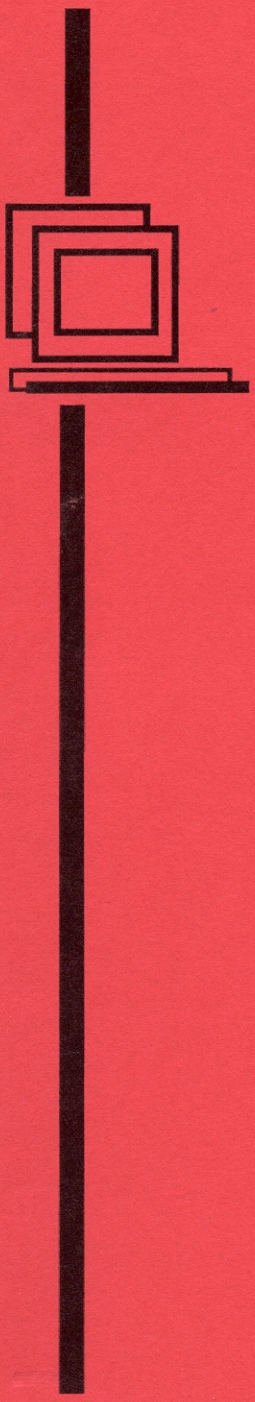
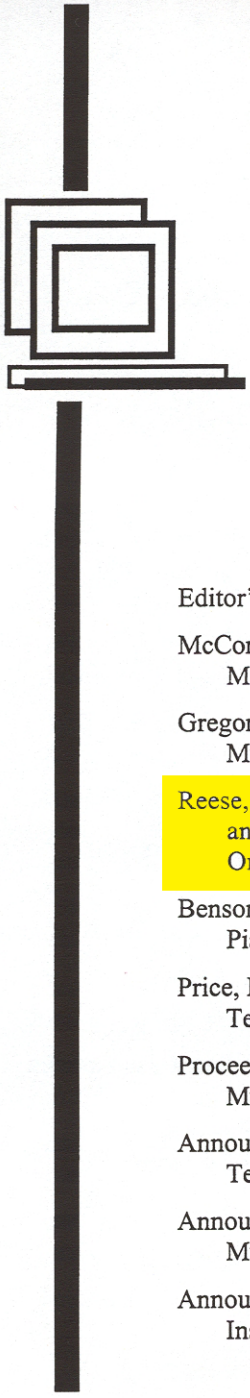


Journal of Technology in Music Learning

Volume 1, Number 2, Fall/Winter 2002



JOURNAL of TECHNOLOGY in MUSIC LEARNING

Table of Contents

Editor's Column 1

McCord, K. • Children with Special Needs Compose Using Music Technology 3

Gregory, D. • Assistive Technology for Computer-Based Music Instruction 15

Reese, R., Repp, R., Meltzer, J., & Burrack, F. • The Design and Evaluation of Use of a Multimedia Web Site for Online Professional Development 24

Benson, C. • The Effects of Instructional Media on Group Piano Student Performance and Attitude 38

Price, H., & Pan, K. • A Survey of Music Education Technology at Colleges in the Southeastern USA 56

Proceedings from the Second National Symposium on Music Instruction Technology 67

Announcement: The Tenth International Conference on Technological Directions in Music Learning 102

Announcement: The Fifth Annual National Symposium on Music Instruction Technology 103

