Profiles, Perceptions, and Practices Related to Customizable Computer-Aided Instruction Among Postsecondary Aural-Training Instructors

Abstract

In this study, we examined demographic and educational characteristics of postsecondary aural-training instructors and their practices using customizable computer-aided (or assisted) instruction (CAI). Although numerous valuable CAI applications exist, one application was selected for the purpose of manageability. Respondents were postsecondary instructors who use MacGAMUT ($N = 278$). We determined that years of experience in teaching aural skills, years of experience in using the selected software, gender, and highest degree obtained may influence instructors’ uses of CAI. Conclusions focus on CAI as having positively impacting students’ learning of dictation, thus placing a greater responsibility on instructors to coordinate their uses of CAI thoughtfully with the curriculum.

Introduction and Purpose of the Study

With this study, we sought to contribute to the understanding of how postsecondary aural-training instructors use CAI. While studies in technology effectiveness have contributed to the development and legitimacy of aural-training CAI, they have largely neglected instructors’ approaches to CAI. In addition, it should not be assumed that all instructors who use CAI do so in the same ways; modifications in approaches to CAI may result in vastly varying educational outcomes. The purpose of this study was to determine, based on demographic variables and educational characteristics, the ways in which instructors approach the uses of CAI in their classrooms and curricula. By studying instructors’ uses of CAI, the aural-training profession can enhance
technological practices, and can address current and future needs in the profession among instructors who use CAI.

Because “literally hundreds” of aural-training programs are available (McGee 2002, 119; Rudolph 1996, 71), we selected a target group from one representative application for the purpose of manageability. To expand the knowledge base in aural-training technology integration, this non-experimental quantitative study targeted instructors who use MacGAMUT because this software is representative of numerous customizable instructor options that can be tailored to postsecondary curricula. We recognize that numerous CAI applications exist and play a vital role in postsecondary aural training; our purpose was to examine the functionality of representative software. Other CAI programs were eliminated because they contain components for sight singing, playing or singing with an accompaniment, improvisation, or composition (e.g., Band-in-a-Box, Hearing Music, Making Music, Playing Music, Practica Musica, SmartMusic); routines for primary- and secondary-school students (e.g., Alfred’s Essentials of Music Theory); or, have a game-based approach (e.g., Hearing Music). Approaches requiring minimal instructor interaction were also eliminated, including guided-instruction software (e.g., Music Ace) and Internet-based CAI (e.g., Teoria.com).

The software selected for this study was limited to one that encourages instructors’ hands-on involvement and emphasizes typical components of dictation skills in postsecondary education (intervals, scales, chords, melodic dictation, harmonic dictation, and rhythmic dictation). MacGAMUT and Practica Musica encourage instructors’ involvement through extensive options for creating custom content. Practica Musica was further eliminated because of components that are beyond the scope of this study (e.g., music theory, sight singing, playing or singing with an accompaniment, improvisation, composition).
Research Questions

Several research questions guided data collection for this study:

1. What are the demographic characteristics and educational backgrounds of postsecondary aural-training instructors who use CAI as a tool for teaching dictation skills?

2. What are the practices of postsecondary aural-training instructors who use CAI as a tool for teaching dictation skills?

3. What influences do demographic and educational characteristics of postsecondary aural-training instructors assert on their software usage practices?

Previous Research

While MacGAMUT was used in this study’s procedures to investigate instructors’ CAI practices, previous researchers who have studied aural-training technology have primarily been concerned with the effectiveness of, and students’ attitudes toward technology.¹ Unlike mixed results

in other areas of music education technology, all but one aural-training study (Tarratus and Spohn 1967) indicated that students using technology for dictation drill made significant improvements over students being taught solely with traditional methods of instruction. Because in-class dictation drills have generally been regarded as a waste of class time (Arenson 1984), aural-training technology has provided instructors with the option to spend less time on in-class drills and more time teaching dictation strategies or other areas of musicianship. Although some instructors use CAI as an entire replacement of in-class drill or rarely as an entire replacement for a traditional course (Cathey 2014), most use it as an out-of-class practice tool (Cathey 2013, 2014; Pembrook and Riggins 1990), implying that face-to-face instruction remains central.

No known previous researchers have investigated the influence of independent and dependent variables on instructors’ uses of aural-training CAI. Independent variables investigated in the current study were years of experience in teaching aural skills, years of experience in using the selected software, gender, and highest degree obtained. Dependent variables were importance of monitoring students’ software usages, impact of CAI on student learning, impact of instructors’ interactions and involvement with the software on student learning, impact of customization on student learning,
importance in requiring students to use Mastery Mode, importance in using Practice Mode, importance in using Make My Own Drills, and how often students are required to submit CAI assignments. Spangler’s thesis (1999) is perhaps the study that comes closest to the present one in terms of aural-training CAI use; however, he minimally addressed instructors’ interactions and involvement with CAI.

Literature in postsecondary instructors’ practices with aural-training technology was insufficient; therefore, literature on K-12 instructors’ uses of music technology was explored. Previous researchers have suggested that music teachers do not have the same type of training in technology as they do in other areas of music, and thus, they feel underprepared to incorporate technology into their teaching (Dorfman 2006, 2013; Meltzer 2001; Ohlenbusch 2001; Reese and Rimington 2000; Taylor and Deal 2003). While some extraordinary uses of music technology are being carried out in the K-12 classroom, the reviewed literature indicated that K-12 music teachers use administrative technology more frequently than music technology; yet, these music teachers ranked music CAI as the most important topic that should be included in professional development opportunities (Reese and Rimington 2000) and in the undergraduate music education curriculum (Ohlenbusch 2001). Further, the majority of K-12 music teachers lack formal training in music technology, and are rather self-taught or peer-taught (Reese and Rimington 2000). These findings show a need for music technology training and integration, especially in the various uses of CAI. Aural-training instructors, therefore, have an important responsibility in modeling, monitoring, and passing on technical skills related to CAI to the next generation of music educators.

