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GENDER DIFFERENCES IN PRESERVICE MUSIC EDUCATORS' FAMILIARITY WITH TECHNOLOGY

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The purpose of this study was to determine gender differences in preservice music educators' familiarity with various types of technology. Preservice music educators (female = 85, male = 50) rated their level of familiarity with 14 types of technology commonly used by music educators: word processing, e-mail, Web browsing, creating Web pages, multimedia/interactive CD-ROM, presentation software, clip art graphics, data processing, music notation, music accompaniment, MIDI sequencing, sound sampling and editing, computer assisted instruction in music, and database software. Results showed that males believed themselves to be more familiar than their female counterparts with three of the 14 technology types. All three types were music specific (database software for music educators, music accompaniment, and music notation). Females believed themselves to be more familiar than males with e-mail. The other 10 technology types had no significant gender effects. Results also showed that females and males had near identical rankings (*rho* = .99) of the familiarity ratings, indicating that, regardless of gender, preservice music teachers were familiar with the same types of technology. Ranked among the most familiar were nonmusic specific types, while among the least familiar types were music specific types, regardless of gender.

Technology has a long history of assisting musicians and music educators. It could be seen as part of the cultural heritage that has woven into musical activities of all times (Swanwick, 2001). Historical documentation indicates numerous inventions and modifications of musical instruments in all traditions. For example, the flute, the piano, the saxophone, the *koto*, and the *mbira* were all invented and modified throughout the centuries. Various tools, such as the phonograph, compact disc, and video were invented and developed for musical enjoyment. Music educators used various technological inventions to assist with their teaching. These inventions included metronome, chalkboard, and overhead projector. These general and musical inventions have facilitated musical transmissions, teaching, and learning for generations.

Today few people view past inventions and developments as "technology." Technology often is associated with computer hardware and software of all sizes and of all levels of complexities. The connotation of technology becomes a massive diversity of devices to include the Internet, digital video, MIDI sequencing, and multimedia presentations, just to name a few. The availability of various technological devices has shaped the way people live and function and has conditioned the way people think and feel (Swanwick, 2001). These devices are important contributions to contemporary musical life.

The range of technologies available for music educators poses a challenge to the profession. Music degree holders are expected to be familiar with a wide range of technology devices (Deal & Taylor, 1997). It can be difficult for music educators to get a good grasp on the full spectrum of available technology. Music educators have to be selective in learning the new technologies and be selective in using them as effective teaching tools. Researchers, including Hagen (2001), Huang, Waxman, and Padron (1995), and Liao (1993) found that the variety of technology usage and length of experience using technology seems to be positively related to comfort at the computer.

Despite the challenges for educators, effective use of current computer related technology in music education might expand opportunities for all students. Comber, Hargreaves, and Colley (1993) suggested that technology has the potential to remove many barriers associated with traditional musical skills. Nearly perfectly tuned sounds can be produced in split seconds with the help of technology. Various hardware and software devices can be used creatively by music educators to share music, teach various aspects of music, teach diverse musical traditions, and manage music classes more effectively (Beckstead, 2001; Haldey, 1996; Rudolph, 1996; Stevens, 1991; Taylor & Deal, 2000; Williams & Webster, 1999). Music can be transformed to data files. Worksheets in text formats can incorporate professional quality music notation. Grades and uniforms can be systematized effectively. Computer networks can transfer various types of text, sound, graphic, and movie files. When used effectively, technology could benefit all music learners.

Given the overwhelming attractiveness of technology use in education, one might easily ignore the social-cultural assumptions embedded in it (Bowers, 1988). Caputo (1994) suggested that computer technology works primarily through digital knowledge, whereby linear forms of thought and the production of knowledge are modeled upon a mechanistic way of thinking. Caputo commented that computers devalue knowledge that cannot be communicated in a digital format. Certain ways of thinking and knowing, and certain cultural values are encouraged over others. Caputo also observed that girls are socialized to pursue mostly relational and analogic ways of knowing and that they must unlearn these ways in order to be successful with technology. Caputo stated that girls are "set up for failure on some level" (p. 89) as they confront technology and measured against a male norm.