Announcement: Association for Technology in Music Instruction 104

JTML, Vol. 1, No. 2, 24-37

THE DESIGN AND EVALUATION OF USE OF A MULTIMEDIA WEB SITE FOR ONLINE PROFESSIONAL DEVELOPMENT

Sam Reese
University of Illinois At Urbana-Champaign

Richard Repp
Terra Community College, Fremont, Ohio

Jason Meltzer
Oak Grove School District, Green Oaks, Illinois

Frederick Burrack
Ball State University, Muncie, Indiana

This study describes the design, development, and evaluation of a multimedia Web site for professional development in music education technology. The site presented examples of how practicing teachers have used technology in music instruction. Forty-five practicing music teachers were divided into three groups. Group 1 used the site and was enrolled in a music technology course. Group 2 used the site but was not receiving technology instruction. Group 3 was a control group that did not use the site. Data were gathered using pre- and posttests of knowledge, attitude pre- and post-surveys, and follow-up interviews with selected participants. Results were mixed and revealed both strengths and weaknesses of the site. Knowledge and attitude gains for Groups 1 and 2 were generally positive but not statistically significant. Personal interaction and structured instruction may be necessary to motivate many teachers to utilize Web resources for professional development in the context of demanding workloads. Although Web sites for professional development may be increasingly necessary, alone they are probably not sufficient for promoting integration of technology into music instruction.

Recent studies have shown that practicing music educators have a high level of interest in professional development in technology (Reese & Rimington, 2000; Sehman & Hayes, 1996). However, access to music related computer training is quite limited and often inconvenient. For example, only 13% of Illinois school districts currently provide music technology training once a year or more for their teachers and less than 25% of teachers have taken a music related technology course at a university. Consequently, most practicing music educators are learning technology skills through informal, self-guided approaches or with assistance from colleagues or friends. Their eagerness for computers is reflected in the fact that more than 92% use computers for some aspect of their work and in their willingness to learn to use music technology for their teaching (Taylor & Deal, 1999).

These findings indicate a need for additional approaches to providing professional development in music education technology beyond traditional workshops and courses. These approaches should increase ease of access to this learning and focus it on supporting the current self-guided or collegial approach to learning. With 63% of United States public school classrooms connected to the Internet by 1999 (U.S. Department of Education, 2000) and more than 48% of music teachers having access to the Internet from home (Reese & Rimington, 2000), professional development from a World Wide Web site is increasingly feasible. This may help overcome the obstacles of geographic distance from training locations and lower the time barriers imposed by conflicting calendars. Since more use of computers and music software happens at home than at school by music teachers, a Web site can promote music technology learning at the times and places that are most available to them.

Bauer (1997) suggested that the asynchronous character of the Internet made it a viable means for music teachers to pursue their professional development independent of time and distance. In an empirical study, Bauer (1999) found that 76% of music educators expressed interest in professional development offered via the Internet, although they were not yet using it extensively for this purpose. He concluded that individuals and institutions appeared to have a good opportunity to use the Internet to provide professional development experiences. In a Delphi study, Talley (1998) investigated possible formats for combining online technology with face-to-face professional development activities and identified some of the reasons why teachers may want to use these tools. She found a consensus that the successful use of online technology for teacher professional development rests not only on the characteristics of the technology but also on the development of a sense of community among a group of teachers who are willing to use this technology for their professional development. This supported the findings of Anderson and Harris (1997) that network-based (online) learning for teachers requires strategies that increase social interactions among teachers and enhances teachers' perceptions that the network has an active social community. Nord (1998) investigated design strategies for creating World Wide Web-based professional development resources for classroom teachers interested in integrating music into their classroom curricula. He adopted a user-centered design approach and went on to develop a Web site that he subjected to formative evaluation.

This investigation followed the lead of these researchers as well as that of Berz and Bowman (1995). In their influential article, they stated, "...greater consideration should be given to the broad musical, educational, and technological contexts in which technology-based instruction is to be implemented, and more attention should be directed toward development of appropriate instructional models and practical teaching strategies" (p. 22).

Purpose

To address these issues, a study was designed to develop and evaluate a multimedia Web site for professional growth in music education technol-

ogy. The purpose of the site was to support the effective use of technology in music instruction and program management, emphasizing self-guided, informal learning based on authentic examples of technology use by practicing music teachers. An important mission of the study was to use multimedia content whenever possible to increase teacher understanding of technology applications through music, MIDI files, videotapes, speech, music notation, and other graphic illustrations. Specifically, the study pursued the following questions.

