Assessing the Winning Teams program of interactive satellite-based training

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This research assessed an interactive satellite-based training program integrating interactive audiovisual experiences with face-to-face interactions. Key elements were content created by experts, high-quality video segments, satellite-based interaction, off-line interactions among teams of parents and caregivers, workshops, and team building exercises. For pragmatic reasons, it was necessary to develop brief assessment instruments concurrently with training. A large set of survey items were created from draft materials and reduced empirically through piloting to those with the best psychometric properties. To avoid the appearance of traditional testing, knowledge was assessed with Likert items. Surveys measured participant satisfaction, knowledge, attitudes, and the application and articulation of concepts. Participant satisfaction was high. Participants increased positive attitudes and learned appropriate vocabulary. Training was more effective than no training or watching videotapes. The program appears to represent a viable model of training that could successfully be applied to Internet technologies.

It is a truism that emerging information technologies are creating new opportunities for education and professional development. Although much of the literature provides conjecture on how the Internet and other interactive technologies might transform teaching and learning (Spicer, 1995), relatively little research attention has been given to evaluating different models of interactive instruction empirically. This paper provides an evaluation of a specific instance of interactive satellite-based training: the Winning Teams program for parents and early childhood professionals. The creators of this program believe that it may serve as a paradigm for integrating "high-tech" interactive audiovisual experiences with face-to-face small group discussions and team building exercises. Thus, a key goal of the research reported here was to evaluate the Winning Teams program of interactive satellite-based training and to assess its broader implications for interactive technology-intensive education. The Winning Teams program also presented a number of challenges to program evaluation. Our approach to these challenges is another focus of this paper.

Satellite-based training has been successfully deployed in a variety of settings, including the United States Postal Service (Whetzel, Felker, & Williams, 1996), corporations, (Filipczak, 1994; Rogers, 1994), and higher education (Massoumian, 1989). Although assessment results have been equivocal, satellite-based training has generally proved to be as effective as standard teaching methods (Chung, 1991; Hunter, 1995; Whetzel et al., 1996). Unlike traditional television broadcasts, interactive satellite technologies afford opportunities for many-to-many, and well as one-to-many, educational experiences (Harasim, 1989). Bidirectional and multidirectional technologically mediated systems such as the Internet (particularly systems that enable high levels of interaction and user control) have been found to be the most effective (Ellis & Mathis, 1985; Hackman & Walker, 1990). Although some look to distance learning to replace face-to-face communications, others make extensive use of small groups and other face-to-face experiences that enhance intellectual exchanges in technology-rich education (Wolfe & Myers, 1996). Recently, there have been calls to integrate technology-based instruction with other kinds of off-line experiences (Wolfe et al., in press).

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The Winning Teams Program

The Winning Teams program represents a model for integrating interactive audiovisual experiences with face-to-face discussions and team building experiences. The Winning Teams program integrates three satellite-based interactive teleconferences with follow-up workshops for parents and for teachers, thus integrating direct and technologically mediated educational experiences (Laurillard, 1993). Winning Teams is funded by a public-private partnership between the state of Ohio and private industry. The program was developed by RISE, Inc., in Cincin-

nati, OH. RISE personnel conducted the workshops for teachers on themes presented in the teleconferences and prepared teachers to lead workshops for parents on Winning Teams themes. Parents and teachers participated as teams. A team ideally consisted of 2 teachers (including professional child care providers) and 6 parents from the same preschool child care facility. However, actual teams ranged from 2 or 3 people from small family day care settings to 11 or 12 people from larger public preschools. Enhancing communication among teammates was a key goal of the training. Approximately 3,000 parents and teachers from across Ohio participated, and the model was designed to support up to 12,000 participants.

Each of the teleconferences and workshops addressed three areas pertaining to early childhood and appropriate child rearing practice: development, learning, and partnership. In the Winning Teams program, development is placed in context, including cultural (Cajete, 1995) and biological influences. Learning, it is argued, takes place when children are actively engaged (e.g., Brooks & Brooks, 1993), have meaningful experiences (Resnick, 1989), and are secure in nurturing relationships where learning activities can be modeled (e.g., Beck, 1994). Effective partnerships between parents and teachers are achieved, according to the training, when all parties clearly communicate their preferences, work on their ability to communicate and negotiate, and maintain a willingness to change and learn.

