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One-to-One Devices in University Group Piano: Preliminary Study of the Impact of Interactive and Static Technology

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The purpose of this study was to explore the initial impact of interactive and static technologies on group piano students' perceptions of achievement and motivation. Twenty-four non-pianist collegiate music majors were asked to practice a brief music excerpt for five minutes while using a static (YouTube video) or interactive (Wolfie iPad app) tool. Results indicated that there were no significant differences between the YouTube and Wolfie groups in terms of student self-reports for the impact of technology on motivation or achievement. However, analyses revealed that females' reports for how technology impacted motivation and achievement were significantly higher than those of males. These results suggest that more in-depth studies of one-to-one technology are needed to understand the role of static and interactive tools in music education. Longer exposure and repeated usage of one-to-one devices may produce different outcomes in comparing static and interactive tools in the group piano classroom. Such technology assistance may advance the actual and perceived motivation and achievement levels of students from childhood through college in the coming years, but only if these tools are properly understood and implemented.

Recently, technological tools have consumed much of the traditional music marketplace. Electronic and online materials that cater to music education have become increasingly pervasive, but research regarding the effectiveness of these tools remains limited (Whitaker, Orman, & Yarbrough, 2014). One-to-one technology, in which every student has access to a personal device containing educational resources, has been an increasingly prevalent avenue of investment in the nation's schools (Dorfman, 2016). However, research results indicate that data to support these investments are complex and contradictory (Cuban, 2010; Dorfman, 2016; Grant, 2011). Although it has been suggested that one-to-one computing models may enhance communication between schools and families (Grant, 2011), there is evidence that the practical implementation of technology in schools may be haphazardly planned and involves serious shortcomings in teacher preparation (Cuban, 2010).

Even though one-to-one computing is intended for use in all school subjects, research concerning the implementation of this technology in art and music classes has been rare (Dorfman, 2016). This current study will contribute to the need for research in this area. A pivotal aspect of technology is that it is continually reinvented and new devices become outdated very quickly.

Researchers cannot keep up with the steady stream of new programs. However, if educators begin to investigate overarching themes, such as the effectiveness of static versus interactive interfaces, then the body of knowledge generated can be transferred and applied to multiple advances in technology. Instead of teaching strategies for specific software programs, educators and researchers may find it beneficial to take a generalized approach in discussing the relationship between music and technological tools (Crowe & Rio, 2005).

Potential Benefits of Technology in Music Education

One way in which technological advancements can benefit the achievement level of group piano students is by making practice more accessible and convenient. Musicians generally accept the idea that strategically distributed practice over the course of days and weeks is more effective then long, uninterrupted practice sessions crammed into a short timeframe (Simmons, 2012). Using a device such as an iPad or laptop to store music scores, exercises, and notes can ensure that students have their materials everywhere they go, avoiding the limitations of a heavy textbook or access to a music school practice room. In this way, personal devices might impact student achievement positively. In addition, research findings have indicated that students possess a variety of strategies to solve musical problems, and that these different strategies may be a product of the gendered identities of students (Abramo, 2011). Therefore, gender must be considered in the context of music technology research.

Student motivation may also be impacted by the use of technology in the music classroom. It has been shown that motivation to play an instrument can be enhanced by positive attitudes toward peers, teachers, course requirements, and music in general (MacIntyre, Potter, & Burns, 2012). But, it is unclear whether motivation is affected by positive attitudes toward the materials used in practicing. For that reason, it is important to understand how technology impacts student achievement and motivation.

Some software developers claim that self-learning apps can replace the role of the teacher and guide a student through the necessary content knowledge and skill sets required to make music. This claim is not yet supported in the literature; however it is certainly worth investigating. The complexity and detail with which a student can process information develops with age and higher education levels (Bautista, Pérez Echeverría, Pozo, & Brizuela, 2009). Furthermore, in a study of young children in Singapore, the use of media was found to be increasingly relevant in most home environments, while the prevalence of family singing was increasingly rare (Lum, 2008). Technology that incorporates interactive music making may help music educators adapt to this modern day reality. According to Lum, "it is imperative for anyone examining the soundscapes of a family home in Singapore—and in much of the postmodern world of developed and developing nations—to recognize the significance of technology and media in exposing children to music" (2008, p. 113).