Gender was explored based in a suggested need to investigate gender differences as a variable in achievement with music technology (Armstrong 2011; Blombach 2001; Dorfman 2006, 2013;  

Dorfman (2013) observed creative uses of technology on the K-12 level, such as an elementary school music teacher who assigned in-class iPad projects using GarageBand and SoundSlate (now, replaced by AudioBoard), and high school music teachers assigning students to compose music for movie trailers and creating podcasts with GarageBand.
Killam et al. 1981; Webster 2002, 2011). Gender equivalency in using music technology, as documented in the current study, was found in some studies (e.g., Bush 2000; Comber et al. 1993), while inequalities in respect to gender and music technology were found in others (e.g., Comber at al. 1997; Meltzer 2001). Earlier literature on gender differences indicated that males used computers (Comber et al. 1997; Dorman 1998; Meltzer 2001; Schofield 1995) and music technology (Meltzer 2001) more frequently than females. Recent studies (Albert 2013; Blanson 2013; Sorah 2012), however, have shown no significant difference in frequency of use or computer self-efficacy.

Methodology

Design

We designed a 31-item questionnaire for this non-experimental quantitative study. Ann Blombach—the designer of MacGAMUT—checked the accuracy of software-related details, lending item validity to the instrument. Blombach nor any other MacGAMUT employee initiated the study, provided funding, or had access to the anonymous raw data. An expert panel of advisors identified questions that were unclear or ambiguous, and gave suggestions for modifications. The survey was pilot-tested with an anonymous random sample of the target population. Cronbach’s Alpha was used to ensure the internal consistency of the instrument and was applied to the results of the pilot test before it was made available to the participants. Results of the pilot test yielded an overall alpha of .973, indicating a very reliable instrument. Because the MacGAMUT database is confidential, Blombach forwarded an email from the researchers with a link to the questionnaire (see Survey 4). Before an expert panel of advisors examined the questionnaire, the following changes were made based on Blombach’s recommendations: we removed the words “allow students to use” (Q15); removed “in a non-graded manner (practice mode)” and “in a graded manner (mastery mode)” because these response options were unrelated to the other response options (Q22); alphabetized textbook choices by author’s name to avoid a biased order (Q23); removed “for remedial work” to avoid appearing judgmental toward instructors who Prep Presets (Q24); added Presets and Libraries for Kostka and Payne’s textbook and Phillips, Clendinning, and Marvin’s textbook (Q24); added “I use my own libraries” and “Other libraries” (Q24); removed “timbre and volume of individual voices” because the default already allows students to use this option (Q29); deleted “identification of what must be notated, including the inner voices” because it was ambiguous (Q29); and added “allowing responses from a MIDI/Virtual Keyboard” (Q29).
Instrument) to all instructors in the database who have registered their software and have deliverable email addresses ($N = 1,717$). Blombach forwarded two email reminders written by the researchers in two-week increments. The respondents ($N = 330$) included 52 pre-college instructors who were eliminated from the results, leaving a final sample of 278 anonymous postsecondary respondents.

**Sampling Procedures**

We used as the population an entire database of instructors who use MacGAMUT. We did not exclude any postsecondary instructors who use MacGAMUT in the United States or other locales. This was an attempt to be more global by attaining a thorough census of these instructors; but, it was also beyond our control to stratify the sample because we did not have access to the confidential database of instructors and the database is not grouped by teaching levels, teaching specialties, institutions, or countries. Out of necessity, a census study was the only viable option for examining the target population. Unlike previous studies that limited data collection to the music theory coordinator (e.g., Pembrook and Riggins 1990), the necessity in using an entire database allowed us to recognize variations in individual pedagogical differences among persons with different academic ranks/positions which may have been overlooked.

**Data Analysis**

The data analysis for this study related variables; therefore, it extended beyond simple descriptive analysis and also used inferential statistics. Multivariate statistics were chosen to simultaneously analyze whether respondents, grouped using four independent variables, differed on eight dependent variables. Survey results were exported from SurveyMonkey to JMP Pro 9 Statistical Software, a version of SAS, to analyze the data. The level of $p = .05$ was used for all tests of

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5 Instructors who use MacGAMUT teach at institutions in Australia, Belgium, Brazil, Canada, China, Finland, France, Israel, Italy, Korea, Mexico, Nepal, Netherlands, New Zealand, Norway, Philippines, Slovenia, Sweden, Taiwan, Turkey, United Kingdom, and the United States (Blombach 2010).
significance. $P$ values less than .05 indicate that a difference between groups was beyond physical chance.

**Research Validity**

**Threats to Internal Validity**

Internal validity is the degree to which a research design rules out explanations for a study’s findings other than that the variables involved (Slavin 1984). The current research violated internal validity with selection threat. As stated in the section on sampling procedures, we did not exclude any potential postsecondary instructors who use MacGAMUT. Steps were taken to reduce additional threats to internal validity. We used an expert panel of advisors and conducted a pilot test with an anonymous, randomly selected group to ensure content validity of the instrument.

**Threats to External Validity**

“External validity, or generalization, refers to the degree to which the findings of a study using a particular sample have meaning for other settings or samples” (Slavin 1984, p. 109). No randomization was used in the current study because an entire target population was invited to participate. A threat to validity was a low response rate (19.22%; $N = 330$) in comparison to the entire population of instructors with deliverable email addresses who have registered their MacGAMUT software ($N = 1,717$). Due to the small sample size, low response rate, and lack of randomization, results and conclusions may not be wholly generalizable to the entire target population.