Assessment Issues

Pragmatic and theoretical considerations presented a number of constraints on conducting a scientific evaluation of the effectiveness of the Winning Teams program. Three assessment issues are particularly noteworthy. First, final approval for project funding was delayed by the state legislature. Once the project was funded, there was a very short time horizon to develop training and evaluation. Thus, training and assessment instruments had to be developed more or less concurrently. Limits of time, funding, and the priorities of RISE prohibited the use of experimental controls that would allow systematic comparisons between each of the components of the training. Second, satellite time is very expensive, and RISE had to pay for satellite time—even when participants were engaged in off-line activities. Any assessment activities would have to take place after more than 3 h of intensive activity. It was imperative to create brief, reliable, and valid measures. Finally, the nature of the training and the participants argued against “test-like” conditions. Thus, there was a need for “user-friendly” means of assessing knowledge without traditional testing.

METHOD

Participants

Approximately 3,000 people participated in the Winning Teams training. The overall number of participants who gave permission for their surveys to be used was 2,611; however, over the course of

the training, attendance fluctuated due to attrition and the continuing appearance of new participants at each teleconference. This resulted in a smaller pool of participants who provided data for the analysis of effectiveness of the entire training experience. For example, although there were 821 participants who completed the presurvey, only 307 parents and teachers completed both the presurvey and the final survey, and only 189 participants completed both the presurvey and all three teleconference surveys (four surveys total). Thus, the actual *N* for specific analyses ranged from 1,822 for participant satisfaction with Teleconference 1 to 259 for knowledge of partnership after Teleconference 3.

Procedure

The teleconferences originated from the WCET television studios in Cincinnati. The 23 teleconference locations were composed of eight sites equipped with complete two-way video and audio communication linking the teleconference presenters and participants across the state and 15 sites equipped with two-way audio and one-way video connections. All sites integrated off-line exercises, viewing professionally produced video segments, and statewide discussions. The two-way video and audio sites were eight PBS-affiliated television stations that were selected on the basis of the quality of their facilities, ability to accommodate several hundred participants, size of city, and geographic region (ensuring video and audio input from all areas of the state). The first teleconference made extensive use of two-way video communication, whereas the second and, particularly, the third teleconferences primarily used two-way audio links.

The evaluation instruments were created in tandem with the development of the training content. Our strategy for creating brief and reliable instruments was to first develop a large number of survey items on areas known to be included in the training and then reduce the set empirically. A set of over 100 items was generated and then reviewed by RISE staff members for content validity. The items were written as statements; the respondents were asked to indicate their level of agreement (5 = *strongly agree*; 1 = *strongly disagree*) with each statement. Eighty-four of these items were field tested for readability and content validity with parents and teachers (*N* = 54) in a group of Indiana Head Start programs in order to avoid influencing the Ohio target population.¹ After the analysis of these responses, a number of additional items were added, and the revised master set of items was tested again with a group of undergraduate students to determine test-retest reliability (*N* = 112). Internal reliability for the master scale was found to be .93, and test-retest reliability was .91. The presurvey and the first and second teleconference surveys contained 34 or 35 items; the final survey contained 75 items, 40 of which specifically related to the third teleconference theme and 35 of which were from the presurvey. The latter set served as the posttest.

On the basis of pilot testing data, the survey items were grouped into categories that exemplified potential areas of change in attitudes, knowledge, and application related to the content of the Winning Teams training. Items representing four major themes that were the focus of training were also identified: active learning, meaningful learning, nurturing relationships, and partnerships. To avoid an intimidating “test-like” knowledge measure, knowledge items were presented in the same Likert format as attitude measures—for example, “Children really do not communicate until they are over a year old” (1 = *strongly disagree*; 5 = *strongly agree*). Because team building and partnerships among parents and teachers were important goals, another objective of the training was to increase the participants’ ability to articulate knowledge using a common vocabulary provided by the Winning Teams training. A set of five items measured participant satisfaction with the teleconferences.

