Ninety minutes is too long...the material could have been covered more quickly.” Most clinical seminars in postgraduate dental programs are scheduled for approximately 60 minutes, and some faculty expressed the sentiment that, “it was logistically difficult to use these seminars.” Some residents felt “there was too much time lag between the professor and the residents answering questions...and sometimes the lecture got off topic. Could these portions of the lecture be removed prior to posting on the web?” One resident recommended “breaking down each seminar into smaller chapters” as a way to maximize learning in the designated time each program has for seminars.

Solution. As mentioned earlier, the flow and direction can be controlled on site by an outline. At the originating schools where interactive seminars are used for didactic subjects, one and one-half to two-hour sessions usually are scheduled. Almost everywhere, clinical seminars are scheduled for one hour. The recorded seminars can and should be either one- or two-hour sessions, with a brief break in the two-hour sessions at the one-hour mark to make seminars more user-friendly. The post-seminar discussion time could be included in the second one-hour session, but splitting the seminar would favor distant discussion at chosen

points by pausing the recording. This would give distant programs options to fit seminars into the available time when they do not have a two-hour time slot.

Use of visual aids within the recordings. The use of slides, video clips and drawings in the seminars varied greatly. Although multiple camera feeds of the seminar leader, residents and visual aids were recorded during the seminar so that later editing could be done, only minimal editing was actually accomplished because of the cost. Most of the editing was done ‘on the fly,’ with an emphasis on providing images of the seminar leader or resident who was speaking. The resulting videos were not as polished as broadcast TV, and both faculty and residents commented on this. One faculty stated that, “more slides emphasizing key concepts and longer camera time on slides” would improve the quality of the recordings. One resident suggested improving the video by “splitting the (video) screen so one could see both the presenter and the presentation” at the same time (which had been planned but was done only occasionally). Some residents felt that, “Keeping the camera on the figures longer while being able to hear the lecturer would be great... [there is] no real value to seeing the lecturer all the time. We just need to hear him, which we could, while seeing the figures being talked about.” Multiple residents echoed the sentiment that, “we need less time staring at residents or faculty and more time on the slides...the PowerPoint and major info slides are up and gone too quickly to take notes.” To some extent, of course, that reflects lack of preparation by the distant residents, but it is a legitimate concern that can be addressed in future production.

Solution. More effort should be placed on visually enhancing and more succinctly editing future seminar recordings. Visual images are helpful for many learners, and editing the video to provide adequate time to display slides and diagrams is important. A split video

display between the speaker and slides would allow more screen time for more complex figures.

High-quality video editing equipment is now available for only a few thousand dollars, but using it significantly increases production costs because of the increased time commitment for both faculty and staff at the originating school. Realistic budgets that include more editing will be required for future high quality productions.

2) Technical Quality

Video and sound quality. Both faculty and residents agreed that the video clarity was acceptable, but both were less pleased with the sound quality. The advent of high definition TV has raised users' expectations of image quality.¹¹ A number of open-ended comments were based on the quality of the visual image and sound quality, for example: "the format for learning worked well, although the quality of the visual materials presented was poor, likely due to limitations in bandwidth;" "it looks like it was filmed in 1985;" "a low quality of video recording."

Audio quality was a bigger problem. One faculty member said, "one must continually monitor the volume on the recording as the presenter and residents are not at the same volume, so you either don't hear the residents or the seminar leader is a bit loud." Both faculty and residents stated the background noise related to use of microphones on the table (especially residents turning book pages and moving papers on the table) was sometimes "distracting to an obnoxious level."

Solution. It is surprisingly difficult to obtain good quality audio while minimizing background noise. Multiple microphones on the table usually are part of the set-up for recording a seminar, but they pick up movement of anything on the table (papers, laptop

computers, whatever) even better than the voices they are meant to record. It may be necessary to have individual microphones for each seminar participant to overcome this—which adds another layer of complexity and expense.