**Results**

The following results are sequenced according to three distinct sections of the questionnaire: instructors’ profiles, perceptions, and practices. Results conclude with an overview of inferential

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6 The actual number of current users is unknown because: (a) instructors remain in the database until they request to be removed; (b) free upgrades are given; and (c) some servers, email recipients, and anti-virus programs stop all mail from macgamut.com (A.K. Blombach, personal communication, 31 March 2011).
findings.

**Instructors’ Profiles**

Research Question 1 asked, “What are the demographic characteristics and educational backgrounds of postsecondary aural-training instructors who use CAI as a tool for teaching dictation skills?” Respondents had between one and 40 years of experience in teaching postsecondary aural skills ($M = 10.84$). Years of experience in using the selected software ranged from zero to 23 years ($M = 4.72$). The majority of instructors identified music theory/aural skills (66.19%) as the primary area of teaching responsibility, followed by applied music (13.67%) as the next highest response. Out of 26 identified primary instruments, piano (33.09%) and voice (12.73%) were most common. The majority (59.85%) of respondents indicated that they have obtained a doctorate, implying a well-educated sample.

The selected software is used among all career age groups. The average age was 43.8, ranging from 22-year-old graduate assistants to a 77-year-old professor emeritus. The most frequent respondents were 30 to 34 years old. Among the entire sample, associate professors and professors were the most common ranks, suggesting the inclusion of veteran professors. The sample consisted of a sizeable minority (30.94%) of part-time faculty, comprised of adjunct professors, graduate assistants, and high school music instructors who teach part-time at the postsecondary level. Table 1 displays gender, highest degree obtained, and academic rank or position of survey participants.

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7 Based on the current sample, piano was the most common primary instrument of the respondents. Further evidence for the prominence of piano is that the second highest primary instrument (voice) trailed behind piano by 20.36%. Moreover, applied music instructors (predominantly piano) comprised the second highest group of respondents, second only to instructors who primarily teach music theory/aural skills. This may imply that piano faculty members are being employed to teach aural training as one of their responsibilities.

8 The most common rank among 30- to 34-year olds was assistant professor, implying that these instructors may be experiencing excitement over promising new careers, and thus, an eagerness to make a contribution in aural-training pedagogy. Further, the majority of 30- to 34-year olds have used the software for one to three years, which may imply enthusiasm for new adventures in using CAI.

9 Lecturers (9.71%) and instructors (3.24%) comprised another 12.95% of the sample; however, it is unknown whether these ranks are full- or part-time appointments. If they are part-time appointments, the percentage of part-time faculty for the current sample could be as high as 43.89%.
compared to the population of music theory/aural skills instructors in the College Music Society (CMS) Directory. In comparison to the CMS data, the current sample and the CMS population have similar percentages of assistant professors and professors; yet, the percentage of doctoral recipients and rank of “instructor” were significantly different between groups. Among survey respondents, doctoral recipients were significantly higher ($p = .048$) than CMS, implying that doctoral recipients may be more likely than non-doctoral recipients to use CAI. Also, the rank of instructor was significantly higher ($p = .001$) in CMS than among survey respondents, which could be a result of nomenclature differences (e.g., adjunct instructor vs. adjunct professor).
### Table 1

*Survey Respondents and the CMS Directory*

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Survey Respondents</th>
<th>CMS Directory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Males</td>
<td>54.68%</td>
<td>58.88%</td>
</tr>
<tr>
<td>Females</td>
<td>44.24%</td>
<td>39.89%</td>
</tr>
<tr>
<td>Unknown Gender</td>
<td>1.08%</td>
<td>1.23%</td>
</tr>
<tr>
<td>Highest Degree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctorate</td>
<td>59.00%</td>
<td>45.04%</td>
</tr>
<tr>
<td>Master’s</td>
<td>34.17%</td>
<td>46.32%</td>
</tr>
<tr>
<td>Bachelor’s</td>
<td>5.03%</td>
<td>4.38%</td>
</tr>
<tr>
<td>H.S. Diploma</td>
<td>0.36%</td>
<td>Not an option</td>
</tr>
<tr>
<td>Artist Diploma</td>
<td>Not an option</td>
<td>0.30%</td>
</tr>
<tr>
<td>No Degree Reported</td>
<td>1.44%</td>
<td>3.66%</td>
</tr>
<tr>
<td>Rank or Position</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjunct Professor</td>
<td>14.39%</td>
<td>10.60%</td>
</tr>
<tr>
<td>Assistant Professor</td>
<td>15.11%</td>
<td>15.28%</td>
</tr>
<tr>
<td>Associate Professor</td>
<td>17.98%</td>
<td>14.43%</td>
</tr>
<tr>
<td>Professor</td>
<td>17.62%</td>
<td>17.45%</td>
</tr>
<tr>
<td>Visiting Professor</td>
<td>1.08%</td>
<td>0.85%</td>
</tr>
<tr>
<td>Professor Emeritus</td>
<td>0.36%</td>
<td>1.96%</td>
</tr>
<tr>
<td>Lecturer</td>
<td>9.71%</td>
<td>7.88%</td>
</tr>
<tr>
<td>Instructor</td>
<td>3.24%</td>
<td>16.60%</td>
</tr>
<tr>
<td>Graduate Assistant</td>
<td>13.31%</td>
<td>Not an option</td>
</tr>
<tr>
<td>H.S. Instructor</td>
<td>3.24%</td>
<td>Not an option</td>
</tr>
<tr>
<td>Artist in Residence</td>
<td>None</td>
<td>0.34%</td>
</tr>
<tr>
<td>No Rank Reported</td>
<td>1.08%</td>
<td>4.81%</td>
</tr>
</tbody>
</table>
Compared to the CMS data (Table 1), gender was fairly balanced with 10.44% more males than females; this is reflective of the profession, yet more evenly balanced than CMS. Academic rank, however, was conspicuously different. Females were employed most frequently in temporary positions as graduate assistants (16.26%) and contract positions as adjunct professors (15.45%). Males, on the other hand, overall had more stability, being employed most frequently as associate professors (21.19%) and professors (20.53%). Because 54.92% of females and 63.82% of males had obtained doctorates, highest degree obtained was apparently not the reason for rank differences.