In an effort to reduce the time needed for the presurvey, it was mailed to all participants who had signed up for the Winning Teams training by the January 1, 1997. Approximately 1,600 were mailed,

and 821 were returned. This procedure yielded a relatively small N because many participants signed up after this "deadline." Thus, the presurvey N of 821 placed an upper boundary on the N of all presurvey–postsurvey comparisons. The second survey was given immediately after the first teleconference and was returned by 1,822 participants. The third survey was administered after the second teleconference, and the respondents numbered 1,447. The final survey, which served both as a measure of the third teleconference, and as a posttest, was returned by 1,051 respondents.

Many participants completed only a portion of a survey or skipped some items. To control the quality of the analysis, while including as many participants as possible, a guideline of completion of no less than 80% of the items in a specific dimension of the survey was set to select cases for the analysis. The mean score for the corresponding dimension was weighted according to the number of items completed.

Measures

Sources of evidence included survey data from all participants before the teleconferences began and after each teleconference and survey data from other parents and teachers. Data were collected from two comparison groups to further test the efficacy of the Winning Teams program. To control for the interactive nature of the satellite-based training, including the workshops, a videotape comparison group was created. Participants in this group viewed video tapes of the satellite-based interactive training, but they did not participate in the workshops or have the opportunity to interact with other parents and teachers locally or across the state. The videotape group consisted initially of 40 parents and teachers from six early childhood programs throughout the state, who agreed to review the videotapes individually and then complete the surveys. Twenty-five parents and teachers from Head Start, public and private preschools, and child care centers across the state of Ohio completed all four surveys, and these participants were used for the analyses reported here. A control group was also created, consisting of individuals who did not receive materials of any kind. The control group consisted of 32 parents and teachers who completed all four surveys but who did not participate in the training workshops (see Wang, Wolfe, Bergen, & Miller, 1999, for a more comprehensive description of the measurement instruments).

The effectiveness of the Winning Teams model was measured on six dimensions: (1) participant satisfaction with the quality and delivery modes of the training, (2) participant knowledge of concepts presented in the training, (3) participant attitudes about the concepts presented, (4) participant ability to apply and articulate the major concepts emphasized in the training, (5) participant responses to specific components emphasized in the teleconferences (e.g., active learning, meaningful learning, partnerships), and (6) differences between Winning Teams participants and nonparticipants (comparison groups) on components emphasized in the training.

Analyses

Presurvey–postsurvey comparisons were tested with paired t tests. Multivariate analyses of variance were used to compare the scores of Winning Teams and videotape groups before and after training. Regression analysis was used to compare groups receiving training with the no-training control group.

RESULTS

Participant Satisfaction with the Winning Teams Training

On the surveys given after each teleconference, the participants responded to a set of items that specifically asked whether they agreed that the format, leaders, video-

tapes, and interactive components of the training were effective. Participant satisfaction was high throughout the teleconference training experience, although there was some variation across teleconferences. The mean satisfaction rating (5 = *highly agree it was effective*; 1 = *highly disagree it was effective*) for the first teleconference was 4.36 ($SD = 0.516$, $N = 1,822$), for the second teleconference 4.38 ($SD = 0.491$, $N = 1,447$), and for the third teleconference 4.31 ($SD = 0.518$, $N = 1,051$).

Changes in Attitude, Knowledge, Application, and Articulation

For the group of participants who answered both presurvey and postsurvey, there was a significant positive change in attitude concerning the concepts presented in the Winning Teams training, active learning, meaningful learning, nurturing relationships, and partnerships. The presurvey mean was 4.41 ($SD = 0.394$), and the postsurvey mean was 4.54 ($SD = 0.364$) [for the group as a whole, $t(306) = -4.71$, $p < .001$]. This effect was found for both teachers and parents. Teachers had a presurvey mean of 4.50 ($SD = 0.39$) and a postsurvey mean of 4.69 ($SD = 0.34$) [$t(136) = -4.42$, $p < .001$]. Parents had a presurvey mean of 4.30 ($SD = 0.41$) and a postsurvey mean of 4.50 ($SD = 0.38$) [$t(84) = -2.72$, $p < .01$]. There was also a significant positive change for the group as a whole in how confident the participants were in articulating their knowledge using Winning Teams vocabulary, with a presurvey mean of 3.70 ($SD = 0.70$) and a postsurvey mean of 3.80 ($SD = 0.66$) [$t(304) = -2.06$, $p < .05$]. There was no significant change in responses on the knowledge dimension, and there was a significant decrease in the application dimension, with a presurvey mean of 4.30 ($SD = 0.66$) and a postsurvey mean of 4.10 ($SD = 0.37$) [$t(297) = 7.19$, $p < .001$].

