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Exploring Models of Technology Integration into Music Teacher Preparation Programs

By

Jay Dorfman
Boston University

Abstract

The purposes of this study were to examine, from the faculty perspective, the structures by which pre-service music teachers gain technology experiences, and to understand the limitations of and influences on those structures. Music Education faculty members (N=169) responded to an online questionnaire that contained questions about implementation of technology into their programs, factors they considered when designing technology experiences for students, and translation of technology experiences into effective teaching. Findings indicated a wide variety of integration structures and a preference for inclusion of a stand-alone course in technology. Time was reported as the greatest obstacle to depth of technology integration. Further research is suggested to compare the quality of the existing models of technology integration. Implications for the field include the importance of relevant educational standards for developing technology experiences, and attention to educational theories that can help guide that development.

Keywords: technology, teacher preparation, curriculum models, standards

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The standards of the Council for the Accreditation of Educator Preparation (CAEP), which guide the structure and content of music teacher preparation programs, state that such programs should ensure that teacher candidates “apply technology standards as they design, implement and assess learning experiences to engage students and improve learning” (CAEP, p.1). General teacher education programs, and the technology experiences within them, have been called a “key catalyst” (Hofer & Grandgennett, 2012, pp. 83-84), and are among the most important influences toward integration of technology in the classroom (Agyei & Voogt, 2011; Drent & Meelissen, 2008). Further, Polly, Mims, Shepherd and Inan (2010) suggested that general teacher preparation programs may not be aligned with local and state standards; this is an issue further complicated by the inclusion of technology mandates in the CAEP standards.

Limitations on the amount of time and expertise with which music technology is taught in preservice curricula have led to several models of integration. A small percentage of preservice teachers have music technology experiences prior to attending music school (Hime, Miksza, & Hunsucker, 2014). Similar to the results found in the general education field, most preservice teachers are not being taught to integrate a full complement of technology resources into their future teaching (Brun & Hinostroza, 2014; Sadaf, Newby, & Ertmer, 2012), and even for those whose technology exposure and experiences are substantial, gaps exist between their knowledge and their skillfulness in teaching with technology (Martinovic & Zhang, 2012). Recent, large-scale research has shown that pre-service teachers are simply not being prepared to be successful in the field, and that topics that are being covered, regardless of the ways in which they are addressed, may not align with those that are most valued in classrooms (Otterbreit-Leftwich, Ertmer, & Tondeur, 2015).

Given recent calls for content-specific examinations of technology experiences at the preservice level (Shinas, Yilmaz-Ozden, Mouza, Karchmer-Klein, & Glutting, 2013), it is incumbent upon music teacher educators to examine means by which preservice teachers gain technology experiences, and to assess the structures in music teacher preparation programs that provide opportunities for technology integration. Such examinations in the sciences, for example, (Chien, Chang, Yeh, & Chang, 2011; Chittleborough, 2014; Rehmat & Bailey, 2014; Stokes, 2009) and in literacy/language (Schmid & Hegelheimer, 2014; Schnackenberg & Still III, 2014), have shown that certain structures of technology integration in preservice programs can encourage teachers to design more interactive lessons, to be more collaborative, and to recognize potentials for enhancing education through technology infusion. Researchers (Kay, 2006; J. Lambert & Gong, 2015) outside of music education have shown that experiences with technology in preservice programs can help pre-service teachers feel more comfortable with technology and can develop self-efficacy with technology (Abbitt, 2011), which can predict whether teachers will use technology once they enter the field (Cullen & Greene, 2011; Funkhouser & Mouza, 2013; Hughes, 2013; Juniu, Shonfeld, & Ganot, 2013; Sadaf et al., 2012). These positive outcomes of technology exposure may also be present when students in music teacher preparation programs gain technology experiences, but approaches to doing so are essentially unexamined.