1. To what extent will participants voluntarily use the Web site?
2. To what extent will use of the Web site impact the participants' attitudes toward technology and interest in using technology for music education?
3. To what extent will use of the Web site impact the participants' knowledge related to technology use?
4. To what extent will the participants understand the systems approach to technology in which the needs and purposes of people who use technology are considered before hardware and software issues?
5. How confident will the participants be that they can contact active users of music education technology within their specialty area for sharing of ideas and getting help?

Site Content, Organization, and Features

After reviewing sources regarding principles of Web site design (e.g., Flanders & Willis, 1999; Lynch & Horton, 1999) and sources of potential music technology content (Richmond, Mash, & Williams, 1997; Rudolph, 1996; Rudolph, Williams & Webster, 1999), the site was designed to help music educators achieve the following learning outcomes.

Awareness

1. Describe how practicing music educators are using music and non-music technology in four ways: (a) administrative uses, (b) preparing teaching materials, (c) leading class activities, and (d) student uses of technology.
2. Explain features of school music programs that have successfully integrated technology resources and the issues they have faced.

Knowledge

3. Contact active users of music education technology within their specialty area (choral, general, instrumental) for sharing of ideas and getting help.
4. Locate and use World Wide Web resources for their professional development in music education technology and for student instruction.
5. Design a funding proposal for a computer workstation or lab for the music teacher and student, including selection of hardware and software components.

Attitudes

6. Develop interest and positive attitudes toward uses of music education technology.
7. Believe they have "friends in the business" and a Web site resource for future reference.
8. Adopt a systems approach to technology in which the needs and purposes of people who use technology are considered before hardware and software issues.

The central content of the site emphasizes helping teachers learn about uses of technology in music education by studying examples of how other teachers and schools have used technology in instruction and program administration. These examples are organized into sections for choral music, general music, instrumental music, and high school music theory, and then categorized into administrative uses, preparing teaching materials, leading class activities, and student uses of technology. Users of the site can read descriptions of how specific teachers are using technology; hear and see examples of the music they are using; view and/or download student handouts, lesson plans, and administrative files; see pictures and videos of teachers, their classrooms, and their projects; search an online database of profiles of music teachers who actively use technology; and exchange ideas with other users of the site. In addition, a "virtual school visit" provides an example of how this technology use occurs in practice by several teachers within an actual school music program. In this part of the site, teachers can virtually look around the music classrooms of the school, see photos and graphics of the school, and listen to interviews with teachers. Additional sections of the site provide information on planning, purchasing, and funding music technology, as well as additional World Wide Web and print resources.

To make this type of content available, the investigators developed downloadable word processing, graphics, and database/spreadsheet files; downloadable music in the form of notation, sequencing, accompaniment, MIDI, and digital audio files; downloadable documents in the form of PDF files; digital and scanned photos; audio and MIDI QuickTime movies; QuickTime video; QuickTime panoramas; and streaming RealAudio and RealVideo files. Readers can view the Web site, *Music Teachers and Technology* (Reese, 2001b) at http://www-camil.music.uiuc.edu/mtt/default.htm.

Methodology

Pilot tests

Prior to the formal evaluation of the site, two pilot tests were carried out. The first pilot was conducted during a one-hour session with 10 undergraduate students who were taking a course in technology based music instruction. It tested the understandability of the site for users and the site's technical functionality. The second pilot test included direct observations of the use of the site during two one-hour sessions by 20 other undergraduate and graduate students who had no technical training. It also included a

test of the data collection procedures planned for the formal evaluation. The observations focused on the number of pages viewed, the order in which pages were viewed, the pages viewed most often, and whether the multimedia examples were used. Data were collected in the form of field notes that were coded into categories. After the observations, interviews were conducted with each participant to determine whether the use of the site was contributing to the learning outcomes being sought (see above). The results of the pilot tests were used to revise the site content and organization.