Video quality is easier to obtain, but wall-mounted cameras that automatically rotate to pick up individuals who are speaking are expensive and not completely reliable. Manual control of cameras from the recording area is better—yet this is another added expense. High-definition video cameras and recorders will be industry standard in the near future and should greatly improve video quality.

Rewind / fast forward control. Both faculty and residents thought that having the capability to stop, rewind and skip through sections of the seminar was extremely beneficial to the learning experience. Forty percent of programs used this feature to further discuss concepts while watching the recorded seminar. One faculty member commented that the “sliding bar” to control what content should be skipped or emphasized was not exact enough: “[You need to] develop a way to move the video to more specific points, allowing intermittent discussion among viewers if they choose to do so.” Multiple residents agreed; one said, “Skipping ahead or rewinding was not very accurate. It seemed to jump too far ahead or behind and wasted more time trying to find an exact location in the lecture. It would be nice to have the lectures broken up into easy-to-find chapters.”

Solution. This is partly a problem of the recording equipment, and partly a problem of the Internet connection. One of the virtues of the blended approach is that only an ordinary broadband connection, not high-speed Internet 2, is needed, but even minor transmission delays can affect the precision with which a specific point on the recording is selected. The better the Internet connection, the better the control, and vice-versa. One possible solution is

to subdivide the recording into sections; another is to have questions posed by the presenting faculty appear above the minute marker of the video for quick reference.

INTERACTIVE SEMINARS IN CURRENT PERSPECTIVE

Although the concept of the blended approach has been validated, it is clear that future production will need greater attention to technical and educational aspects, to obtain better video and audio quality, better time management and more visual aids, and a better match between resident's expectations and experiences.

The development of a library of recorded seminars produced by multiple institutions is a current goal of the AAO-supported project from which this evaluation was derived. Despite the problems outlined in this paper, 70% of the participating residents said they wanted to use these seminars in preparing for their specialty board examination and 92% thought the post-seminar discussion was an important part of the learning experience. Perhaps the bottom line is now that we have learned to manage distant interactive learning inexpensively, we need to invest a bit more in production to do it better.

Figure 1: Preparation and Use of Recorded Interactive Seminars

% of Residents	
Recorded Seminar Viewings	
With faculty and classmates at school	66
With classmates at school	8
At home alone	32
Preparation for Recorded Seminar Viewing	
Read all articles in depth	14
Read some articles	29
Skimmed some articles	28
Did not read	29

Figure 2: Timing of Discussions Regarding Recorded Seminar Content

An approximately equal percentage of residents had discussions with faculty regarding recorded seminar content either immediately after watching the seminar, or while watching the video.