Models of Integration

Gillingham and Topper (1999) discussed their experiences with several models of integrating technology into teacher preparation and explained that, “Each method requires various program compromises in order to fit within the constraints of student and faculty loads and other institutional requirements” (para. 3). Wildner (1999) described an approach to integrating technology into teacher preparation programs using modules of technology-related content in several courses throughout the program. Granston (2003) further assessed various models and determined that, for the particular situation in question, a cross-curricular approach was most effective. Several years later, Price and Roth (2011) claimed, “We now know that stand-alone technical skills courses isolated from content curriculum are insufficient for effective classroom technology integration” (p. 4). While few of the cases described in research would be considered “isolated,” the point Price and Roth make is that relationships to content enhance the effectiveness of such courses. Sprague, Parson, and Swalwell (2013) have documented difficulties in technology integration in circumstances in which the context is general teacher education rather than teacher education with a particular content area. In the context of art education, Roland (2010) suggested that, “Instead of limiting technology use to a small portion of the curriculum, meaningful connections need to be made between course content, pedagogy, and technology use throughout the entire art teacher education curriculum” (p. 21).

Dorfman (2013) suggested that, in music teacher education programs, technology is generally included as a stand-alone course, integrated into several courses, or is addressed outside of the context of courses. These structures are similar to those found in other content areas, but a full review of strategies does not exist (Tondeur et al., 2012). Bauer and Dammers (2013) conducted a study regarding pre-service and in-service music teachers’ understanding of technology integration into their classrooms. Perhaps more recently, Haning (2015) studied a small sample of undergraduate music education students to examine their perceptions of technology in their preparatory programs. Haning determined that stand-alone technology courses were the primary means by which music education students receive technology-related instruction, and that the courses were “of limited use in preparing participants to use technology effectively in their own teaching" (p. 9). Students in music teacher education programs, however, are not always aware of the factors that motivate faculty to structure experiences in particular ways.

Theoretical Orientation

Technological Pedagogical and Content Knowledge, or TPACK is the prevailing theoretical orientation in the recent literature about educational technology is a framework known as. Attributed to Mishra and Koehler (2006), this framework is an extension of Shulman's (1986) theory of Pedagogical Content Knowledge. TPACK layers technology as a component that intersects with pedagogical knowledge and with content knowledge. This results in a newly conceived form of teacher knowledge that includes technology as a means of delivering content in pedagogically appropriate ways. Researchers apply the framework as a mechanism for supporting and evaluating teachers' skillfulness with technology (Colvin & Tomayko, 2015; Fisser, Voogt, van Braak, & Tondeur, 2015), and as a conceptual tool for design of preservice and in-service teacher professional development (Bakir, 2015; Baser, Kopcha, & Ozden, 2015; Jaipal-Jamani & Figg, 2015). Within music education Dorfman (2013) cited TPACK as a foundational theory for the design of lessons that include musical content delivered through technological means. Bauer (2014) also grounded lesson design in TPACK and led the development of TPACK-based activity types (Bauer, Harris, & Hofer, 2012) that can guide curriculum development. The body of literature related to the TPACK framework is large and rapidly growing. Cited here are exemplars from only the most recent literature. A comprehensive listing of the TPACK literature is available through a Mendeley bibliography, which can be accessed through the site www.tpack.org.

While the present study was not an examination of in-service teachers' technological competency, gaining an understanding of the present state of technology integration into preservice music teacher programs may lead to suggestions for modifying the structures of those programs. Because it promotes equal importance of technology, pedagogy, and specific content domain, the TPACK framework can and will serve as a foundation for those suggestions.

Purposes and Research Questions

The purposes of the present study were to examine, from the faculty perspective, the structures by which pre-service music teachers gain technology experiences, and to understand the limitations of and influences on those structures.

The following questions guided this study:

1. At which points in music teacher preparation programs, or by which structures, do technology experiences most commonly occur?
2. What factors do music teacher educators consider in designing technology experiences for students in their programs?
3. From faculty perspectives, how well do technology experiences in music teacher education programs prepare students for their initial years in the field?

Method and Participants

Music Education faculty members with knowledge of the technological components of the programs in which they work participated in this study. I emailed an invitation to participate in a survey to all members of the College Music Society who indicated in their membership profile that they were music education faculty members (*N*=2,896). I sent the initial email invitation on September 8, 2015 and sent a follow-up email two weeks later to increase participation. Although CMS has members outside of the U.S., invitations to participate were sent only to faculty at U.S. institutions because of the differences is teacher licensure procedures found in other countries. Of the 81 respondents who provided their university affiliation, 31 of the 50 United States were represented. The data collection system also tracked IP address locations for all respondents, but that information was not analyzed in order to maintain anonymity for those respondents who did not wish to provide their location.

