Electronic Tablets and Choral Singing:

Initial Investigations

An Interactive Qualifying Project Completed in partial fulfillment

Of the Bachelor of Science degree at

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Abstract

In an age where technology plays a significant role in our lives, there is little research on the effect of technology on live performances, specifically singing, one of the most popular activities in the world. This paper provides research into how tablets might be better utilized to advance choral singing in a university setting. To answer this we analyzed existing applications, surveyed university choral students, and categorized a set of features that could make tablet computers a more useful tool.
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Introduction

Music has defined and altered cultural characteristics from religious ceremonies to joyful celebrations to orating stories as entertainment. Choral music has sculpted a definite niche of society designed to improve moods, transform attitudes, lighten situations, and even affect important decisions. Music has the unique ability to mellow or enrage, calm or invigorate.

In recent history computers and technology have molded nearly every aspect of our lives. The bridge between music and technology is much shorter than in other fields. Computer generated and enhanced music is popular, and will continue to become an important part of music. From AutoTune to Dubstep, advanced algorithms can change the tone and pitch of music in real time with many different effects. The music technology field is crowded with applications and innovation, however a major facet of music technology still remains in its infancy – education.

The use of technology in choral learning is quite bare, and this paper set out to find out not only why, but what changes could be made that would encourage more growth in this area. In an age where there are a plethora of mobile applications for seemingly every subject field and industry, musical learning assistance is unexpectedly absent. While there are some applications that strive to meld music and technology, they vary greatly in popularity and usefulness. By researching the applications that are commercially available, analyzing their purpose, and surveying a group of university choral singers, this paper proposes a set of features that may improve the technological education component for choral singers.
Although the research was limited by the number of students at WPI in the choral program, this survey was designed to target these choral students and get their insight into a field which they are already largely familiar with. The data not only shows that the needs of the students in the choral program are also needs of non-musically inclined students with the desire to learn singing, but also that anyone could benefit from the practices laid out in the survey for finding useful features for any industry. By comparing studies that have already been conducted with a survey performed with WPI students, the group was able to recommend a set of features to be included in a mobile application for use in the aid of choral singing.

**Background**

To fully understand the implications of the study and the process needed to complete it, previous studies were reviewed that had characteristics related to choral learning and technology that touched upon different topics that were the focus of this paper. Many different studies were found, varying widely in scope and accuracy in the relation to this paper. Some studies tried to relate technology and music on a large scale, such as musical instrument alteration, while others tried specifically to lessen the learning curve associated with choral singing.

One such research paper, *Effect of External Auditory Pacing on the Neural Activity of Stuttering Speakers*, depicts the effects of a metronome sound and the effect on speech impediments such as stuttering. By using the metronome sound, the researchers were able to improve the overall timing and stability of the stuttering while there was no real gain in the timing of the control group (Akira, p.
While not directly related to choral learning, the effect of technology aids such as a metronome on such speech impediments will likely show a positive correlation with the effect of the metronome on choral learning and singing development. This could be useful, because a feature such as a bouncing ball could be useful for students that struggle with keeping time with the music or background beat.

In a separate study, it was found that "While iPads are most effectively used in bulk in the classroom, there is still great potential with few or even one iPad. While having a classroom set is good for traditional whole-class instruction, fewer iPads actually promote more of an individualized one on one environment." (Bennett, p. 23, 2011). This goes to show that results could be seen in a classroom with even one iPad instead of trying to give one to every student. Early childhood educators are starting to heavily consider the use of iPads or other similar tablets to complement their teaching styles. Programs ranging as low as preschool level have started to integrate iPads into their curriculum. It can be used to help them later in life as the influence of digital technologies is more and more relevant in daily life (Beschorner, p. 17, 2013). Because technology is becoming increasingly engrained in our everyday lives, it is important that the music industry keeps up with the curve and use the power of mobile applications to aid choral singing.