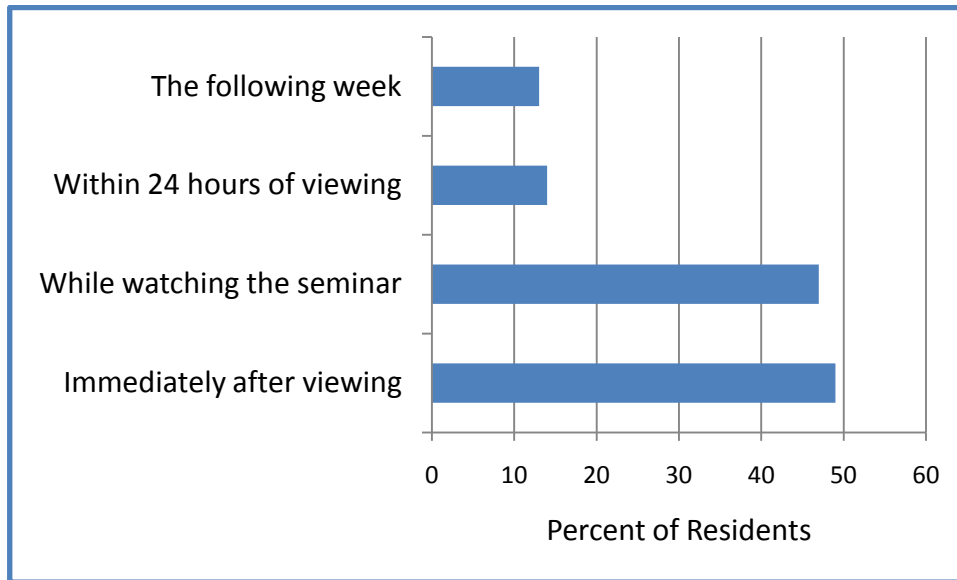


Figure 3: Program Faculty and Resident Perceptions of Blended Distance Learning

Program faculty and resident perceptions of interactive distance learning (Likert scale).

Overall, participants enjoyed the experience. In general, faculty