I designed a survey instrument and hosted it on using the Qualtrics survey system at Boston University. The survey was designed to collect demographic information, then with three parts, each addressing one of the research questions. The questionnaire employed skip logic, and survey items were not enforced as mandatory, so response rates for each item varied. The full survey instrument is available at https://jaydorfman.files.wordpress.com/2016/05/models_of_integration_survey.pdf.

Two music education researchers with doctoral degrees and two music education doctoral students, each with knowledge of the structure of music education programs and common technology integration strategies checked the survey for validity. Based on feedback from this pilot group, I made minor modifications to the instrument for the sake of usability. These changes included repagination of some survey items and checking for consistency of webpage loading. The independent reviewers found that the survey items were consistent with the research questions, and therefore suggested no changes to the content of the questionnaire.

Results

Based on the email invitations to participate, 169 individuals responded to the survey and granted permission for me to use their responses. This represented an overall return rate of 5.83%. While the response rate was low, the responses were geographically diverse and most of the participants chose to include open-ended responses, making the data richer. I made attempts to increase the number of responses (Fink, 2017). Of the 80 respondents who provided their institutional affiliation, there were 71 unique institutions represented; the total number of institutions represented cannot be known because this potentially identifying information was not a mandatory item in the questionnaire. Results from the questionnaire are organized below according to the research questions, followed by additional analyses.

Results for Research Question 1

Of the respondents, 97 (57.4%) indicated that students in their Music Education programs were required to take a course that is focused on music technology; 68 (40.2%) reported that such a course was not required, and 4 (2.4%) chose not to supply this information. Using a Chi-square test, I found the difference between the "required" and "not required" groups to be statistically significant (X^2=5.097, sig=.024). I performed all tests of significance at the *p*=.05 level. Based on the data provided, the largest proportion of those who were required to take a class focused on music technology typically did so during the sophomore year (*n*=33; 19.5%), followed by the junior year (*n*=29; 17.2%), the freshman year (*n*=25; 14.8%), and the senior year (*n*=4; 2.4%).

I asked respondents to rate their agreement with the statement that the required music technology course adequately prepares students to use technology in their future teaching; 89 respondents answered this question. Table 1 displays the results. The largest proportion of the sample (*n*=29, 32.6%) agreed that the courses were adequate in preparing to use technology in their future teaching.

Table 1

Agreement with Adequacy of Courses to Prepare for Future Teaching (n = 89)

Response	Frequency	Percent
Strongly Agree	8	9.0
Agree	29	32.6
Somewhat Agree	27	30.3
Somewhat Disagree	15	16.9
Disagree	8	9.0
Strongly Disagree	2	2.2

Respondents indicated additional structures that were in place for their students to obtain technology experiences. Of the sample, only 31 (18.3%) reported that students took a course focused on technology outside of the music unit. When this was the case, the majority of students took this course in either the sophomore (n=15; 48.4%) or junior (n=11; 35.5%) years. Table 2 indicates other points within the music teacher preparation program where students typically have exposures to technology (See Table 2). Respondents selected as many of these points as were appropriate. Instrumental/Choral Methods courses (n=96, 54.8%), Introduction to Music Education courses (n=95, 56.2%) and Student Teaching (n=102, 60.4%) were the most frequent responses.

Table 2

Points in Programs Containing Technology Exposures (*N* = 169)

Program Point	Frequency	Percentage
Introduction to Music Education Course	95	56.2
Instrumental/Vocal Techniques Course	59	34.9
Instrumental/Choral Methods Course	96	54.8
Stand-alone Technology Course	79	46.7
Student Teaching	102	60.4
Student Teaching Seminar	61	36.1
Pre-practicum Field Experiences	62	36.7

Of the sample, 39 (23.1%) also indicated that their departments offer technology related workshops; the frequencies of these workshops ranged from “once every 3-4 years” to “twice/ each month.” In open-ended responses, additional points of technology exposure included music theory classes, conducting classes, composition/orchestration classes, audio and acoustics courses, marching band techniques classes, general music methods classes, popular music classes, music research and writing classes, educational psychology classes, and in non-curricular experiences such as e-portfolio development.