Interactive technology such as iPad apps that "listen" to a student and provide grades or other feedback based on performance achievement may be one way for students to acquire necessary feedback at home (or in a crowded group piano class) in combination with teacher instruction. Research findings have demonstrated that children who discontinued piano study within the first three years sought approval more often but received less feedback in their first few lessons compared to children who continued piano lessons for more than three years (Costa-Giomi, Flowers, & Sasaki, 2005) — perhaps technology could be used to provide early feedback for piano students between lessons. A key to future success in the field of music instruction may be the development of standards and protocols to assist teachers, administrators, and school districts in exploring the possibility of technology-generated feedback and other meaningful technological applications. Without guidelines and research implications for implementation, technology may be considered the "wild west" of music education in which every teacher is left to make sense of materials on their own.

Complexities of Time and Technology

Researchers may find it valuable to consider the amount of time that it takes to assimilate technology into the music classroom. In a study of the effectiveness of technology workshops for teachers, results indicated that teacher knowledge, comfort, and frequency of use could be significantly improved in just one week, but without continuing support, these three indicators decreased over time (Bauer, Reese, & McAllister, 2003). However, a distinction may be drawn between the time it takes to assimilate technology into the classroom versus measuring valuable reactions regarding the impact of technology on motivation and achievement. A content analysis of YouTube music education videos indicated that the mean video length is 243 seconds and that 65 seconds represented the most frequently occurring video length (Whitaker et al., 2014). The complexities of time and technology interactions necessitate further study.

Suggested Research Methodologies

Numerous research methodologies have been employed to study the use of one-to-one technology, but no particular method has found widespread support and success in music education settings (Dorfman, 2016). Some researchers have chosen to focus on sample size and how technology can be used in small-group collaboration (Chang, Liu, & Shen, 2012) or large-scale implementation in specific regions (Lowther, Inan, Ross, & Strahl, 2012). Studies in general education have most frequently used qualitative means, particularly single or multiple case study methods to explore the implementation of one-to-one devices (Donovan, Harley, & Strudler, 2007; Li, 2010). In his examination of music teachers' experiences with one-to-one technologies, Dorfman (2016) also chose a multiple case study design because of its frequency of use in one-to-one

technology implementation research, but acknowledged that his interpretative framework did not address all facets of the technological implementation.

Reacting to this lack of a common methodology amongst one-to-one technology implementation studies, the present study sought to explore the initial impact of technology, rather than its longitudinal implementation. In higher education, music majors come to required classes such as group piano with many different educational and musical backgrounds and technological experiences. These may range from high schools with one-to-one technology provided to schools with few technological resources. Thus, it is unlikely that a single technology will cater to the needs of every collegiate student. For that reason, initial student reactions to the technology, in addition to longitudinal implementation measures may provide useful information applicable for transfer in higher education settings. The current study used quantitative methods to explore the transfer of music performance/practice tools and technologies to specialized higher education settings. Existing literature indicates that the practice strategies utilized by high school wind players on the initial day of observation were most often repeated on days 2 and 3 (Miksza, 2007). This finding, and the practice behaviors of first-year collegiate group piano students that I have observed, indicate that the reactions and practice behaviors exhibited by students in initial practice sessions may demonstrate the routines that students are likely to continue in later practice.

Current State of Technology in Music Education

The National Association of Schools of Music (NASM) specifically requires all music students to be educated in how technology serves music (Crowe & Rio, 2005). However, the rapid changes that have brought the iPad to the forefront of music curricula have quickly altered the way in which teachers and students use and perceive of these tools. Based on their primary instrument and major, collegiate students may be required to have varying experiences with music notation software, MIDI technology, recording devices, and educational apps during their collegiate careers, but the extent to which first-year students are familiar with these tools is largely unknown. Assessing the initial student reaction to unknown technologies may be a valuable tool in evaluating the potential for highly specialized music students to quickly adapt to these tools in a short time frame.