tended to be more extreme in their opinions of the learning experience. Both faculty and residents agreed that distance learning was effective and they would use seminars again in the future.

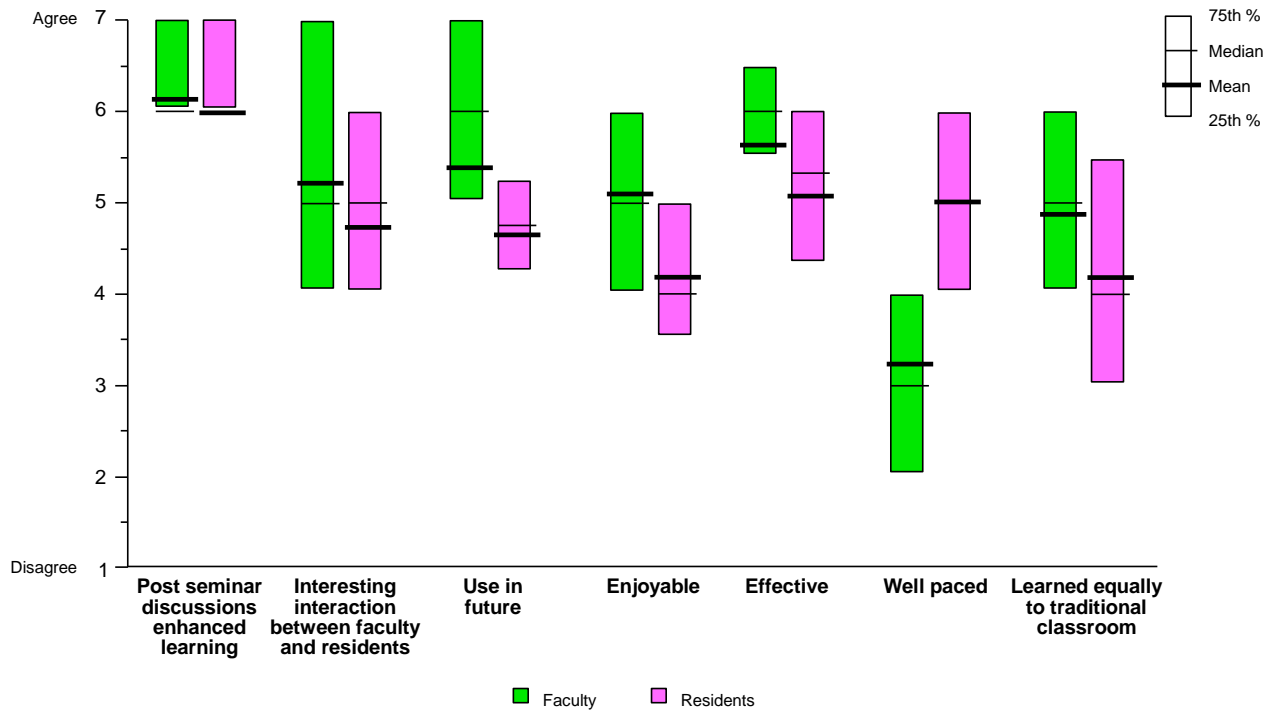
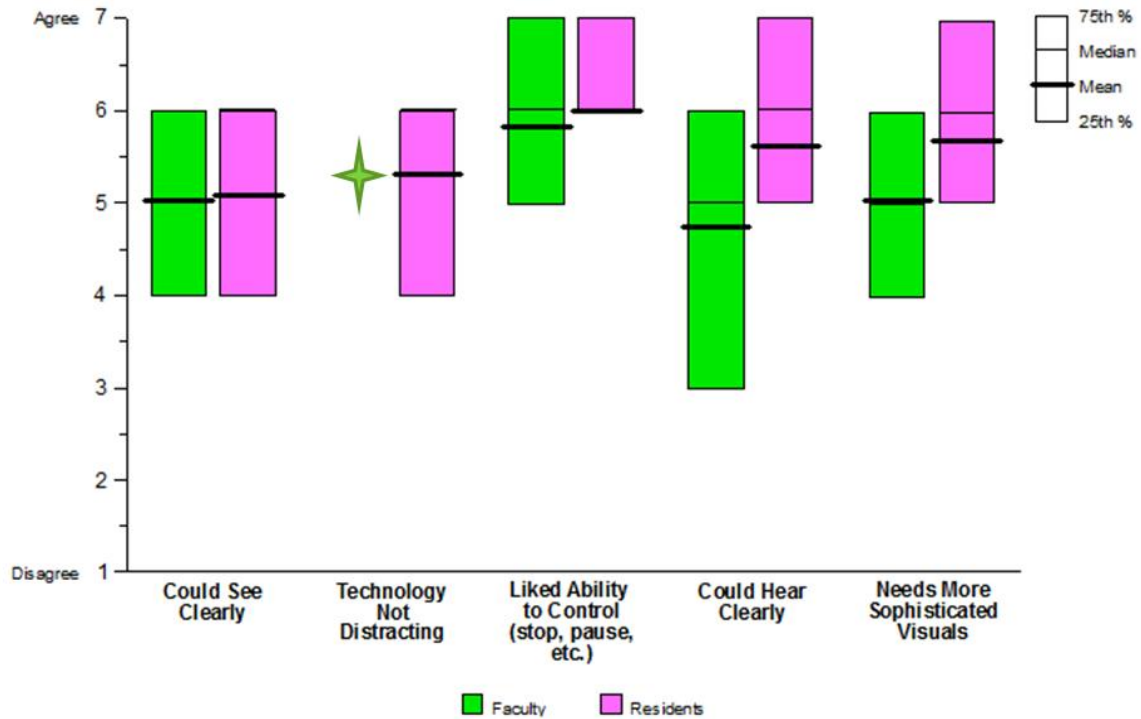