On a different note, some current applications claim to have a positive effect on assisting with musical learning, such as SightSing. "Sight Sing Choral Learning is use to enhance your choral learning experience. It visually shows you the music, how to play the notes, and helps keep the tempo and notifies you of any deviations
from the proper tempo. It also offers the ability to start at any measure and adjust the tempo to a slower pace if you are struggling. Sight Sing Choral Learning offers a huge leap in choral education." (Vaught, 2014). Although not immensely popular, Sight Sing strives to directly affect choral students and help them keep time, a feature that this team found to be extremely beneficial for students trying to learn.

Even further studies were carried out that analyzed the similarities in temporal congruence in the brain of listening to different tempos of music and the effect on motor skills. The results were not hugely conclusive, although there was a relationship between the tempo of the music and the pace at which the participant performed the motor skill. If something as basic as walking with a beat playing helped participants keep time, there is a strong probability that the same method of keeping time would help choral students. As much as a metronome is effective in helping a pianist keep time, a visual or audible cue in a mobile application could keep students in time and aid in the learning process.

An overall result of many of the studies out there is that instructors that use different methods of teaching have greater results and more positive feedback from students. Instructors that use technology to aid their lessons along with unorthodox methods such as group performances and individual choral assignment performances in front of the class have great results. In an age where the average attention span of an adolescent is decreasing at an alarming rate, the learning process needs to shift concurrently and use tools that students are fully immersed in – technology.
Methodology

The start of our research was deciding which project opportunities the team wanted to explore. The group was essentially broken into three teams deciding which of three topics to research and fully develop. The bulk of the research at this point was using popular search engines to find various phrases that pertained to the effects of tablets on choral learning. Various searches including different keywords and varying the scope of our articles and research papers led to many different types of results. The searches with the largest scope were those that included all forms of technology using any form of music learning. These included terms such as, “choral learning technology” or “technology and singing”. The most specific search criteria dug into vocal chord construction and pitch frequency of specific tonalities. Everything in between ranged from existing mobile applications, touch pad features, visual cues that are used in mobile applications, the design analysis of the development of mobile applications, and user feedback ratings.

To select the recipients of the choral music survey, the group collaborated with organizations on campus that had experience in the subject as well as candidates that would typically use a mobile application with a select set of features. The sample population was chosen from students at WPI that were involved in the WPI Festival Chorus and Alden Voices Choral Group. Of all students and organizations at WPI, these students from these groups specialize in theatre and choral activities at WPI, so they were determined to be the best possible candidates. After establishing that this topic deserved further research, the type of research that was used in this study was qualitative as well as quantitative. Qualitative research
was used to gather a better understanding of how choral students can better learn through the use of tablets. In addition to the qualitative assessment, we used statistical analysis to determine the subset of students that used different types of technology, including iPads, tablet computers, smart phones, laptops, and even desktop computers. The research that was performed before the survey allowed a collected list of descriptions and features of various tablet applications.

After a lengthy list of applications was found, there was a rigorous process that reviewed the number of downloads, the credentials of the developers, the app store rating, and the customer reviews to narrow the list of applications to ten. These ten apps were used in a data collection survey sent out to the WPI Festival Chorus and Alden Voices. Survey questions were designed to gauge interest and familiarity of various applications and various features pertaining to choral learning.

The first question asked if the user had experience with Sonja, Sight-Sing Choral Learning, forScore, Choral Master, Better Ears for iPad, Ear Trainer, MuseScore, Woodchuck Rhythm. The following questions asked the user to indicate if they have owned an iPad, alternate tablet, smartphone, or any other device and if so for how long. From there, the survey went on to ask the participant to select any number of features that he would deem useful to someone learning choral music as well as someone that was experienced and was looking to improve. When provided with the option to enter in an "other" feature, some students mentioned converting music from PDFs to scores used in other applications. While this was slightly out of the scope of the project, it was nice to see that it was a feature that students cared
about. Overall, the data was gathered in a very strategic manner, and was detailed enough to get some hard set results.