Because much of the existing research has focused on longitudinal implementation of technology in music education classrooms (Dorfman, 2016), the impact of interactive and static music self-learning technologies on practice achievement and motivation in the fast-paced collegiate atmosphere is largely unknown. Research findings suggest that educators are still in the earliest stages of understanding the effects of technology on student success (Foldnes, 2016). However, there is a variety of literature that indicates self-learning technologies promote student engagement. For example, measures of indirect success such as increased student satisfaction were associated with individualized technology

implementation in higher education settings (Gilboy, Heinerichs, & Pazzaglia, 2015). Additionally, self-directed learning associated with technology may help students self-evaluate and keep track of their own progress (Kim, Kim, Kheara, & Getman, 2014). In K-12 education, survey results indicated that teachers identified increased student-to-teacher interaction and more time for varied instructional techniques in classrooms with self-learning technologies when compared to traditional classrooms (Gough, DeJong, Grundemeyer, & Baron, 2017). These findings indicate the potential for technology to effect positive change in student motivation and achievement.

Central Questions

Because of my background in teaching group piano classes, I have been interested in ways to increase student motivation for practice. One possibility is the usage of practice apps that have become available, but there is little research to indicate what role this technology might play at the college level, or how students would respond to various apps. However, a study of undergraduate business administration majors indicated that students reacted positively to interactive technology, and generally preferred courses that used the technology to those that did not (Guthrie & Carlin, 2004). Therefore, the primary research question for this study was: What are the effects of interactive piano practice apps on college music majors' perceived achievement and motivation as compared to static apps?

Although interactive materials may seem more useful than passively received tools, Whitaker, Orman, & Yarbrough (2014) completed a relevant content analysis of YouTube videos which found that piano/keyboard performances were the most prevalent topical performance videos, making up 37% of all performance-based music education videos on YouTube. The authors also found that the majority (65%) of all music education videos related to teaching were categorized as tutorials. The prevalence of both piano performance videos and tutorial content in music education videos on YouTube indicates that despite the static nature of the YouTube platform, this technology is pervasive in society, and potentially addresses many of the same practice concepts when compared to interactive piano apps. For that reason, this study sought to compare the use of static YouTube videos and the interactive Wolfie app in a controlled piano practice environment.

The purpose of this study was to explore the initial impact of interactive and static technologies on achievement and motivation, as self-reported by group piano students. However, little is known about how other factors, including gender, affect student use of practice-oriented technology. Results of previous research studies have indicated that gender differences in musical problem solving and in practice routines and practice effectiveness among music students were mixed, and were largely interrelated with other individual differences (Abramo, 2011; Miksza, 2006). The need for further research in this area led to the second research question in this investigation: Are there any effects attributable to gender

on student perceptions of achievement and motivation for interactive versus static piano practice apps?

Method

Participants

The participants in this study were 24 group piano students (18 males, 6 females) enrolled in their first semester of music study at a large Midwestern university. All participants had little or no piano experience prior to the semester in which this study took place. They were all music majors whose primary instrument was not piano. At this point in their study, these first-semester students had little or no interaction with one-to-one technology as a part of their group piano or other music courses. This study treatment was therefore viewed as a baseline introduction to the use of technology as a piano practice tool, with the intent of analyzing initial student reactions to combining their pre-existing practice strategy routines with the technology in a short time frame.

Participants were enrolled in three sections of the same class (Group Piano 1) with three different teachers who had previous experience teaching the course. One instructor was the coordinator of the group piano program (the author), one was a former graduate teaching assistant at the university who had just completed a Master of Music (MM) degree in Piano Performance and Pedagogy, and the other was a current graduate teaching assistant enrolled in the second year of the Piano Performance and Pedagogy MM program. The curriculum for the course was designed by current and former faculty members, and revised by the coordinator of group piano. Course calendars and content, syllabi, exams, and final projects were the same for all three sections, although individual differences in teaching style existed. These differences included the format for quizzes and assignments, use of pair, group, and collaborative work in class, and the pacing of each class. However, students in all three sections developed similar practice routines based on analysis, rhythm, pitch, and harmony pattern isolation, as well as various techniques designed to "break apart" a music score into manageable chunks. Students also developed the same skills through exercises pertaining to sight-reading, transposition, technique, harmonization, improvisation, and solo repertoire.