Figure 4: Faculty and Resident Perceptions of Distance Seminars Technology

Program faculty and resident perceptions regarding technological aspects of the seminars (Likert Scale). Residents strongly agreed they were not distracted from learning because of the technology. Both groups thought that having the capability to stop, rewind and skip through sections of the seminar was beneficial to the learning experience. Participants wanted more extensive visual aids in the recorded seminars.



★ Faculty members were not asked if the technology distracted them from learning as they were not learning from the distance seminars.

Figure 5: Relationship of Resident Preparation and Satisfaction with Distance Learning Seminars

One way ANOVA with least squares mean pairwise comparison were used to compare the perceptions of students who read all articles in depth (n=60), skimmed articles (n=86) and did not read articles (n=59). Global tests demonstrated that statistically significant differences existed between groups of residents based on their level of preparation: effectiveness (p=0.0016); enjoyability (p=0.0016); ability to learn from the seminars (p=0.0035); likelihood to use the seminars again in the future (p=0.0018). The residents who read at least something got a lot more out of the experience than residents who either skimmed articles or did not read.

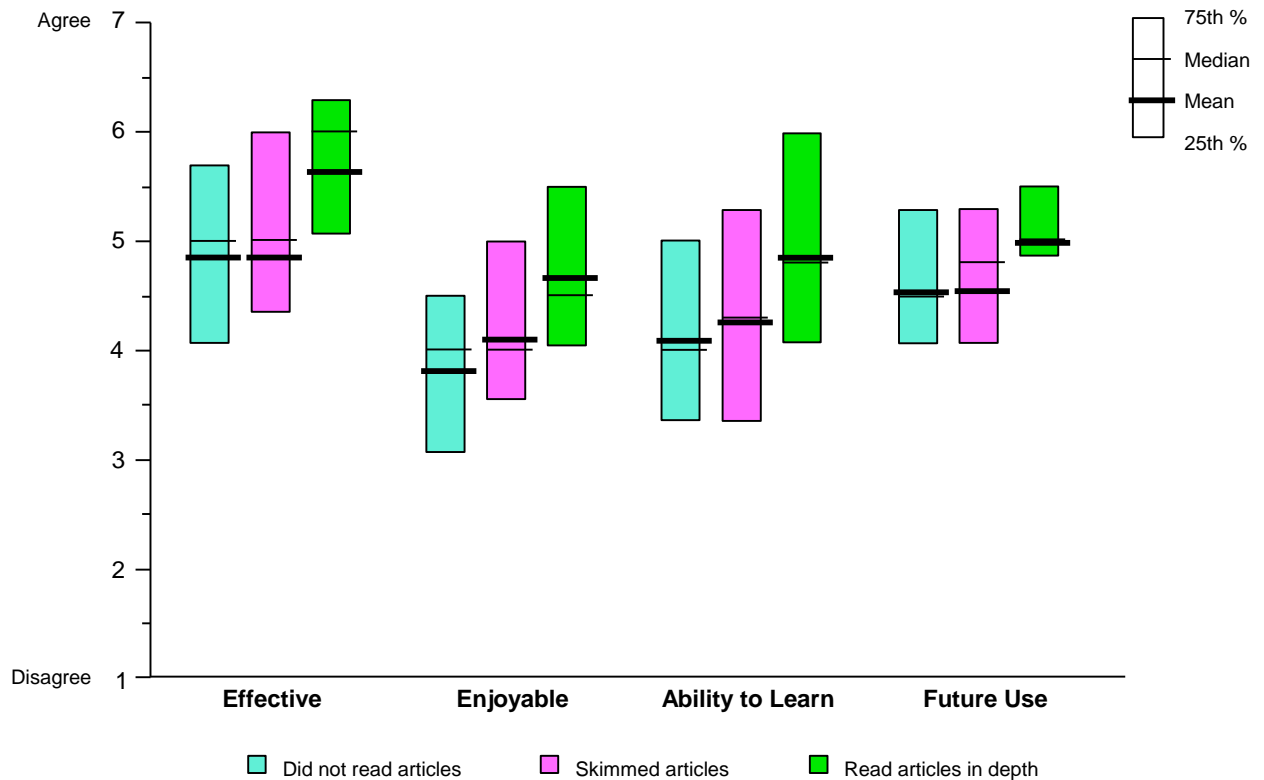


Figure 6: Reasons Faculty Used Distance Learning

Our project was originally conceived to deal with a faculty shortage. Despite this, only 23% of faculty reported using these seminars because they did not have enough faculty resources. Instead, faculty wanted to use these seminars to offer their residents a different point of view.

Faculty open ended responses to the question “*Why did you choose to use the distance learning materials?*” included the following: “(Seminars were) an efficient use of faculty and resident time to maximize learning;” and an “excellent reinforcement of concepts taught in our curriculum.” Other faculty stated, “We have enough faculty but we can't expect the group to have experts on all topics;” and, distance learning was “a very helpful adjunct to our curriculum.” One faculty stated a more global reason for participating, “As an orthodontic educator for a number of years, I am fully aware of the need for more orthodontic faculty and better quality of orthodontic education. I support the concept of distance learning for all of the reasons mentioned above, and because I believe it should have a significant role in the future of orthodontic education.”