The final demographic item assessed respondents’ experience with CAI. As a group, respondents identified 30 aural-training software packages they had used, indicating general proficiency in CAI experience. Besides the selected software, the most-used programs were MusicTheory.net ($n = 135$), Practica Musica ($n = 111$), Benward and Kolosick’s (2010) Ear Training: A Technique for Listening ($n = 73$), Teoria.com ($n = 72$), Auralia ($n = 63$), Horvit, Koozin, and Nelson’s Music for Ear Training ($n = 50$), Music Ace ($n = 38$), and MiBAC ($n = 24$). Three of the top CAI (MusicTheory.net, Benward and Kolosick’s Ear Training, and Teoria.com) are online sources, perhaps projecting mobile preferences of Digital Natives.

**Instructors’ Perceptions**

Instructors were asked about a variety of perceptions to determine their teaching effectiveness, most helpful training or technology support, and several software-related perceptions, such as the importance of demonstrating CAI to students. Perceptions were also used to identify the impact that the selected software and instructors’ interactions with the software have on student learning.

Respondents indicated self-perceived competency in their effectiveness of teaching dictation ($M = 4.51; SD = 0.85$ on a 6-point scale). Instructors who primarily taught composition or music theory/aural skills had a significantly ($p = .05$) more positive perception of their teaching
effectiveness than instructors in other music fields.\textsuperscript{10} Terminal degrees had the most positive impact on self-perceived competency among instructors with 10 to 15 years of teaching experience. Among instructors with 1 to 3 years of teaching experience, mean scores were almost identical for instructors with bachelor’s, master’s, and doctoral degrees. Also among this least experienced group, males were significantly higher ($p = .016$) than females with the same amount of experience; yet, there were more female doctoral recipients than male doctoral recipients in this group. As females gained more experience, their perceived effectiveness increased.\textsuperscript{11} Females with 10 to 15 years of experience had higher perceived effectiveness than males with the same amount of experience, and were significantly higher ($p = .008$) than females with 1 to 3 years of experience. The entire group of males, however, responded significantly higher ($p = .029$) than the entire group of females. Table 2 summarizes descriptive differences among groups.

\textsuperscript{10} Respondents who primarily taught composition had a significantly more positive perception of their effectiveness in teaching dictation than those who primarily taught instrumental ensembles ($p = .002$), choir ($p = .032$), and music history ($p = .042$). Instructors who primarily taught music theory/aural skills were significantly higher than instructors who primarily taught instrumental ensembles ($p = .019$) and choir ($p = .038$).

\textsuperscript{11} Females with 1 to 3 years of experience had a mean score of 4.00, compared to 4 to 9 years of experience ($M = 4.37$), 10 to 15 years of experience ($M = 4.86$), and 16 to 40 years of experience ($M = 4.52$).
Table 2

Perceived Effectiveness by Years Teaching Aural Skills, Gender, and Highest Degree Obtained

<table>
<thead>
<tr>
<th>Years Teaching</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 years</td>
<td>73</td>
<td>4.26</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>36</td>
<td>4.50</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>35</td>
<td>4.00</td>
</tr>
<tr>
<td></td>
<td>HS Diploma</td>
<td>1</td>
<td>6.00</td>
</tr>
<tr>
<td></td>
<td>Bachelor’s</td>
<td>10</td>
<td>4.20</td>
</tr>
<tr>
<td></td>
<td>Master’s</td>
<td>34</td>
<td>4.23</td>
</tr>
<tr>
<td></td>
<td>Doctorate</td>
<td>26</td>
<td>4.23</td>
</tr>
<tr>
<td>4-9 years</td>
<td>69</td>
<td>4.44</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>40</td>
<td>4.48</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>29</td>
<td>4.37</td>
</tr>
<tr>
<td></td>
<td>HS Diploma</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bachelor’s</td>
<td>2</td>
<td>4.50</td>
</tr>
<tr>
<td></td>
<td>Master’s</td>
<td>30</td>
<td>4.33</td>
</tr>
<tr>
<td></td>
<td>Doctorate</td>
<td>36</td>
<td>4.52</td>
</tr>
<tr>
<td>10-15 years</td>
<td>70</td>
<td>4.77</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>37</td>
<td>4.66</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>33</td>
<td>4.86</td>
</tr>
<tr>
<td></td>
<td>HS Diploma</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bachelor’s</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Master’s</td>
<td>15</td>
<td>4.53</td>
</tr>
<tr>
<td></td>
<td>Doctorate</td>
<td>53</td>
<td>4.86</td>
</tr>
<tr>
<td>16-40 years</td>
<td>61</td>
<td>4.57</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>36</td>
<td>4.61</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>25</td>
<td>4.52</td>
</tr>
<tr>
<td></td>
<td>HS Diploma</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bachelor’s</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Master’s</td>
<td>13</td>
<td>4.46</td>
</tr>
<tr>
<td></td>
<td>Doctorate</td>
<td>47</td>
<td>4.57</td>
</tr>
</tbody>
</table>

Instructors were asked to identify the most helpful training or technology support in using the selected software (Figure 1). The most common answer was “none,” followed by the software’s technical support, and “other” answers. Self-exploration of the program was the most common
“other” answer. Professional publications, conferences, and workshops were the least common responses.