The music majors in Group Piano 1 were chosen for this study because they represented the largest population of group piano students within a single level of the curriculum. These students (in the twelfth or thirteenth week of the semester) had not received formal instruction in one-to-one technology or self-learning apps as a part of their group piano courses or in other music courses. However, data regarding the students' background experiences with technology were gathered and are reported in the results section.

Research Design

The independent variables used for comparison were type of one-to-one technology used (static v. interactive) and gender. In order to examine the effects of the primary types of one-to-one technology, it was necessary to compare the use of static, passively received resources versus interactive resources that require more critical thinking and engagement on the part of the student. I initially reviewed four interactive piano practice apps including Piano Maestro, Piano Marvel, the ABRSM Piano Practice Partner, and Wolfie. These apps are all designed for one-to-one technology application, and are marketed as useful practice aids in lessons, classes, and at home. Each app was analyzed based on content relevance, user friendliness, age appropriate graphics, affordability and equipment requirements, and diversity of repertoire. Based on these criteria, I selected the interactive Wolfie app for use in this study because (a) its practice steps seemed most similar to those espoused by Group Piano Level 1 instructors, (b) the interface proved user friendly to students of similar age and level as the participants, and (c) the graphics were designed to look like "real music" rather than cartoon based images for young children. Wolfie was a cost-effective option for future classroom use, and required no additional equipment, while also providing an ever-expanding catalog of repertoire and practice pieces. A YouTube video was selected as the static, passive stimuli for comparison because of the popularity of the YouTube platform and the existing literature regarding music education videos (Whitaker et al., 2014).

In addition to the type of technology, gender served as a second independent variable. This was based primarily on previous research regarding gender differences in practice strategies and problem solving of music students (Abramo, 2011; Miksza, 2006). Previous research findings have also suggested that males report more positive affective attitudes, higher self-efficacy, and more frequent use of technology, whereas females are more positive about online learning and appear to perform slightly better on computer-related tasks (Kay, 2008).

The dependent variables were student perceptions of the impact of technology on achievement and motivation. It is important to note that these variables were based on student self reports, and not teacher assessments or observations. Although the link between student perceptions of achievement and actual achievement has been largely unexplored in the literature, previous research indicates that perceptions of achievement may impact other factors related to actual achievement. For example, in a study of adult piano students, Cooper (2001) found that participants who rated their keyboard skills as "very good" or "pretty good" during childhood were more likely to enjoy lessons, playing, and practicing as adults. In the present study, perceptions of achievement and motivation were assessed using 5-point Likert-type items ranked on a scale from 1 (negative) to 5 (positive) to reflect how students felt about their practice and performance of the music excerpt during the treatment session.

Students were randomly assigned to complete one of the two treatments. They participated in individual ten-minute appointments, which included a

background survey, piano practice/performance treatment, and a post-treatment questionnaire. At the start of treatment, participants were instructed to use the technology-based tools in front of them to practice and eventually perform a music excerpt. Brief demonstrations of the technology preceded all treatment appointments. Both treatments involved studying the same sixteen-bar piano piece (Louis Köhler's *Melodic Tune,* Op. 218, No. 20)[1] without teacher assistance for five minutes. This piece was selected because it emphasized rhythmic, harmonic, and melodic patterns that students were familiar with from in-class sight-reading examples. The level of difficulty of the piece matched that of examples that students would deem as accessible in similar five-minute practice sessions used during their group piano classes. A five-minute practice protocol was also utilized because of the prevalence of music education videos of this length on YouTube (Whitaker et al., 2014), and the necessity to understand how brief treatment times can affect student perceptions given the pervasiveness of brief instructional exercises in self-learning technology.

Before students began their five-minute practice treatment, they had the opportunity to explore and ask questions about the use of their assigned technology so that the full treatment time could be devoted to incorporating the technology into their existing practice routines. Students in the YouTube group played from a printed score. Students in the Wolfie group read the music directly from the iPad app. The YouTube treatment group augmented their practice with a static (non-interactive) 23-second video recording[2] of the piece, and the Wolfie treatment group used an interactive piano self-learning app (Wolfie for iPad). The YouTube video included a performance of the piece with a view of the performer's hands. The Wolfie app included an interactive score and recording of the piece, which allowed students to adjust the tempo, hear hands separately, and get feedback on their own performance. After engaging with their designated technology, both treatments concluded with a student performance of the piece.