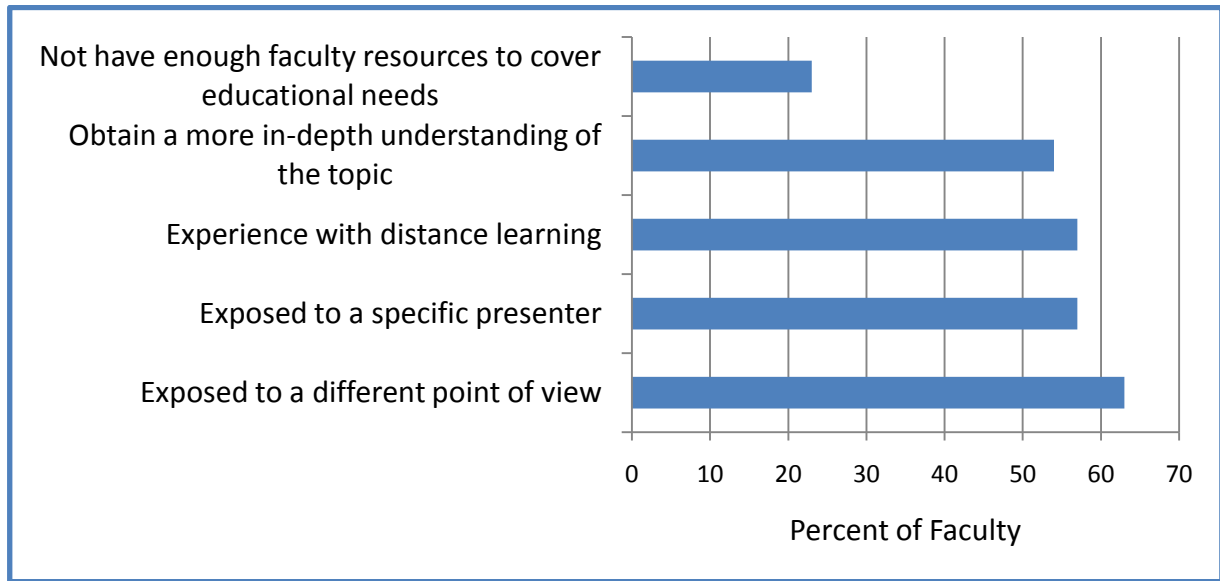
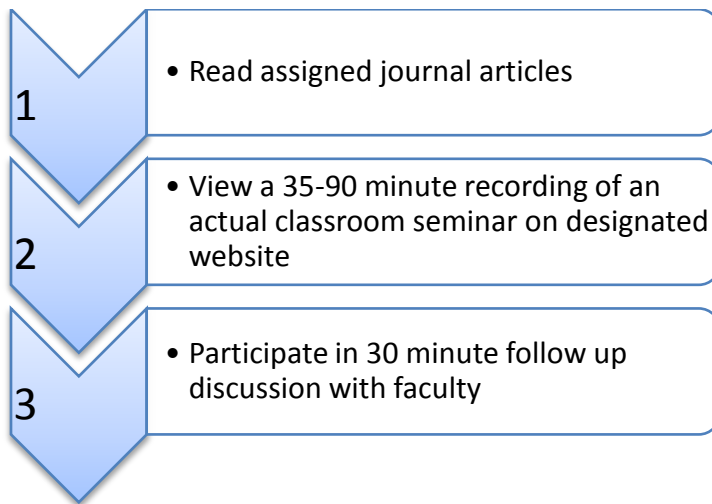


Figure 7: Schematic of the Blended Distance Learning Approach

The schematic shows three components and the data indicate including each can optimize the experience and effectiveness of the method.



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