Evaluation procedure

The participants in the evaluation were 45 practicing music teachers attending a summer graduate music education program at the University of Illinois. All participants reported at least one year of paid teaching experience as a certified teacher in the public schools. Their mean teaching experience was seven years ($SD = 6.9$). There were 17 females and 28 males with a mean age of 31 years ($SD = 8.1$). Fifteen taught in grades K-5, 23 taught in grades 6-8, and 27 taught in grades 9-12 (some overlap exists among groups). Twelve teachers reported a choral specialty, 14 taught general music, 25 had an instrumental specialty, three taught music theory, and four responded "other" (some overlap exists). Thirty of the teachers taught in Illinois schools, 12 were from the United States outside of Illinois, and three taught outside the United States.

Participants were divided into three groups. Group 1 ($n = 14$) used the site and was simultaneously enrolled in a music education technology course that provided instruction in uses of notation, sequencing, accompaniment, computer-assisted instruction, World Wide Web, and presentation software for music teaching. Group 2 ($n = 16$) used the site but was not receiving any other technology instruction during the evaluation period. Group 3 ($n = 15$) was a control group that did not use the site or receive technology instruction during the evaluation period. The 31 participants who were not enrolled in the technology course were randomly assigned to Group 2 or Group 3.

The evaluation of the site took place over a six-week period. At the beginning of the period, all three groups completed a knowledge pretest and an attitude pre-survey. Group 1 (technology course and Web site) and Group 2 (Web site only) then received a one-hour orientation session to familiarize them with the use and organization of the site. They were encouraged to return to the site as often as possible over the next six weeks, but were not given any specific expectations for amount of use in order to determine how much they would choose to use the Web site on their own time. Two e-mail reminders encouraging use of the site were sent at spaced intervals during the six-week period. Participants kept a time log of the number of times they used the site and the number of minutes they used it. At the end of the period, a second guided one-hour session took place to insure at least a minimum use of the site by Groups 1 and 2 participants. At the end of the

evaluation period, all groups completed a knowledge posttest and attitude post-survey and time logs were collected.

The content of the pre- and posttests was determined based on the learning outcomes for the site (see above) and through a review of several computer attitude tests (e.g., Dupagne & Krendl, 1992; Gardner, Discenza, & Dukes, 1993; Woodrow, 1991). The knowledge pre- and posttests focused on use of software programs for music teaching and administrative purposes, types of hardware and software, types of files delivered on the Web, and understanding of the systems approach. These items were presented as forced choice questions. The attitude surveys focused on interest in using technology now and in the future, degree of comfort with technology, beliefs about the value of technology for music learning, and beliefs about the value of the Web for teaching. Because group time was limited and to guard against test sensitization, not all the attitude items from the pre-survey were repeated in the post-survey, allowing us to gather more data. Participants responded to attitude items using a five-point Likert scale (See Table 1).

To gain more understanding of the impact of the site on teachers who were not receiving other technology training (since this circumstance was more like the way teachers would use the site when not at a university), eight participants from Group 2 were randomly selected for follow-up semistructured interviews. Interview data were recorded as field notes, coded and categorized, then subjected to content analysis.

Test and Survey Results

Voluntary use of the site

To determine how much participants would voluntarily use the Web site, Groups 1 and 2 were asked to log the number of sessions and amount of minutes spent using the site on their own time (in addition to the two hours spent in the orientation and final session). It proved difficult, however, to collect these logs, with only 20 of the 45 participants submitting them. Therefore, these data must be interpreted cautiously. We considered use of web server logs or server login procedures as alternative means of collecting data on who used the site and how much. Unfortunately, neither of these procedures was feasible at the time. In addition, we were cautious about discouraging novice web users by asking them to follow a login and logout procedure. Future studies should investigate these techniques for gathering this data.