Both technology tools were presented in full-screen mode on an iPad so that students were not distracted by other apps or background functions. I remained present in the room during treatment to observe and take notes, but moved across the room from the student in order to minimize distractions. Casual observations based on these notes are included in the discussion session in the context of suggestions for future research. Both treatment groups completed an initial background survey to provide information about prior experiences, and the post-treatment questionnaire about their perceptions of motivation and achievement.

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[1] *Melodic Tune,* Op. 218, No. 20 can be found in *Masterwork Classics Levels 1-2,* compiled and edited by Jane MaGrath (Alfred Publishing, 1997).

[2] The YouTube recording used for this treatment can be found at the following link. https://www.youtube.com/watch?v=surobWaOfGQ

Results

Results from the background survey indicated that 67% of students occasionally used technology to practice piano, 12.5% reported using technology often in their piano practice, while another 12.5% reported rarely using technology and 8% of participants reported never using technology. Fifty-four percent of the students indicated that they were somewhat motivated to use technology to practice piano, 25% of responses were neutral, 12.5% indicated they were either not or not at all motivated, and only 8.5% indicated they were very motivated. While 58% of participants indicated that they believed technology would have a somewhat positive impact on their motivation to practice, 34% indicated technology would have no impact. Although no students indicated that the technology would have a very negative impact, small numbers of participants indicated that technology would have a somewhat negative impact, or that technology would have a very positive impact (4% for each response).

Group comparisons of post-treatment data were conducted via independent sample, two-tailed *t*-tests (.05 was the alpha level set for all statistical comparisons). The results of the *t*-test regarding student perceptions of the impact of one-to-one technology on motivation during treatment indicated that there were no significant differences between the YouTube and Wolfie groups (YouTube, M=2.33, SD=0.89, Wolfie, M=2.75, SD=0.97, $t(22) = 1.10$, $p > .05$). Regarding student perceptions of the impact of one-to-one devices on achievement during treatment, the results of the *t*-test indicated no significant differences between the technology groups (YouTube, M=2.83, SD=1.03, Wolfie, M=2.92, SD=1.08, $t(22) = 0.19$, $p > .05$). However, when analyzing student perceptions of the impact of technology on motivation during treatment by gender, the results revealed that female participants' ratings indicated that they believed that the technology affected their motivation more positively as compared with their male counterparts' ratings (Female, M=3.33, SD=0.82, Male, M=2.28, SD=0.83, $t(22) = 2.72$, $p = .01259$). The result of the *t*-test for gender and student perceptions of the impact of technology on achievement during treatment revealed similar significant differences between females' and males' self-reported ratings (Female M=3.67, SD=0.82, Male M=2.61, SD=0.98, $t(22) = 2.37$, $p = .02688$).

Participant ratings of the impact of technology on their motivation and achievement levels are displayed in Figures 1 and 2. Two-thirds of participants indicated that the technology had little impact (score of 2) or some impact (score of 3) on motivation. In student ratings of the impact of technology on achievement, two-thirds of participants indicated that the technology had some impact (score of 3) or moderate impact (score of 4), while one-fifth indicated it had little impact (score of 2). None of the participating students responded with a score of 5 (technology had a lot of impact) on the questions pertaining to the impact of technology on motivation or achievement.