Figure 1

Most Helpful Training or Technology Support

<table>
<thead>
<tr>
<th>Training/Technology Support</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>39.34%</td>
</tr>
<tr>
<td>Tech Support</td>
<td>21.69%</td>
</tr>
<tr>
<td>Other</td>
<td>9.93%</td>
</tr>
<tr>
<td>Observation of Colleagues</td>
<td>9.56%</td>
</tr>
<tr>
<td>Experience as a Student</td>
<td>8.82%</td>
</tr>
<tr>
<td>Video Tutorials</td>
<td>7.35%</td>
</tr>
<tr>
<td>Conference Demonstrations</td>
<td>1.84%</td>
</tr>
<tr>
<td>Workshops</td>
<td>1.10%</td>
</tr>
<tr>
<td>Professional Publications</td>
<td>0.37%</td>
</tr>
</tbody>
</table>

Pedagogical techniques used in conjunction with CAI were rated by their level of importance to respondents (Figure 2). On a six-point Likert-type scale, checking students’ statistics in Mastery Mode and counseling students on effective uses of CAI were the top two responses. Instructors were least likely to check details of the Dates/Times field to see how often and how much time students spend using the selected CAI.
On another six-point scale, instructors rated their perceptions of the software’s six aural elements for improving aural skills (Figure 3). Respondents identified Aural Intervals and Aural Scales as the most effective components for improving aural skills, while Harmonic Dictation was rated as the least effective.
Instructors also rated their perceptions of technological factors that impact students’ dictation skills (Figure 4). Respondents believe that their direct interactions and involvement with the software have the most positive impact on how well students learn dictation skills. Males and females believe with relative equality that the selected software also has a positive impact on student learning. Although CAI with customization features has the potential to provide powerful instructional and learning options that can be tailored to the curriculum and the diverse backgrounds and levels of students, respondents rated customization as the component that has the least positive impact on student learning of dictation skills.
Instructors’ Practices

Research Question 2 asked, “What are the practices of postsecondary aural-training instructors who use CAI as a tool for teaching dictation skills?” Practices data included a variety of behaviors, such as current use of the selected software, how instructors use the software, grading of CAI, and how instructors use Presets (default settings), Libraries, and customization features.

The majority (75.91%; \( n = 208 \)) of respondents were using the selected software at the time of the survey. Out of the instructors who had discontinued using the software, most (59.09%; \( n = 39 \)) had used it for zero to three years, implying that a lack of experience contributes toward discontinued use. Among all respondents, checking students’ statistics in Mastery Mode (\( M = 4.77; SD = 1.47 \)) yielded the most favorable pedagogical practice measuring hands-on involvement with CAI.

Respondents also believe it is important to regularly check students’ work using the statistics function (\( M = 4.14; SD = 1.61 \)), and require students to submit CAI assignments regularly (\( M = 4.33; SD = \))
1.44. Further, a strong majority (81.65%; $n = 227$) reported using MacGAMUT “as a requirement” with their students. Although most instructors require students to regularly submit assignments using Mastery Mode, overall, respondents had a slightly more favorable perception of Practice Mode ($M = 4.66; \text{SD} = 1.39$) over Mastery Mode ($M = 4.56; \text{SD} = 1.45$).

In this study, CAI assignments most frequently contribute 11-20% of students’ overall grades (Figure 5), leaving 80-89% for other elements such as exams, quizzes, homework, attendance, and participation. The selected software is most often used as a graded supplement to enhance other content, rather than for ungraded practice or extra credit.

Figure 5

*Percentages that MacGAMUT Contributes to Overall Grades*
As found in Figure 6, the selected software is primarily used as a required, out-of-class practice tool to supplement in-class dictation. It is less often used as an entire replacement of in-class dictation, and rarely used as an entire replacement for a traditional course.

Figure 6

*How instructors use CAI with their students*

Customization practices indicated that the majority (59.60%) of instructors customizes their uses of the CAI package. Gender was nearly equally matched: 59.09% of females and 60.00% of males customize, implying gender equivalency in technology competency. Instructors with 16 to 40 years of experience in teaching aural skills were the most likely to customize their uses of CAI.

Overall, 79.85% of instructors in this study make CAI Presets easier, rather than harder. They primarily customize Presets to fit the curriculum. In some courses, such as Fundamentals of Music, Presets are made easier, while in other courses, such as Aural Skills IV, Presets are made more

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12 Instructors were asked to select multiple responses.
difficult. Although instructors have several library files from which to choose, the majority (60.40%) of respondents use the software’s Original Presets and Libraries. Although instructors modify libraries, they typically do not create entirely new libraries. Further, the majority (75.58%) of respondents do not create new levels, indicating overall satisfaction with the packaged levels.

Instructors can modify any of the parameter or level settings in the software package in several ways. The most common are: (1) increasing the number of hearings before the first answer check, (2) allowing students to choose any tempo, (3) providing a choice of levels that students are required to complete, and (4) ordering levels that students are required to complete. The majority of customizing instructors allow students to have multiple hearings and reduce the tempo, implying that the software’s Presets are too challenging.