Another test of the efficacy of the Winning Teams model is the comparison between participants in the Winning Teams training and a group of subjects who viewed three video tapes (originally shown in the teleconferences) individually before completing the surveys but who did not participate in other activities. Significant differences were found on attitude change, with the attitude of the Winning Teams group showing improvement, from a presurvey mean of 4.40 ($SD = 0.383$) to a postsurvey mean of 4.53 ($SD = 0.376$), whereas the videotape group declined, from a presurvey mean of 4.31 ($SD = 0.367$) to a postsurvey mean of 3.91 ($SD = 0.659$) [Wilks's Lambda, $\Lambda(2) = 24.32$, $p < .001$]. A similar pattern was found for knowledge, with the knowledge of Winning Teams participants showing an increase from a presurvey mean of 4.17 ($SD = 0.402$) to a postsurvey mean of 4.25 ($SD = 0.486$), and the videotape group showing a decrease from a presurvey mean of 4.10 ($SD = 0.333$) to a postsurvey mean of 3.68 ($SD = 0.534$) [$\Lambda(2) = 15.35$, $p < .001$]. A similar pattern was also found for the ability to articulate concepts using Winning Teams vocabulary, with an improvement in the scores of Winning Teams par-

ticipants from a presurvey mean of 3.69 ($SD = 0.688$) to a postsurvey mean of 3.82 ($SD = 0.685$), and a decrease of videotape scores from a presurvey mean of 3.72 ($SD = 0.463$) to a postsurvey mean of 3.45 ($SD = 0.595$) [$\Lambda(2) = 4.10, p < .05$]. On the ability to apply their knowledge, the Winning Teams group scores dropped from a mean of 4.29 ($SD = 0.448$) to 4.09 ($SD = 0.381$), and the videotape group scores stayed about the same, with a presurvey mean of 4.36 ($SD = 0.324$) and a postsurvey mean of 3.68 ($SD = 0.618$) [$\Lambda(2) = 12.37, p < .001$].

Changes in Knowledge and Practice on Themes Emphasized in Specific Training Sessions

A number of themes were emphasized in the Winning Teams training. Some of these were stressed at particular teleconferences, and some were themes carried through all the teleconferences. At the first teleconference, the importance of active learning for young children was emphasized. At the second teleconference, meaningful learning was stressed. At the third teleconference, promoting communication and positive relationships between parents and teachers (i.e., partnerships) was promoted. Although all of these themes were incorporated throughout the training; each was particularly stressed in one teleconference. Another theme, nurturing relationships with children, was a strong component in a number of the training activities. Two other content areas were also stressed in the second teleconference and in teacher and parent workshops: developmentally appropriate approaches to art and to literacy.

A significant difference was found between the participant group and the no-training comparison group on the combination of the themes of active learning, meaningful learning, partnership, and nurturing relationships after Teleconference 3, using the responses to Teleconference 1 as covariate [$F(1,558) = 4.30, p < .05$]. The participant group scored consistently higher than the comparison group. All four dimensions contributed significantly to this overall difference: For active learning, the participants had a mean of 4.47 ($SD = 0.384$), and the control group mean was 4.33 ($SD = 0.515$) [$F(1,561) = 3.50, p < .05$]; for meaningful learning, the participants had a mean of 4.37 ($SD = 0.380$), and the control group mean was 4.07 ($SD = 0.432$) [$F(1,561) = 15.20, p < .05$]; for partnerships, the participants had a mean of 4.39 ($SD = 0.329$), and the control group had a mean of 4.25 ($SD = 0.384$) [$F(1,561) = 4.65, p < .05$]; and for nurturing relationships, the participants had a mean of 4.24 ($SD = 0.342$), and the control group had a mean of 4.12 ($SD = 0.455$) [$F(1,561) = 3.51, p < .05$].