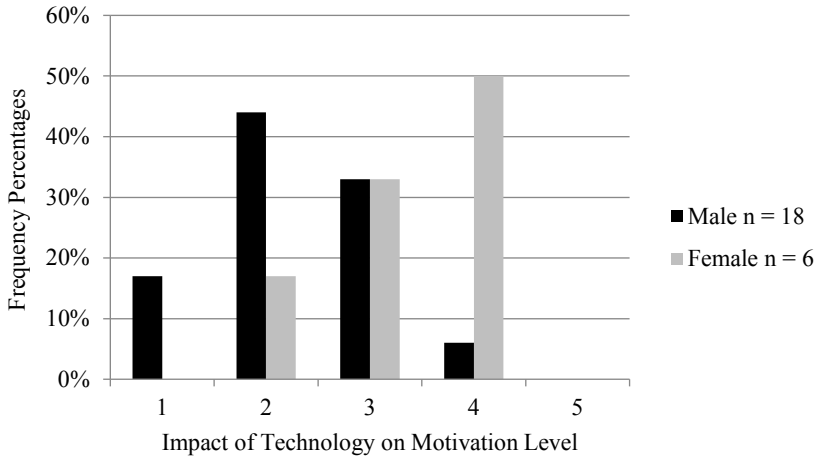

Figure 1. Student Perceptions of the Impact of Technology on Motivation *Note*: Likert-type items ranked as 1 = (negative); 5 = (positive)

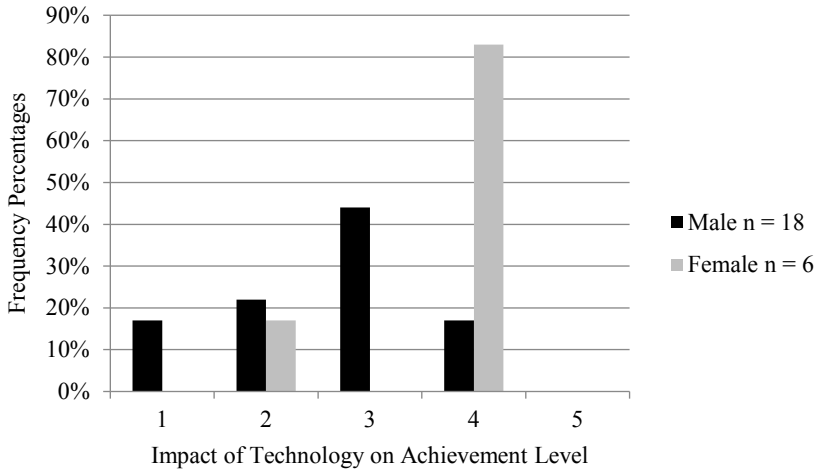

Figure 2. Student Perceptions of the Impact of Technology on Achievement *Note*: Likert-type items ranked as 1 = (negative); 5 = (positive)

Discussion

The results of this preliminary study suggested that the impact of technology on student perceptions of motivation and achievement were not significantly different for those who used a static resource (YouTube recording) versus those who used an interactive resource (the Wolfie app). However, the brief treatment

time of five minutes is a limitation when discussing the application of these results. My observations from the study and the classes I have taught reflected the basic premise that if students demonstrated efficient practice methods in the first five minutes, they would be better equipped to continue applying those strategies at subsequent levels of learning. But, longer treatments and repeated usage of technology may produce different outcomes in comparing static and interactive tools (Bauer et al., 2003). Current trends in music education have focused on longitudinal implementation studies with technology. Essentially, these longer and repeated usage implementations demonstrate the value in understanding the ability of students to adapt over time. In contrast, my perceptions in the context of this study and group piano teaching experiences indicate that with the wealth of one-to-one technology available, effective practice strategies can be accomplished in a short time frame, especially within the group piano class setting. Thus, analyzing the initial effects of students' brief technology use in conjunction with pedagogically sound practice strategies can provide useful insights. The results of both longitudinal and short-term studies provide valuable tools for music educators who are trying to ascertain how best to use technology in the classroom, even though they may produce seemingly contradictory results because of their differing design premises.

There was no observable impact of the researcher's presence during treatment sessions, but replicating this study with a video camera to monitor the students' practice may also be of interest to simulate a more realistic individual rehearsal. Casual observations made while students were engaged in their treatment sessions indicated that students demonstrated a wide variety of reactions toward both types of technology, and longer treatment times combined with repeated exposures may lessen the impact of initial student fears, frustrations, or ineffective practice strategies in coordination with these tools, resulting in a more accurate assessment of their use as practice aids. However, it is important to note that the average length of music education content videos on YouTube is brief (Whitaker et al., 2014). For that reason, analyzing how students react to technological practice tools in the 5-minute treatment protocol of this study is critical to understanding how to reach today's students, who may be increasingly likely to engage with technology for only a short period of time in their individual practice. Authors of future studies that investigate technology use in music education may consider how much time is necessary for successful implementation and analysis, as well as how brief practice protocols with these tools impact student outcomes.