Results from these 20 participants showed that the amount of volunteer use was small. Table 2 shows that the Group 1 (course and site) used the site for more sessions and for more minutes than Group 2 (site only). Possibly because of the 25 missing cases, neither the number of sessions ($t[12] = .165$, $p = .69$) nor the total minutes was significantly different between the groups ($t[12] = .38$, $p = .54$).

Attitudes and interests

For items matched between the attitude pre-survey and post-survey, scores for Group 1 improved slightly while scores for Groups 2 and 3 both

Table 1

Survey Items

Pretest and posttest matched items

- I am uncomfortable in front of a computer.
- Computers are only for "techies."
- Many schools have successfully integrated technology into their music programs.
- Technology is too expensive for my school
- Computers are not worth the expense.

Pretest items unmatched

- Computers will lead to a more Constructivist classroom.
- I know someone I could ask about computers and music.
- Women are not as good at computers as men.
- I like computers.

Posttest items unmatched

- I know how to ask for funding for my classroom.
- There is a place for technology in my specialty (Choral, Instrumental, General, etc.).
- I am going to use the computer more in the future.
- I would come back to this site again.
- The WWW is a good place to find teaching resources.
- Many teachers in my specialty have successfully integrated technology into their music programs.
- These web pages gave me new ideas I am going to try with my students.

Table 2

Mean Sessions and Minutes Spent Using Site Outside Class

Group	# of sessions	*SD*	Total minutes	*SD*
1 ($n = 7$)	3.7	2.1	114	101
2 ($n = 13$)	2.3	2.1	85	67
All ($n = 20$)	2.8	2.2	95	79

deteriorated somewhat (see Table 3). When the pre-survey scores were factored in as a covariate, the differences in attitude on matched questions were significant, $F(2, 42) = 3.2$, $p = .05$.

Table 3

Mean Change in Attitude for Matched Items (1 Minimum, 5 Maximum)

Group	Pretest	*SD*	Posttest	*SD*	Change	*SD*
1 ($n = 14$)	4.08	.40	4.13	.48	.04	.41
2 ($n = 16$)	3.91	.65	3.73	.60	-.18	.54
3 ($n = 15$)	4.10	.41	3.77	.32	-.34	.54

Additional attitude items differed from the pretest to the posttest. The absolute differences in these scores are not important, since the questions differed, but the relative changes in attitude are worthy of note. Overall, the changes were small, but positive, for all groups. Table 4 shows that the change in attitude for Group 1 was the greatest, with the control group having the least change in attitude score. The change in overall attitude was not found to be significantly different among groups, $F(2, 42) = 1.75$, $p = .19$.

Table 4

Mean Change in Attitude in Unmatched Items (1 Minimum, 5 Maximum)

Group	Pretest	*SD*	Posttest	*SD*	Change	*SD*
1 (n =14)	3.12	.43	3.54	.50	.42	.38
2 ($n = 16$)	3.02	.61	3.19	.57	.17	.55
3 ($n = 15$)	3.23	.29	3.31	.28	.08	.58

As one way to measure attitudes and interests, participants were asked on the pre-survey to report the number of ways they had used technology in the past by marking the categories of (a) administrative uses, (b) preparing teaching materials, (c) leading class activities, (d) student hands-on uses, or (e) non-teaching uses. On the post-survey, they indicated their plans for using technology in the future by again marking these same categories. The number of categories marked was compared between the pre- and post-

surveys. All groups indicated an increase in the number of ways (categories) they planned to use technology in the future, with Group 1 showing the greatest increase, and Groups 2 and 3 showing smaller and nearly identical positive changes (see Table 5). The change in the number of ways that teachers planned to use technology was significantly different among groups, $F(2, 42) = 5.1, p = .01$.