Studies in general technology use have found mixed results in computer attitudes by gender. Chen (1996) found that males were generally more knowledgeable and receptive to computer uses than their female counterparts. Results found by Comber, Colley, Hargreaves, and Dorn (1997) suggested that males had more positive attitudes toward computer technology than females. Sheffield (1998) found male advantages in certain quantitative computer applications over females. However, some researchers found nonsignificant gender differences in high school and college students' (Lloyd

& Gressard, 1984) and preservice teachers' (McCoy & Baker, 1997) attitudes towards general computer use. Studies from the 1980's to the 1990's also have suggested a consistent increase in computer proficiency (McCoy & Baker, 1997) and a decrease in computer anxiety (Reed, Anderson, Ervin, Jr., & Oughton, 1995).

Few researchers have examined gender differences in music technology use. Comber et al. (1993) studied 10- to 18-year-olds ($N = 278$) using surveys and interviews. They found that boys were more confident in using music technology and that boys showed an interest in music as a result. They also suggested that teachers had an important role in ensuring girls' participation in music technology use. Thus, it seemed worthy to investigate if there were gender differences in technology use among preservice music teachers who would be role models in future music classrooms.

Colley, Comber, and Hargreaves (1997) studied the effect of school-type (single-gender versus coeducational schools) on teenagers' attitudes toward music technology use. They found that older girls (15-16-year-olds) from coeducational schools had a particular lack of confidence in music technology compared with their male counterparts and their younger counterparts (11-12 year olds). When female and male teenagers shared the same learning environment, being female seemed to be a social disadvantage for music technology use. The authors suggested that a single-gender school environment could encourage girls to gain the initial confidence in using music technology.

Recently Hagen (2001) surveyed 21 females and 21 males enrolled in an introductory music technology course at the college level. She found that gender was not related to preferences for paper versus digital homework. Gender was also not related to preference for handouts versus online help. There was no significant attitudinal difference towards technology use between females and males. However, results indicated that "females had far less experience upon entering the course" (p. 35). By asking questions on future plans to pursue music technology, Hagen (2001) found that there was no correlation between gender and future plans, but chi-square statistics showed that "the more experience a student had, the more likely they were to continue their studies in music technology areas" (p. 36). Hagen concluded that females generally had less experience in music technology but that they were not necessarily less interested in it.

Music educators seem to see the need to equalize opportunities, skills, and knowledge in technology between females and males. If music educators believe that having both female and male role models who are competent in various types of technology can help alleviate the technological gender differences, preservice music educators of both genders ought to show similar level of technological competencies. There is a need for instructors in music teacher training programs to identify gender differences and create strategies accordingly.

Since both female and male music educators can serve as role models, it is important to know if preservice music educators show any indication of

gender difference in their level of familiarity with various types of technologies. The purpose of this study was to determine gender differences in preservice music educators' familiarity with various types of technology. Familiarity is addressed by preservice music educators' beliefs of their own familiarity, not their actual familiarity. The following research questions are asked: (a) Are there differences between females and males in their self-reported familiarity with various types of technology, (b) What are the rankings of females and males in their self-reported familiarity with various types of technology, and (c) Is there a relationship between the familiarity rankings of the female and male samples?

Method

Participants

A total of 135 preservice music educators (female = 85, male = 50) participated in this study. They were music education majors (74.8% sophomores or juniors) enrolled in a music education class before the technology component of the music education program began. Most of the participants were preservice instrumental music educators (60.7%) and preservice choral music educators (29.6%). Only 6.7% of the sample was preservice general music educators. The rest of the sample (3.0%) majored in more than one music education area. All participants were from a large music teacher training program in the Midwest.

Instrument

The instrument consisted of a list of 14 types of technology commonly used by music educators: word processing, e-mail, Web browsing, creating Web pages, multimedia/interactive CD-ROM, presentation software, clip art graphics, data processing, music notation, music accompaniment, MIDI sequencing, sound sampling and editing, computer assisted instruction in music, and database software for music educators. Two to three commonly used examples were given for each technology type. Each type of technology was accompanied by a five-point scale (1 = have no idea what it is, 5 = very familiar with it).

Procedure

Participants completed the instrument during a regular class period. They answered questions on gender, classification, and major area in music education. They also responded to the five-point scale for each type of technology. Data were collected across five consecutive semesters. Preliminary analysis showed no significant difference in the sample's familiarity ratings across the five semesters.