After the data was collected, the statistical significance of each question as it related to the number of responses was determined. For all responses that had multiple selections, an origin to the answer was inferred, whether it be from a specific type of mobile hardware used, or whether the student had any experience with the given application. Finally, the top results were combined into a comprehensive list of features that were determined to be the most useful for students to learn choral singing. These features were collated into a formal recommendation for a further project to pursue and implement into a mobile application.

Results

At the start of the survey, participants were presented with a list of eight tablet applications geared towards assisting choral singers with practicing, learning, and performing music. For each application, they were asked if they had any experience with the app. The results show that usage of such apps is not terribly great, as half of the apps showed that nobody surveyed had experience with them, and usage rates among the others was low, with the greatest being the app Muse Score, which just over one-third of respondents had experience with. This confirmed the team’s suspicions that the mobile applications that were available were not widely known or used.
Next, the survey takers were asked to note which, if any, "smart" devices they owned, and then how long they had owned the devices for. The results showed that most respondents own smartphone, and many possess some sort of tablet computer. It also showed that the tablets had been owned for about 2 years on average, while the other smart devices were owned for about 3 years on average. So, even though tablet computers and smart phones are a somewhat new phenomenon, their use has increased dramatically over the past 4 years, and shows no sign of decline. Also to note is that even though students that possessed smart phones or tablets selected only one device, every student has a laptop or a desktop computer, or at least access to one on campus.

<table>
<thead>
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<th>Question</th>
<th>Experience</th>
<th>No Experience</th>
<th>Total Responses</th>
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<tbody>
<tr>
<td>Senja</td>
<td>1</td>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td>Sight-Sing Choral Learning</td>
<td>3</td>
<td>26</td>
<td>29</td>
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<tr>
<td>forteScore</td>
<td>0</td>
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<tr>
<td>Choral Master</td>
<td>0</td>
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<td>29</td>
</tr>
<tr>
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<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Ear Trainer</td>
<td>2</td>
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<tr>
<td>Muse Score</td>
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<td>29</td>
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<tr>
<td>Woodchuck Rhythm</td>
<td>0</td>
<td>29</td>
<td>29</td>
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</table>

2. Please indicate all devices you own:

<table>
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<th>Answer</th>
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| iPad                            | 10       | 34%
| Other tablet                    | 8        | 28%
| Smartphone                      | 23       | 79%
| Other (please specify)          | 9        | 31%

Other (please specify):
- ASUS Laptop (Windows 8.1) and Microsoft Surface (Also 8.1)
- Computer
- Desktop Computer
- iPod Touch
- Laptop
- Laptop
- Laptop
- Nexus 7 (Android)
Finally, the singers were given a list of nine possible features that they would be interested in seeing in a future app. They were also given the opportunity to provide their own ideas. Overall, features relating to practice and feedback appear less popular, whereas those dealing with ease of reading were much more desired. The most popularly requested feature was a warmup tuning aid. Those who submitted their own ideas often stated that the ability to import and export scores would be helpful. While some features were more popular than others, it is important to note that every feature in our list was important to be contained in a mobile application for at least seven of the students in our survey. This proves that the features available are widespread, but also widely useful for different types of students trying to learn choral singing.
## Conclusion

Based on the data collected there is a clear desire for a mobile application to improve choral learning. Many studies outlined the connection between technology and the music industry, but few of them described how to bridge the gap between choral singing and mobile applications. Because of the quickly evolving technology industry, there are not comprehensive studies between the connection of choral music and tablet usage, although some research papers proved the existence of positive feedback from students when incorporating technology into the curriculum.
The WPI festival chorus clearly showed a desire for a warm-up voice tuning feature, a sight reading guide feature, and a synchronized page turning feature along with other featured outlined in the study. The data also shows that mobile phones along with tablets and laptops would have an enormous on the music industry, and more specifically the choral singing aspect of music that has been popular for many years.
References


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Liow Bee Teen, Affendi bin Haji Ramli, Loo Fung Ying, *Raising Interest with Software