**Relationships among Instructors’ Characteristics**

Research Question 3 sought to determine the influences that demographic and educational characteristics of postsecondary aural-training instructors assert on their software usage practices. This question was answered by the use of two multiple analyses of variance (MANOVAs) and Post Hoc ANOVAs. MANOVA 1 was related to instructors’ perceptions, while MANOVA 2 was related to instructors’ practices. Dependent variables (DVs) for MANOVA 1 were importance of monitoring students’ software usages, impact of CAI on student learning, impact of instructors’ interactions and involvement with the software on student learning, impact of customization on student learning. DVs for MANOVA 2 were importance in requiring students to use Mastery Mode, importance in using Practice Mode, importance in using Make My Own Drills, and how often students are required to submit CAI assignments. Independent variables (IVs) used in both MANOVAs were years of

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experience in teaching aural skills, years of experience in using the selected software, gender, and highest degree obtained.

As seen in Tables 3 and 4, years of experience in using the selected software, years of experience in teaching aural skills, and gender had significant influences on the variability of dependent variables (DVs). Highest degree obtained did not have a significant influence on the variability of DVs in either MANOVA. Although statistical significance was found for years of experience in teaching aural skills (Table 4), the Post Hoc ANOVA did not reveal any specific interactions with DVs that were contributing to the statistically significant result. Thus, gender and years of experience in using the selected software were the only two IVs that revealed specific interactions with DVs (Table 5).

Table 3

<table>
<thead>
<tr>
<th>Identity</th>
<th>Value(^a)</th>
<th>(F)</th>
<th>(df)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Model</td>
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<td>1.69</td>
<td>32</td>
<td>.010*</td>
</tr>
<tr>
<td>Years Teaching Aural Skills(^b)</td>
<td>0.952</td>
<td>0.87</td>
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<td>.567</td>
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<tr>
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<td>4</td>
<td>.018*</td>
</tr>
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<td>Highest Degree</td>
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<td>1.01</td>
<td>12</td>
<td>.434</td>
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<tr>
<td>Years Using Selected Software</td>
<td>0.067</td>
<td>3.65</td>
<td>4</td>
<td>.006*</td>
</tr>
</tbody>
</table>

*Note.*

\(^a\) The value of each multivariate statistical test in the report

\(^b\) Aural Skills

\(p < .05\)
Table 4

*MANOVA 2 Results*

<table>
<thead>
<tr>
<th>Identity</th>
<th>Value</th>
<th>$F$</th>
<th>$df$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
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<tr>
<td>Years Teaching AS</td>
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<td>.015*</td>
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<tr>
<td>Gender</td>
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<td>.764</td>
</tr>
<tr>
<td>Years Using Selected Software</td>
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<td>4</td>
<td>.001*</td>
</tr>
</tbody>
</table>

*Note.*

$p < .05$

Table 5

*Significant Tukey-Kramer HSD Post Hoc ANOVA Test Results*

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variables</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of experience in using the selected software</td>
<td>CAI has a positive impact on student learning</td>
<td>&lt; .0001*</td>
</tr>
<tr>
<td></td>
<td>Instructors’ interactions with the software</td>
<td>&lt; .0001*</td>
</tr>
<tr>
<td></td>
<td>Customization has a positive impact on student learning</td>
<td>.004*</td>
</tr>
<tr>
<td></td>
<td>Required use of Mastery Mode</td>
<td>.005*</td>
</tr>
<tr>
<td></td>
<td>How often assignments are submitted</td>
<td>.011*</td>
</tr>
<tr>
<td>Gender</td>
<td>Monitoring student usages of the software</td>
<td>.017*</td>
</tr>
</tbody>
</table>

*Note.*

$p < .05$

As displayed in Table 5, statistical significance was found for the influence of gender on monitoring student usages of the selected software, in that females were significantly ($p = .017$)
higher than males. Monitoring student usages implies that females in the present study are spending time with students, and are likely to be instructive and relational in their interactions with students. From these results, it appears as though female instructors may be more likely to develop one-on-one relationships with students and to initiate positive instructional strategies, thus implying an interest in monitoring students’ work. Additional items related to instructors’ involvement with students’ work were investigated to determine if females and males interact differently in other areas. Females were also significantly higher than males in the importance of counseling students on effective ways to use the software \((p = .006)\), checking students’ statistics in Mastery Mode \((p = .049)\), and how often students’ work is checked using the statistics function \((p = .007)\).

Years of experience in using the selected software had the most striking influence because it demonstrated a significant relationship in both MANOVAs and had a significant influence on five of the eight DVs (see Table 5). In all five cases, the most experienced software users (four or more years of experience) indicated beliefs that were significantly different from the least experienced software users (zero to three years of experience). The most experienced software users require students to use Mastery Mode and submit CAI assignments, and believe that customization, CAI, and instructors’ interactions with the software have a positive impact on students learning dictation skills. The perception that CAI has a positive impact implies that experienced CAI users trust software’s ability to provide students with a personal tutor that can facilitate the acquisition of dictation skills. Longevity of using CAI increases instructors’ interactions and involvement with CAI, and the perceived value of CAI. Furthermore, longevity of using software also produces seasoned CAI users who maximize the benefits of customizable software in a meaningful way to aid students in the progressive stages of acquiring aural skills. The most experienced software users also represented the largest percentage of customizing instructors.
Although the Post Hoc ANOVA did not reveal any specific interactions with years of experience in teaching aural skills (see Table 4), instructors with 10 to 15 years of teaching experience (Group C) consistently had the lowest mean responses among the other groups\textsuperscript{14} of instructors for the importance of requiring students to use Mastery Mode, Practice Mode, Make My Own Drills, and requiring students to submit CAI assignments. Group C had the most amount of variance from the other groups.\textsuperscript{15} The exact reason for their unfavorable outlooks toward the software is unclear. One possible explanation is that Group C had the highest percentage (30.77\%) of instructors who have discontinued using the software package. Further, Group C differed from the other groups in that these instructors represented the highest number of doctoral recipients, the highest perceived effectiveness in teaching dictation, and the most confident group of females.