Results for Research Question 2

Participants responded to a series of items that examined their perspectives about factors that might influence the integration of technology into their programs (Appendix A). Item means indicate that desire for students to gain technical knowledge (*M* =4.96, *SD*=1.01) and facility (*M*=4.83, *SD*=1.06) were the two most strongly agreed upon influential factors.

In addition to the influential factors provided, respondents offered additional influential factors in open-ended responses. Additional factors included faculty viewing technology as essential, faculty training and expertise, acquisition of the latest technology, general issues of access, priorities of faculty outside of the Music Education department, practicality of integration, meeting accreditation requirements (such as NASM), and the general needs of the students.

Results for Research Question 3

The majority of respondents felt that the professionals their students observed during field experiences, observations, and student teaching make excellent uses of technology; strongly agree, agree, and somewhat agree responses combined totaled 97, or 57.3% of the responses. Also framing this section of the findings was that the respondents largely felt that students who enter the field with excellent technology skills will be more successful at reaching a broad audience of students (Strongly Agree=25, Agree=45, Somewhat Agree=41, Somewhat Disagree=18, Disagree=9, Strongly Disagree=3) than those without such skills. They also agreed that the students who successfully complete Music Education degrees are comfortable using technology, and were well-prepared for teaching music—positive responses accounted for 65.7% of the responses. Strongly agree, agree, and somewhat agree responses totaled 104, or 61.5% of the responses for this item.

Additional Analyses

The survey asked respondents to indicate their familiarity with sets of educational standards that may influence inclusion of technological components in teacher education programs, and specifically in music teacher education programs. Table 3 summarizes these responses. The respondents claimed to be most familiar with the technology strand of the

NAfME standards (*M*=3.22, *SD*=1.70). None of the sets of responses were found to be normally distributed using Kolmogorov-Smirnov statistics (sig<.01 for each distribution).

Table 3

Familiarity with Sets of Standards

			1 - Not at all familiar		2		3		4		5		6 – Very familiar	
	Item Mean	Item SD	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Technology strand of NAfME standards (*n*=144)	3.22	1.70	33	23.0	20	13.9	30	20.8	23	16.0	20	13.9	18	12.5
Technology portion of CAEP standards (*n*=14 3)	2.36	1.60	65	45.5	23	16.1	22	15.4	14	9.8	10	7.0	9	6.3
ISTE National Educational Technology Standards (*n*=144)	2.26	1.61	75	52.1	18	12.5	16	11.1	16	11.1	11	7.6	8	5.6

In an open-ended item, one respondent suggested that standards such as those listed “are not likely to aid in the use or integration of technology, nor are they likely to be catalyst or advocacy tool for integration.” This respondent further suggested that the stand-alone course model might not be beneficial for students to learn to teach in ways suggested by the new NAfME standards. Several reported that they did not cover technology-related standards as a topic in many music education programs. Another respondent suggested that the issue of standards may suggest that a common set of outcomes related to technology preparation needs to be established for preservice teachers. Also noted was the disparity in technology use between K-12 schools of varying socioeconomic settings.

I conducted one further analysis to determine the perceived effectiveness of the stand-alone course in music technology. Using as the independent variable the categorical response to whether or not programs required a stand-alone technology course, I conducted a Mann-Whitney U analysis. The dependent variable was the continuous response to the item, "The students who successfully complete the Music Education program at my college/university are well prepared to use technology in their teaching upon entering the field." This non-parametric statistic was appropriate because of the non-normal distributions of the independent variable. Results determined that the group of respondents, whose programs require a stand-alone course, responded significantly higher regarding their students' preparation than did those whose programs do not require such a course (Z=-3.04, sig=.002).