Table 5

Mean Number of Ways Teachers Have Used and Plan to Use Technology (0 Minimum, 5 Maximum)

Group	Have used	*SD*	Plan to use	*SD*	Change	*SD*
1 (n = 14)	3.20	0.94	4.80	0.40	1.60	0.99
2 (n = 16)	3.69	1.25	4.06	1.00	0.38	1.40
3 (n = 15)	3.71	0.83	4.07	1.10	0.36	1.22

Technology knowledge

In addition to the attitude surveys, the participants completed pre- and posttests of knowledge to determine any change in their technology related knowledge. All groups showed a gain in knowledge scores, with Group 1 showing the largest gain (see Table 6). The knowledge changes, however, were not significantly different among the groups, $F(2, 42) = 2.74, p = .077$.

Table 6

Mean Change in Knowledge Scores (100 Possible Points)

Group	Pretest	*SD*	Posttest	*SD*	Change	*SD*
1 ($n = 14$)	48	26	80	13	30	24
2 ($n = 16$)	46	29	65	17	19	25
3 ($n = 15$)	58	23	73	20	14	25

Voluntary use of the site

Although the amount of time that participants voluntarily used the site during the evaluation period (according to the time logs) was small, the

interviews revealed that they had a real interest in using the site as a future reference. In this statement, one participant captured the thoughts of others by saying, "I know that I will use the Web site in the future. It's a wonderful idea to have a place where you can acquire information, get in contact with others who are in the same field, see what they are accomplishing, and share ideas."

Attitudes and interests

The interviewees demonstrated clearly positive attitudes toward technology and showed their interest in using technology for music education through their ability to describe a variety of ways they might integrate technology into their teaching. They could also cite software programs described on the Web site and how they might use these for administration, preparation of teaching materials, leading classroom activities, and direct student uses. The teaching examples they described reflected the types of uses of technology that they had encountered through use of the Web site. A recurring example cited by the teachers of how they might use technology was as an accompaniment and a presentation tool. Most mentioned technology as a helpful accompaniment tool allowing students to experiment with improvisation, primarily within jazz styles: "I would set up the program so that the students could practice improvising with the computer accompanying them, then let the students go to the computer workstation one at a time during rehearsal to work with the program." They also cited uses such as having students compose through use of sequencing: "Students can use sequencing software for composition and experimenting with input onto multiple tracks."

Understanding systems approach

Teachers revealed their understanding that successful technology systems in schools include critical elements that go well beyond hardware and software components. They believed that successful integration of technology in schools required (a) a strong desire of the teacher to apply technology in their music program; (b) financial support sufficient for technology-related purposes; (c) an emphasis on theory, improvisation, and/or composition in music curricula; (d) a sufficient period of years to achieve true technology integration; and (e) a desire to provide a comprehensive musical education for students. They cited insufficient financial support from school districts and lack of time to apply new technologies as major hindrances to effective technology systems. Of special concern was the large investment of learning time required for teachers and students to become fluent with music education technologies. One teacher stated, "I believe a large challenge we face in trying to integrate technology is the time to learn to use the programs efficiently and the investment of instructional time for students to use the technology and benefit from it." They also consistently voiced concerns about the dependability and limitations of the technology.

Ability to contact active users

When asked where guidance could be found concerning technology applications in music education, only a few responses cited the Web site or the teachers featured there. The majority of the responses demonstrated a preference for seeking advice from those they already know, citing friends and colleagues with technology expertise. Perhaps it was not clear that teachers featured on the site might be used as future contacts.

Discussion

The purpose of this study was to design and evaluate a multimedia Web site for professional growth in music education technology, with an emphasis on self-guided informal learning that is based on authentic examples of technology use by practicing music teachers. The intention was to provide an additional source of learning beyond traditional workshops and courses, since access to these often proves difficult for teachers. Overall, the results of the evaluation were mixed, revealing both strengths and weaknesses of the Web site.