While years of experience in using the selected software had a significant influence on the importance of using Mastery Mode, none of the IVs had a significant influence on the importance of using Practice Mode or Make My Own Drills. This is due to an overall favorable attitude toward Practice Mode ($M = 4.66; SD = 1.39$), and an overall less favorable attitude toward Make My Own Drills ($M = 3.54; SD = 1.53$).

**Discussion of Results and Implications for Pedagogy**

The following discussion serves to address concerns and themes which emerged from the data analysis. It addresses software usage practices, lack of accessible professional development, gender, graduate assistants, years of experience in teaching aural skills, and generalizability.

\textsuperscript{14} Instructors in the sample were divided into four fairly evenly balanced groups: Group A - one to three years ($n = 73$), Group B - four to nine years ($n = 69$), Group C - 10 to 15 years ($n = 70$), and Group D - 16 to 40 years ($n = 61$). Mean ages for each group are: 34.4 (Group A), 39.8 (Group B), 46.4 (Group C), and 56.3 (Group D).

\textsuperscript{15} Group C had the most amount of variance with Group D ($p = .053$), which nearly reached statistical significance, for the importance of requiring students to use Mastery Mode. Group C also varied with Group B on the importance of using Practice Mode and Make My Own Drills, and with Group A for how often students are required to submit CAI assignments. Additionally, the least experienced group—Group A—indicated a higher average on requiring students to submit CAI assignments than the most experienced group of instructors—Group D.
Software Usage Practices

In this study, aural-training software is most often used as a graded requirement, implying that instructors place much confidence in the software’s ability to meet out-of-class dictation needs. Although most instructors require students to submit assignments using Mastery Mode, respondents were more favorable of Practice Mode than Mastery Mode. This may suggest that instructors place more value on the process of practice skills leading up to tested skills. On the other hand, possible negative student attitudes toward Mastery Mode may influence instructor perceptions.

Instructors indicated that their top pedagogical practices with CAI are checking students’ statistics, counseling students on effective ways to use software, customizing the software to meet pedagogical needs, and demonstrating the various uses of the software to students. Findings suggest that these instructors use a guided approach rather than an unguided approach when introducing students to CAI. It stands to reason that instructors who use a guided approach in teaching students how to use CAI are less likely to produce students who have resentment and frustration toward CAI. Furthermore, these instructors are probably less likely to discontinue using CAI.

Lack of Accessible Professional Development

Results from this study suggest a lack of accessible professional development training that is available regarding the use of CAI. Although the targeted software provides technical support and video tutorials, respondents overwhelmingly indicated that they had not used these materials, nor had they sought professional development in the use of the software. Perhaps delivery of training could be facilitated through online resources or networks of users.

A strong percentage (91.37%) of respondents either perceived that their previous student experience in using the software was unhelpful or they had no student experience, perhaps because some were students prior to the advent of the software. It appears that many respondents trained
themselves how to use CAI during their teaching careers, which raises curricular concerns regarding graduate preparation in technologies associated with aural-training pedagogy. Ideally, students preparing for the aural-training profession would benefit most from curriculum integration of CAI in their aural-training courses and learning how to customize CAI in their music technology courses.

The perceived ease in using CAI is a possible reason for the lack of training. Although respondents reported their own lack of training, they rated the importance of counseling students on effective ways to use the software as a top priority in pedagogical practices. Further study is needed on accessible professional development training opportunities.

**Gender**

This study provides implications that males are not technologically superior to females. Males, as a whole, responded significantly higher than females in one area—perceived effectiveness of teaching dictation—yet, this area is unrelated to technology competency or involvement with CAI. Neither male dominance nor gender difference in technology competency was found among instructors who use CAI. Males were not significantly more involved with CAI than females’ involvement with CAI, but were significantly lower in several areas.16 Instructors’ interactions with CAI are perhaps most noticeable in customization and checking students’ statistics because both require hands-on involvement with CAI. In customization, gender was nearly equally matched, implying gender equivalency in technology competency.

Females in this sample appear to interact differently with their students than male instructors. Significant findings imply that female instructors are more involved with CAI, have a high interest

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16 Males were significantly lower than females in monitoring students’ software usages, the importance of counseling students on effective ways to use the software, checking students’ statistics in Mastery Mode, and how often students’ work is checked using the statistics function.
for students’ success in the progressive stages of acquiring dictation skills, spend more time with students, and are likely to be instructive and relational in their interactions with students.

**Graduate Assistants**

Consistent with previous research (Collins 1979; Gillespie 2001; Nelson 2000, 2002), graduate assistants are used to teach aural skills courses. Graduate assistantships may provide valuable learning opportunities through observation of faculty members, grading experiences, and student teaching opportunities; however, they may not necessarily allow students to become engrossed in aural-training pedagogy and research, pedagogical resources, and learning how to use customizable CAI, among other topics.

The inclusion of graduate assistants may have influenced the overall results of this study. Over one-third of graduate assistants were not currently using the software package at the time of the survey, implying sporadic use of CAI, which could have skewed some of the data. Further, over half of graduate assistants do not customize. Many who claimed to customize were most likely answering questions based on how their supervisor customizes.\(^\text{17}\) This implies that graduate assistants lack hands-on involvement with CAI and training in using CAI.