Results

The instrument used in this study showed a high level of internal consistency among the 14 items using the five-point scale, with a coefficient alpha of .87. A multivariate analysis of variance (MANOVA) was used to determine gender differences among various technology types. Gender served as the between participants variable, while familiarity with each of the 14 technology types served as dependent variables. Results showed that there was a significant gender difference in the overall model ($p < .01$, see Table 1). Univariate F-tests indicated that four technology types had significant

Table 1

MANOVA Results of Technology Type Familiarity by Gender

Source	*Wilks*	*df*	*F*	*p*
Gender	.763	14, 120	2.668	<.01

Univariate-F tests with df (1, 133)

Source	*SS* (between)	*SS* (error)	*F*	*p*	r^2
Clip art graphics	.670	223.967	.398	NS	
Computer Assisted Instruction in music	3.792	198.312	2.543	NS	
Creating web pages	.904	121.496	.989	NS	
Data processing	.113	210.820	.072	NS	
Database software for music educators	2.637	59.096	5.934	<.05	.04
Email	7.253	79.680	12.107	<.001	.08
MIDI sequencing	2.833	106.900	3.525	NS	
Multimedia/Interactive CD-ROM	5.096	217.304	3.119	NS	
Music accompaniment	4.351	100.508	5.758	<.05	.04
Music notation	7.077	147.027	6.402	<.05	.05
Presentation software	.402	187.332	.285	NS	
Sound sampling and editing	1.743	69.694	3.326	NS	
Web browsing	.201	52.880	.507	NS	
Word processing	.670	49.967	1.783	NS	

Note. $N = 135$

gender differences: e-mail ($p < .001$), music notation ($p < .05$), database software for music educators ($p < .05$), and music accompaniment ($p < .05$). Gender explained only 4% to 8% of the variances in the reported familiarity levels for each of these four technology types. Examination of the means (see Table 2) showed that the male students reported higher familiarity levels than the female students on music notation, music accompaniment, and database software for music educators. However, the female students rated e-mail with higher familiarity levels than the male students. The results indicted that 10 of the 14 technology types had no significant gender differences ($p > .05$): word processing, Web browsing, creating Web pages, multimedia/interactive CD-ROM, presentation software, clip art graphics, data processing, MIDI sequencing, sound sampling and editing, and computer assisted instruction in music. This indicated that both females and males were almost equally familiar, or equally unfamiliar, with each of these 10 technology types.

Table 2 also presents the rank orders of familiarity levels of the female and male samples. The rank orders of both samples were highly similar, yielding an unusually high rank order correlation coefficient (*rho* = .99). The similarity in ranks indicated that both females and males were familiar with the same types of technology over the other types. Regardless of gender, this sample of preservice music educators believed that they were most familiar with word processing, Web browsing, e-mail, multimedia/interactive CD-ROM, music notation, and clip art graphics. They reported that the least familiar technology types were database software for music educators, sound sampling and editing, MIDI sequencing, music accompaniment, creating Web pages, computer assisted instruction in music, data processing, and presentation software. These eight least familiar types were rated below the midpoint of the scale for both females and males. The four technology types reported to be the most familiar were all nonmusic specific (word processing, Web browsing, e-mail, and multimedia/interactive CD-ROM), while the four technology types reported to be least familiar were all music specific (database software for music educators, sound sampling and editing, MIDI sequencing, and music accompaniment).

Discussion

Results showed that there were no significant differences in reported familiarity with 10 of the 14 technology types between female and male music education majors. This finding suggests that the gender differences in technology use found in earlier studies (Chen, 1996; Comber et al., 1993; Comber et al., 1997; Sheffield, 1998) could be diminishing. In this study male students believed themselves to be more familiar than the female students with 3 of the 14 technology types. These three technology types were music specific types (database software for music educators, music accompaniment, and music notation), indicating that female music education majors might feel more inferior in using these music technologies compared to

their male counterparts. This finding paralleled that of Hagen (2001) in that college female music students generally had less experience in music technology. It was important to point out that the group of women in Hagen's study was not necessarily less interested in music technology.