A somewhat disappointing result was the small amount of time that participants voluntarily used the Web site, even though at the end of the evaluation period they voiced intentions to use the site as a future reference. This minimal experience with the site content partially explains the limited impact of the site on the attitude and knowledge changes of the participants. In the context of demanding graduate school schedules, good intentions to use the site did not translate into actions as often as hoped. Likewise, practicing music educators face high demands on their time during the school year and may also find it difficult to voluntarily spend time learning from Web site materials. Of interest is the fact that the participants who took the technology course (Group 1) voluntarily used the site outside of class 34% more than those not taking a course (Group 2) (114 min vs. 85 min). It seems that teachers may still need the structure of a class schedule and the motivation provided by technology related class activities to remind them to voluntarily seek out additional learning resources available from the Web. It would be worthwhile in future studies to contact participants several months after the research period to determine to what extent sites may be used as a learning resource while involved in actual teaching practice.

The influence of the site on attitudes and knowledge of the teachers toward technology and its integration into music instruction was also mixed. There were changes in both positive and negative directions on the attitude surveys over the evaluation period. However, all groups showed positive attitudes in their intentions to use technology in more ways in the future, and Group 2 participants expressed clearly positive attitudes in the interviews. Group 1 showed the most positive attitude changes overall. Some of the deterioration in attitudes by Group 2 on the surveys about technology may be explained by the often unrealistic expectations we hold about technology resulting from the large amounts of media hype to which we are all exposed. When the real experience with technology proves more difficult

and less dependable than these media generated expectations, attitudes inevitably become more realistic and less positive. Other recent studies also have reported this phenomenon (Reese, 2001a; Repp, 1999/2000). With the Group 2 and Group 3 (control) attitude survey results being so similar, and the nonsignificant differences among all groups on the knowledge tests, it is unlikely that the Web site alone had much discernible impact on participants' attitudes and knowledge. Once again, it appears that the structured and guided experience of the technology course may be a necessary ingredient for many teachers to benefit from the additional resources of the Web site.

The measures of whether teachers understood the systems approach to technology also returned varied results. The results of ranking "people" in a technology system did not show the desired high ranking in importance. However, the Group 2 interviews demonstrated that these teachers could indeed express a developed understanding that effective technology use in schools concerns far more than just hardware and software. Interestingly, the Group 1 participants did least well on the ranking measure, perhaps due to the emphasis on learning software and hardware skills within the technology course they were taking.

One of the learning outcomes sought for the participants was that they would believe that they have "friends in the business" and would know how to contact active users of music technology for assistance. While this outcome was partially achieved, the results also revealed the strong influence on teachers of other people who are in their immediate school environments. Apparently, the teachers who were featured on the Web site were still perceived as "unfamiliar contacts" compared to those who were in their immediate environment, even though these people (e.g., technology coordinators, technical support staff) were less likely to have the specialized knowledge and experience of actually using music technology for instruction than the teachers featured on the Web site. If one of the purposes for the site is to help novice technology users contact experienced teachers who use music education technology, then an organization should be sought for the site which will better contribute to this goal. It was also apparent in the responses that the teachers often thought of sharing ideas and getting help as being "technical support" for solving software and hardware problems rather than advice on teaching strategies for how to use technology to support music learning. This reflects the level of concern that less experienced users of technology often have for simply keeping technology in working condition. Overall, Web sites with professional development goals will need to find mechanisms to provide a more personalized, "human" network of teachers that encourages confidence in communication and willingness to contact others whom teachers have not already met.

In conclusion, results from this evaluation indicate that Web sites as a single source of learning may be less effective than our initial enthusiasm led us to expect. It is genuinely intriguing to try to take advantage of the unsurpassed ability of the Web to reach teachers, any time and any place,

with rich multimedia learning resources. It appears, however, that face-to-face personal interactions and structured schedules may be necessary for many teachers to have sufficient motivation to turn to Web resources for additional learning in the context of demanding workloads. Simply put, Web sites for professional development may be increasingly necessary, but are probably not sufficient for good progress in integrating technology into music instruction. These sites presumably work best for those teachers who prefer self-guided informal learning over the structured guidance of group instruction, have an immediate technology goal to accomplish and are actively seeking resources to achieve that goal, and have others in their immediate environment to whom they can turn for ideas and assistance.