Limitations and Discussion

The small response rate for this survey study was a limitation. Further research might be conducted with more targeted methods of obtaining participants; however, the dispersion of the participants in this study lead to a hesitant claim of geographical representativeness. I made no claims for representativeness of any other kind such as type or size of institution, teaching/research focus, or availability of graduate programs. Because the survey was distributed through the College Music Society, I did not have a list of that organization's members or institutional affiliations. It was therefore not possible to know how well the responses reflected CMS's membership in terms of geography. Furthermore, despite the low response percentage, the number of respondents fell well within recommended liberal guidelines for participation based on the sample size (Nulty, 2008). Using incentives or direct contact with individuals may have increased the return rate, but those methods were not reasonable for this particular study. The geographic dispersion suggested representativeness, which was as important as rate of participation (Comensoli, 2014; A. D. Lambert & Miller, 2014; Shlomo, Skinner, & Schouten, 2012). I can also assume that most of the individuals who responded had a vested interest in the topic of integration of technology into music teacher preparation, which indicated quality of the data.

An additional limitation, which was revealed during data analysis, was that the mere definition of the word *technology* represented some confusion on the part of the respondents. They were unclear about what technologies were included in the term. Though the term might be considered vague, it was used this way intentionally so as to not limit respondents to discussing only particular kinds of technology. Still, further research could focus on specific types of technology such as performance technology, presentation technology, or computer-assisted instruction technology.

The statistically significant difference between the number of programs represented in the responses that require a stand-alone technology course and those that did not indicate that the stand-alone course was indeed the favored model in the field of music teacher preparation. The Mann-Whitney U test provided evidence of the respondents' beliefs that the stand-alone course model was more effective than not requiring a course at all. While this finding supported the previously cited literature claiming that technology experiences make teachers more comfortable with integration (Abbitt, 2011; Cullen & Greene, 2011; Funkhouser & Mouza, 2013; Hughes, 2013; Juniu, Shonfeld, & Ganot, 2013; Kay, 2006; J. Lambert & Gong, 2015; Sadaf et al., 2012), the finding stood in disagreement with other researchers who claimed that stand-alone courses were inadequate (Price & Roth, 2011; Roland, 2010; Sprague et al., 2013). This study was designed primarily to examine the existing models. Further research to determine the perceived, and perhaps the actual effectiveness of the various models is recommended. Regardless of model, faculty felt their students were generally well prepared to use technology in their teaching, which concured with findings of another recent survey that examined this question (Bauer & Dammers, 2012).

The examination of factors that influenced the respondents' decisions about inclusion of technology in the preservice curriculum revealed that the greatest obstacle to the stand-alone course structure was time. This echoed the sentiments of previously cited authors in other content areas. Of course, management of time was a complex issue that involved curriculum balance, scheduling, and faculty loads. Responses showed that the participants supported knowledge acquisition and technical facility with technology for their future teaching. Analyses for research question 3 showed that faculty largely felt that the technology knowledge and skills that their students acquired translated well into their future teaching.

Familiarity with sets of standards that are supposed to guide curriculum development in teacher preparation programs was found to be non-normally distributed and, in all cases, skewed toward a general lack of familiarity with the standards. Despite the open-ended response suggesting that standards may not be useful for advocacy or guidance, the general lack of familiarity may indicate that faculty were unaware of the potential usefulness of standards.

Implications for Music Education

The participants in this study were music education faculty members whose perspectives regarding technology, presumably, influenced the structures and depths to which it was integrated into teacher preparation programs. While it was not the purpose of this research to determine the relative effectiveness of models of technology integration into teacher preparation programs, the results indicated that, in programs where a stand-alone technology course was required, faculty members had confidence in their students' future abilities to use technology in their teaching. Previous researchers have questioned the effectiveness of the stand-alone course, but have typically couched their hesitations by citing a lack of content-specific context for the course. The findings of this study, taken in light of previous claims, implied for the music teacher education field that some type of required technology inclusion in music teacher preparation programs was favorable, and program designers should explore means by which to do so. This echoed the implications of Haning's study (2015) in which the author suggested that student participants expressed desire for more technology instruction than they were presently receiving, and in more varied ways.