Postsurvey scores for the Winning Teams group were relatively higher than those for the videotape group on the dimensions of active learning [$\Lambda(2) = 17.49, p < .001$], meaningful learning [$\Lambda(2) = 15.77, p < .001$], partnerships [$\Lambda(2) = 23.69, p < .001$], and nurturing relationships [$\Lambda(2) = 16.04, p < .001$].

To further explore the relationship between specific teleconferences and emphasized themes, separate analy-

ses, using the revised scale scores, were conducted. The responses of the participants to the specific themes emphasized in each teleconference were compared with the same measurements conducted prior to the first teleconference. Results indicated that there was significant improvement on active learning after Teleconference 1, with a presurvey mean of 4.43 ($SD = 0.408$) and a postsurvey mean of 4.48 ($SD = 0.381$) [$t(505) = 2.76, p < .05$]. There was also significant improvement on meaningful learning after Teleconference 2, with a presurvey mean of 4.20 ($SD = 0.476$), and a postsurvey mean of 4.57 ($SD = 0.350$) [$t(386) = 14.05, p < .05$], and on partnership after Teleconference 3, with a presurvey mean of 4.27 ($SD = 0.400$) and a postsurvey mean of 4.36 ($SD = 0.333$) [$t(258) = 3.34, p < .05$].

DISCUSSION

Summary of Major Findings

Participant satisfaction. Overall, participant satisfaction was very high (averaging above 4 on a 5-point scale). While there were many suggestions for improvement, the content and presentation mode of the teleconference videos were noted as high in quality.

Changes in attitude, knowledge, application, and articulation. The participants increased their positive attitudes and judged themselves to be more able to articulate their knowledge with Winning Teams vocabulary. The latter was seen as an important first step in team building and improving communication among parents and teachers. Comparisons of the participant with the non-participant groups showed the attitude-change component was higher for the participants. On the knowledge and application dimensions, results from various data sources were mixed. The participants' preknowledge/postknowledge, as measured by survey data, remained relatively stable, and their application of knowledge to problems of practice showed a decrease. The survey results may have been influenced by the press of time at the final session, making the participants' careful consideration of knowledge and application items less likely. Data from teams with varied engagement levels and from the interview show different patterns of effectiveness on the knowledge and application dimensions (see Bergen, Wang, Wolfe, Baker, & Colquhoun, 1999, for an in-depth analysis of the consequences of team engagement). The generally high education level of the participants initially may also have contributed to the lack of a significant increase in knowledge as measured on the surveys.

Comparisons between the Winning Teams and videotape groups were relatively small but important tests of the program. If the videotapes alone were more effective than the entire Winning Teams model, the expense and effort of the full model might not have been justified. The videotapes alone were clearly less effective than the Winning Teams training. Of course, there were a number of limitations to this comparison. First, teachers and parents in the videotape group watched the videotapes at

home, and there was no standard method for watching the tapes. Second, although the participants who did not receive Winning Teams training were randomly assigned to either videotape or control conditions, it was not possible to randomly assign them to either Winning Teams or other conditions. This was the case because there was not a large enough pool of potential participants agreeing to participate in the research on that basis. Finally, the number of participants in the two comparison groups was relatively small.

Changes in knowledge and practice on themes emphasized in specific training sessions. The comparison between the participant and nonparticipant groups showed that the participants improved on the themes stressed in the training. When the Winning Teams training emphasized active learning, meaningful learning, and partnerships, the participants showed significant increases on these dimensions.

Most of the measured improvements on the Likert items were relatively small in magnitude. Generally, these differences were less than 1 standard deviation. It is difficult to assess the importance of these findings in terms of changes in child rearing practices. The participants generally scored quite high, creating a ceiling effect. Of course, the relatively large number of participants made it easier to detect subtle differences. Thus, caution is warranted in interpreting the importance of these results.