References

Anderson, S.E., & Harris, J.B. (1997). Factors associated with amount of use and benefits obtained by users of a statewide educational telecomputing network. *Educational Technology Research and Development, (45)*1, 19-50.

Berz, W. L., & Bowman, J. (1995). An historical perspective on research cycles in music computer-based technology. *Bulletin of the Council for Research in Music Education, 126,* 15-28.

Bauer, W. I. (1997). Using the Internet for professional development. *Music Educators Journal, 83*(6), 22-27.

Bauer, W. I.. (1999). Music educators and the Internet. *Contributions to Music Education, 26*(2), 51-63.

Dupagne, M., & Krendl, K. A. (1992). Teachers' attitudes toward computers: A review of the literature. *Journal of Research on Computing in Education, 24,* 421-429.

Flanders, V., & Willis, M. (1999). *Web Pages that Suck: Learn Good Design by Looking at Bad Design.* Almeda, CA: Sybex Incorporated.

Gardner, D. G., Discenza, R., & Dukes, R. L. (1993). The measurement of computer attitude scales: An empirical comparison of available scales. *Journal of Educational Computing Research, 9,* 487-507.

Lynch, P. J., & Horton, S. (1999). *Web style guide: Basic design principles for creating Web sites.* Boston: Yale University Press.

Nord, M. B. (1998). Music in the classroom (MITC): Designing a World Wide Web professional development resource for the integration of music into elementary classrooms (Doctoral Dissertation, Columbia University Teachers College, 1998). *Dissertation Abstracts International, 59,* 1983.

Reese, S. & Davis, A. (1998). The systems approach to music technology. *Music Educators Journal, 85*(1), 24-28.

Reese, S. & Rimington, J. (2000). Music technology in Illinois public schools. *Update: Applications of Research in Music Education, 18*(2), 27-32.

Reese, S. (2001a). Integration of on-line composition mentoring into music teacher education. *Contributions to Music Education, 28*(1), 9-26.

Reese, S. (2001b). Music teachers and technology. Technology Based Music Instruction at the University of Illinois at Urbana-Champaign. Retrieved September 2, 2001 from http://www-camil.music.uiuc.edu/mtt/default.htm

Repp, R. (1999/2000). The Internet, auto-accompaniment software, and spectral analysis in undergraduate voice lessons (Doctoral dissertation, University of Illinois, 1999). *Dissertation Abstracts International, 60/11,* 3947.

Rudolph, T. E. (1996). *Teaching music with technology.* Chicago: GIA Publications, Inc.

Rudolph, T. E., Richmond, F., Mash, D., & Williams, D. B. (1997). *Technology strategies for music educators* (1st Ed.). Wyncote, PA: Technology Institute for Music Educators.

Sehmann, K., & Hayes, C. (1996, April) The Status of Computer Technology in Kentucky's Music Classrooms. Paper presented at Music Educators National Conference, Kansas City, MO.

Williams, C. (2000). U.S. Department of Education. (2000). Internet access in public schools and classrooms: 1994-99. Retrieved from http://nces.ed.gov/pubsearch/ (NCES 2000086).

Talley, S. G. (1998). The use of online technology tools and teacher professional development. *Dissertation Abstracts International, 59,* 3417.

Taylor, J., & Deal, J. (1999, January). Integrating technology into the K-12 music curriculum: A pilot survey of music teachers. Paper presented at the Sixth International Conference on Music Education Technology, San Antonio, TX.

Williams, D. B., & Webster, P. R. (1999). *Experiencing music technology: Software, data, and hardware* (2nd ed.). New York: Schirmer Books.

Woodrow, J. E. J. (1991). A comparison of four computer attitude scales. *Journal of Educational Computing Research, 7,* 165-187.