As faculty search for new and innovative ways to include technology as part of music teacher preparation programs, both the findings of this study and the framework on which it was based hold potential for guidance. The findings regarding awareness of standards that may guide technology inclusion suggested, in a broad sense, that faculty members were generally unaware of the standards that govern this component of music teaching and learning. To benefit the field, people with deep knowledge about these standards and the applicability to music teacher preparation should consider writing and speaking about how teachers might use the NAfME, CAEP, and ISTE standards. The standards can suggest approaches to technology integration and digital citizenship that faculty members might not otherwise consider. While these standards may not be specifically and entirely intended for music teacher preparation, they are certainly as germane to curriculum development and experience design as are standards in any other component of music teacher preparation. Awareness of standards is rarely harmful, and may ultimately lead to more sound design and equality of experiences in technology across music teacher preparation programs.

Finally, the TPACK model served as a theoretical underpinning for this study, and awareness of the model holds implications for pre-service music education. As faculty members modify programs to accommodate for the unrelenting integration of technology into students' lives, the TPACK model can help to preserve the importance of musical content in the curriculum. Some respondents to this study expressed concerns about technology overtaking other important areas of music teacher preparation, or about their students becoming technology- or "prop"-dependent. The TPACK model, as described here and elsewhere, helps teachers to maintain the importance of the content area and use technology as one interesting means to guide students' experiences with that content. It is important that inclusion of technology in music teacher preparation curricula is done with a careful eye toward maintaining the integrity of music as a content area. Models of integration, as examined by this study, are varied, but can help prepare teachers for effective integration of technology that supports their teaching and their students' musical learning.

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Jay Dorfman (jdorfman@bu.edu), Assistant Professor of Music Education at Boston University, is an active presenter at local, state, and national music education conferences. His writing has been published in several scholarly journals including the *Journal of Research in Music Education, The Journal of Music Teacher Education,* and the *Bulletin of the Council for Research in Music Education*. He is the author of *Theory and Practice of Technology-based Music Instruction* (Oxford University Press, 2013). Dr. Dorfman is the Past President of the Technology Institute for Music Educators (TI:ME). His research interests include the uses of technology in music teaching and learning; instrumental music teacher education; and comprehensive and interdisciplinary approaches to music education. Dr. Dorfman holds BM and MM degrees from the University of Miami (FL) and the PhD from Northwestern University. In the fall of 2016, Dr. Dorfman will assume the post of Associate Professor and Coordinator of Music Education at Kent State University.

Appendix A

Importance of Influential Factors

	Item mean	Item SD	Strongly agree #	Strongly agree %	Agree #	Agree %	Somewhat Agree #	Somewhat Agree %	Somewhat disagree #	Somewhat disagree %	Disagree #	Disagree %	Strongly Disagree #	Strongly Disagree %
It is important to the faculty in my college/university's Music Education program that students develop knowledge about using technology for teaching music. (*n*=145)	4.96	1.01	52	35.9	49	33.8	34	23.4	7	4.8	2	1.4	1	0.7
It is important to the faculty in my college/university's Music Education program that students develop technical facility with technology for teaching music. (*n*=145)	4.83	1.06	46	31.7	47	32.4	40	27.6	7	4.8	2	1.4	1	0.7
The financial and personnel costs of offering a stand-alone technology course make it difficult to offer such a class for our Music Education students. (*n*=145)	3.34	1.70	18	12.4	31	21.4	17	32.4	20	13.8	35	24.1	24	16.6
The time needed for a stand-alone technology course make it difficult to offer such a class for our Music Education students. (*n*=145)	3.94	1.8	41	28.3	27	18.6	21	14.5	11	7.6	28	19.3	17	11.7
The technical support needed for a stand-alone technology course make it difficult to offer such a class for our Music Education students. (*n*=144)	3.31	1.65	20	13.9	19	13.2	27	18.8	17	11.8	42	29.2	19	13.2
The network and infrastructure needed for a stand-alone technology course make it difficult to offer such a class for our Music Education students (*n*=144)	3.19	1.65	18	12.5	19	13.2	22	15.9	23	16.0	38	26.4	24	16.7
The culture or traditions of my college/university and program make it difficult to offer such a class for our Music Education students. (*n*=144)	2.89	1.68	15	10.4	16	11.1	21	14.6	14	9.7	42	32.6	36	25.0