Assessment Issues

The Winning Teams program presented a number of problems for conducting a scientific evaluation. There was a need to develop training and assessment instruments more or less concurrently. The expenses of satellite time required us to produce brief yet reliable instruments. Finally, the nature of the training and participants and the wishes of the RISE staff suggested that traditional testing would be inappropriate. Our approach to the first two issues was to work with rough drafts of the training materials and generate a large number of items on those concepts. As the training was further developed, we secured commitments from RISE about which concepts would be included in the training. We eliminated items for materials not guaranteed to be part of the training and generated more items for those that would be included. Working from a core of items approved by RISE for content validity, we conducted two empirical tests of the instruments, selecting only those items with the best psychometric properties. This process yielded four instruments of 35–40 items measuring knowledge, attitudes, application, and articulation with reliability indices of over .90. We believe this was a successful strategy.

The codevelopment of training and assessment greatly affected the assessment process. The chief advantage of developing training and assessment concurrently was that it afforded some opportunities for better coordination between training and assessment. The disadvantages include time pressures and the inability to assess some training content areas because we were not completely confident

that they would “make the final cut” and be included in the Winning Teams program. We would have preferred to have had more time.

We were less successful in managing the number of participants. The original plan was to require all participants to sign up for all three teleconferences by January 1; therefore, we mailed presurveys to everyone who was enrolled at that time. This strategy proved suboptimal. Only about half of those receiving presurveys completed them, reducing the *N* for all presurvey–postsurvey comparisons. Although we expected attrition, we did not anticipate that large numbers of participants would enroll at the door or come only for the second or third teleconference. These fluctuations in the number of participants leads to the possibility of selection biases in the sample; thus, our results must be interpreted with caution.

We measured knowledge with Likert items using the same format used to measure attitudes. There were no complaints about this format from the participants or RISE staff, and knowledge items were high in reliability. Although we did not find significant improvements in knowledge on all measures, we do not attribute this to failures of the instruments. Using Likert items to measure knowledge appeared to be a successful strategy.

Implications for Technology-Intensive Instruction

This research on the Winning Teams program amplifies previous research on video-intensive education suggesting that high levels of interaction and participant involvement are key ingredients of successful technology-based education (Ellis & Mathis, 1985; Hackman & Walker, 1990). These findings also provide evidence of the efficacy of integrating technology-based instruction with other experiences that enhance intellectual exchanges among participants (Wolfe et al., in press; Wolfe & Myers, 1996).

Although interactive satellites provided the technological infrastructure for the Winning Teams training, all of the key elements of the model could be built on existing Internet technologies with moderate sacrifices of audio-visual quality. Audio–video streaming and Webcasting technologies permit presentations of professionally produced videos such as those produced by RISE for Winning Teams training (see <http://www.iep.com/rti.html> for a listing of audiovisual materials available on the Web). The Web also affords opportunities for interactive “N-way” communication with tools such as CUSeeMe. The first Winning Teams teleconference made extensive use of two-way video, but sites were linked primarily through two-way audio in the second and third teleconferences. We found intersite communication to be a valued component of the participants’ Winning Teams experience. However, there were no appreciable differences between the participants’ ratings of the two media. We conclude that video feedback between sites is not essential to the quality of participants’ experience. Apparently, the participants appreciated the opportunity to share their

comments and questions and to hear the questions and comments of other parents and childcare professionals, without having to see those participants or be seen themselves. It may be that the additional expense of two-way video is unwarranted.

Although the high-quality video segments were undeniably important, comparisons with the videotape comparison group clearly demonstrate that the off-line and interactive components of the experience were essential to the overall success of the project. Unfortunately, pragmatic considerations, such as limited time, limited funding, and the priorities of RISE, did not permit systematic comparisons of the relative merits of each element of the model. Interactions between sites made each teleconference "an event" and underscored the importance and universality of parental concerns. Intersite communications permitted the sharing of comments and questions of, for example, inner-city parents in Cleveland and childcare providers in rural Ohio. This enabled the participants to learn from the experiences of others from different cultural and socioeconomic backgrounds. Small group face-to-face discussions, team building exercises, and other off-line experiences provided benefits that might have been diminished or unobtainable taking a high-tech approach.

Conclusion

The need for sophisticated models of interactive training will grow as teachers and trainers gain access to interactive information technologies. The evidence suggests that integrating elements of the Winning Teams model—polished video segments, intersite interactions, on-site interactions among teams of parents and caregivers, complementary workshops, and team building exercises—represents a viable approach to interactive education. It is also apparent that this model could successfully be applied to emerging Internet technologies.

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NOTE

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