Table 2

Mean Ratings and Familiarity Rankings of Various Technology Types by Gender

Type of Technology	Female (n = 85)		Male (n = 50)		Total sample (N = 135)	
	Mean (*SD*)	Rank	Mean (*SD*)	Rank	Mean (*SD*)	Rank
Word processing	4.71 (.55)	1	4.56 (.71)	1	4.65 (.62)	1
Web browsing	4.60 (.60)	2.5	4.52 (.68)	2	4.57 (.63)	2
Email***	4.60 (.64)	2.5	4.12 (.96)	3	4.42 (.81)	3
Multimedia/Interactive CD-ROM	3.12 (1.30)	4	3.52 (1.23)	4	3.27 (1.29)	4
Music notation*	2.91 (1.01)	6	3.38 (1.12)	5	3.08 (1.07)	5
Clip art graphics	3.11 (1.28)	5	2.96 (1.32)	6	3.05 (1.30)	6
Presentation software	2.55 (1.14)	7	2.44 (1.26)	8	2.51 (1.18)	7
Data processing	2.40 (1.27)	8	2.46 (1.25)	7	2.42 (1.26)	8
Computer Assisted Instruction in music	1.95 (1.08)	9	2.30 (1.43)	9	2.08 (1.23)	9
Creating web pages	1.87 (.84)	10	2.04 (1.12)	10	1.93 (.96)	10
Music accompaniment*	1.59 (.75)	12	1.96 (1.05)	11	1.73 (.89)	11
MIDI sequencing	1.60 (.79)	11	1.90 (1.06)	12	1.71 (.91)	12
Sound sampling and editing	1.37 (.57)	13	1.60 (.93)	13	1.45 (.73)	13
Database software for music educators*	1.27 (.52)	14	1.56 (.86)	14	1.38 (.68)	14

Note. 1 = have no idea what it is, 5 = very familiar with it.

* Significant difference at the .05 level.

*** Significant difference at the .001 level.

In contrast to the three music specific types mentioned above, female preservice music educators believed they were more familiar with e-mail, a nonmusic specific technology type focusing on interpersonal communications, than their male counterparts. The significantly higher rating of female preservice music educators' familiarity with e-mail could be related to Caputo's (1994) observation of the female's tendency to pursue relational and analogic ways of knowing. This notion was further supported by another recent study with college undergraduates (Jackson, Ervin, Gardner, &

Schmitt, 2001) where women used e-mail more than men. Jackson et al. (2001) suggested that this finding is consistent with women's stronger motive for interpersonal communication. A recent study of household Internet use also found that women spent more time in using e-mail than men (Boneva, Kraut, & Frohlich, 2001).

The near-identical ranking of the familiarity ratings between the female and male participants indicated that, regardless of gender, preservice music teachers believed themselves to be familiar with the same types of technology. This could be a reflection of the broader culture that has accounted for some types of technology, such as Web browsing and word processing. Nonmusic specific technology types, as such, tended to receive higher familiarity ratings for both women and men. Perhaps society is gradually accepting certain types of technology as part of contemporary lives for both genders. Caputo's (1994) belief concerning girls being "set up for failure on some level" (p. 89) could be gradually fading in some ways. Some nonmusic specific technology has become part of the cultural heritage (Swanwick, 2001), regardless of gender.

The technology types reported to be least familiar by both female and male students were music specific. This could be a reflection of the relatively infrequent use of technology in music education settings compared to the use of technology in general daily life. This suggests a possible area of weakness in the preservice music educator's preparation before they began the technology component of the music teacher training program. The need for more training in music specific technology appears to be inevitable.

College music education graduates are expected to be competent in a range of technological devices (Deal & Taylor, 1997). Given the results of this study, more emphases should be placed on some music specific technology, such as the last four listed in Table 2, and creating Web pages rather than other nonmusic specific applications, such as those ranked as the top four in Table 2. This strategy should allow preservice music educators to be familiar with the currently least familiar types and should allow them to be ready to be role models who are capable of using the full range of technology.

Although there were nonsignificant gender differences in the familiarity levels for most of the technology types, students in male group still believed themselves to be more familiar than the students in the female group with some of the music specific technology types. This suggests a specific challenge for music educators, especially in teaching areas where female teachers clearly outnumber male teachers (e.g., choral, general, keyboard, and special learners, Music Educators National Conference, 2001). Music teacher training institutions should be aware of this gender difference when teaching the use of music technology. Instructors should give female students more attention to help develop skills in using certain music specific technology such as notation, accompaniment, and database software for music educators. This is important because children of choral, general, keyboard, and special education should have chances to be exposed to, to

learn about, to use, and to see their music teachers (their role models) use technology.

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