**Years of Experience in Teaching Aural Skills**

Instructors with 10 to 15 years of postsecondary teaching experience (Group C) may have the ideal level of experience and confidence. Their mean age (46.4) places them in the middle of their teaching careers. The most experienced group (Group D; mean age = 56.3) with 16 to 40 years of experience declined in perceived teaching effectiveness possibly due to burnout or dissatisfaction with teaching. Group A (mean age = 34.4) with one to three years of experience required students to submit CAI assignments more frequently than any other group, possibly to impart any components

\(^{17}\) When asked about customization of the software’s Presets, Libraries, and default changes, common answers provided by graduate assistants included: “Not sure, my supervisor takes care of the presets”; “Not sure – I just grade”; “I don’t know.”
that they do not feel competent teaching. Group B (mean age = 39.8) with four to nine years of experience found Practice Mode and Make My Own Drills more important than any other group, implying an eagerness to explore the software’s ungraded modes. Interestingly, the overall sample generally had an unfavorable outlook toward Make My Own Drills. A longitudinal survey would be beneficial to study teaching effectiveness among Group D, determine software preferences of Groups A and B, and understand why Group C consistently had the least positive software attitudes. Further research should also address, “How long has it been since you last used the selected software in your teaching?”

Years of experience in teaching aural skills also influenced customization practices. In Group A, there were nearly an equal number of customizing and non-customizing instructors. Groups B, C, and D showed a gradual, continual increase in the number of customizing instructors, indicating that years of experience in teaching aural skills increased the likelihood of customization. Instructors in Group D were the most likely to customize their software uses. Most of these veteran instructors customize and have used the software for four or more years. Group D males rated Practice Mode higher than Group D females, which may suggest that years of experience in teaching aural skills influences males’ interest in students’ acquisition of dictation skills.

**Generalizable Characteristics**

Based on current findings, we believe that further research using similar demographic samples may produce comparable results. The following characteristics may be generalizable to samples of instructors who use other aural-training software titles. In the current sample, doctoral recipients outnumbered non-doctoral recipients, and the percentage of doctoral recipients was significantly higher when compared to the CMS population of music theory/aural-training instructors. It is possible that doctoral recipients are the largest educational group of aural-training instructors who use CAI. In
the current sample, the majority identified music theory/aural skills as their primary area of teaching responsibility. The current sample, predominantly comprised of four-year college/university (81.48%) instructors, had 20.19% more theory specialists than Anderman’s (2011) survey of aural-training instructors at community colleges. This may also be generalizable to the population of aural-training software users. Because the piano is the most accessible instrument for in-class dictation, it seems likely that the piano is the primary instrument of many aural-training instructors. In the current sample, piano was the most commonly identified primary instrument. Gender equality in customization practices was found in the current study. Further, females in the current study were more likely than males to monitor student CAI uses, counsel students in effective CAI uses, and check students’ statistics. It is also possible that other aspects of CAI use (e.g., how instructors use CAI with their students; most frequently-used components, etc.) are generalizable to users of other software titles. Further research is needed to determine if instructors who use MacGAMUT are more likely to assign a grade weight for CAI work in comparison to instructors who use other software titles.18 We recommend a replication of this study using other software applications.

Recommendations for Further Research

Harmonic Dictation

It is unclear from the data analysis why the software’s Harmonic Dictation is the least favorable component for improving dictation skills. Future research is needed to identify which settings are most frequently changed, reasons for changing default settings, and reasons for lower perceptions of improving dictation skills. Because harmonic dictation is consistently underprepared among incoming college music majors (Livingston 1982; Livingston and Ackman 2003), additional

18 Spangler (1999) found that instructors using MacGAMUT (n = 70) are more likely than instructors using other applications to assign a grade weight for CAI. MacGAMUT assignments most frequently contribute 11-20% (n = 24), 1-9% (n = 10), and 30-39% (n = 8) of the students’ overall grade. Although the majority (69.57%) assigns a grade weight, a sizeable minority (30.43%) use MacGAMUT as ungraded practice, extra credit, or “other.”
research is needed to investigate whether underdeveloped skills influence instructors’ perceptions of CAI’s ability to improve these skills. A study employing open-ended responses may provide useful information related to perceived potential problems in the design of various CAI applications, ways of meeting student deficiencies, and other variables related to harmonic dictation. While drill-and-practice and flexible-practice CAI are the most common types of aural-training technology, more research is needed in interactive software that appeals to constructivists.19

Graduate Training in Technology

Findings from the present study imply a lack of graduate training in technology preparation. The majority of respondents appeared to be self- or peer-taught in using CAI, consistent with previous research (Reese and Rimington 2000). Current graduate assistants exhibited a lack of hands-on involvement with MacGAMUT, training in using CAI, and knowledge of how their supervisor customizes the software. The majority of graduate assistants do not customize, which provides further support for a lack of graduate training in technology. Exploring graduate training in technology is another possible avenue of investigation that is needed.

Foundational Assumptions Regarding Technology among Digital Natives

Foundational assumptions regarding aural-training technology among current traditional-age college students is another beneficial topic to study.20 Digital Natives learn in “more mobile, customized, and varied ways” (Bowen 2012, xiii). Future researchers should investigate Digital Natives’ attitudes toward and preferences of aural-training technology for out-of-class practice. Researchers should also explore mobile computing opportunities in aural training, and investigate

20 Jones and Shao (2011, 3) indicated that this generation prefers to receive “information quickly” and has a “low tolerance to lectures.” Further, Bowen (2012) recommended a six-phase cycle that can be used to extend technology uses beyond the physical classroom as a means to create an interactive postsecondary environment for Digital Natives.
interactive software options in aural training that encourage creativity beyond a drill-and-practice model.

**Additional Suggestions**

Additional suggestions for further research include gender differences using other types of music technology, in-class practices of aural training, reasons for default changes, user-friendliness, reasons for discontinued use, and professional development. We also recommend a replication of this study using other software applications.
References