Significant gender differences were evident in the student perceptions of the impact of technology on their motivation and achievement in this study. Although it would be inappropriate to generalize these results to larger groups of students, or to imply that females benefit more from technology use in group piano than males, these results suggest that further research is needed. Considering the brief treatment time, gender differences may represent initial student reactions to the technology in general, rather than the potential for technology to impact feelings of motivation and achievement over time. Understanding the ways in which female and male students differ in their perceptions of self with regard to practice

may lead to more effective teaching, feedback, and practice strategies for all students.

During my observations of the students' treatment sessions, I noticed that many had difficulty selecting appropriate practice tempi, despite the prevalence of tempo selection activities in each of the three class sections. Almost all of the students that used the static YouTube video practiced at the video's tempo and did not seem to consider the utilization of controlled, slower practice. Students who used the interactive Wolfie app were able to select from a range of tempi, but many still chose to practice on the faster end of the scale, even though slow and controlled practice could have been more beneficial. Because of the carefully chosen level and accessibility of rhythmic, melodic, and harmonic patterns in the music excerpt as well as its overall length (16 measures), the use of faster practice tempi is unlikely to be a result of the brief treatment time, especially considering the prevalence of tempo selection and control activities in student course content. However, this consideration may be taken into account in future studies with longer treatment times.

This observation regarding tempo selection contradicts previous research regarding middle school band students, whose choice to vary tempi was one of the most common practice strategies used in student self-regulated practice during the 20-minute sessions observed (Miksza, Prichard, & Sorbo, 2012). Although the comparability of the middle school band student study and the current study may be questionable given their differing protocols, sample sizes, and participant instruments and ages, tempo control remains an important factor to consider when incorporating technology and practice tools in music rehearsals. The unexpected phenomenon of tempo stagnation demonstrated in the present study was consistent in both groups of participants, and suggests that further research is necessary to understand how students select appropriate practice tempi, and how technology tools can make this selection process easier and more consistent. Music educators may consider realistic goals for students regarding tempo selection, as I did when selecting the treatment time and overall level of the music excerpt for this study. If students can quickly select an appropriate starting tempo to begin their practice, adapt their practice tempo from a static technology video, or change the setting on an interactive tool to reflect their chosen tempo, they may save valuable practice time and strengthen effective practice routines. Comparing self-directed practice with technology-directed practice may also provide insight for understanding differences in individual student learning and the expediency of teaching various other rehearsal strategies, including hands separate drills, blocking, chunking, and the isolation of transition material.

The wide range of pianistic fluency demonstrated by the participants also limits the interpretation of these results. Even though all participants were enrolled in the same level of group piano, and had similar backgrounds as non-pianist music majors, they represented numerous levels of piano accomplishment and comfort at the instrument. Researchers may wish to divide students into similarly leveled or matched groups based on their semester sight-reading grade in subsequent studies. This would allow researchers to compare the self-reported

motivation and achievement levels of students at various stages of fluency, as well as the impact of technology on perceptions of motivation and achievement over time. Investigations involving how students progress to more complex levels of learning may impact the development of technology tools that can assist students in capitalizing on the natural growth of their skills and understanding at the instrument (Bautista, et al., 2009).

Research about the prolonged effect of static and interactive technology is necessary to drive effective usage of new software and devices in the classroom. In a rapidly changing landscape of electronic and online tools, it is important that educators investigate the common themes and strategies that contribute to successful music practice so that the body of research on this topic can expand and produce continuing practical change. Combining existing research about gender, music background, and length of study with short and long-term technology use in the music classroom is a strategy that could provide valuable information to the community of music educators and researchers. Although student perceptions of their own achievement are valuable to assess, future research related to their actual achievement under various technology conditions should be examined. Technology assistance may advance the motivation and achievement levels of students from childhood through college in the coming years, but only if such tools are properly understood and implemented.

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Appendix

Background Survey

Consider these definitions and answer the following questions on a scale of 1 to 5.

Technology - In this study, technology refers to any electronic tool that can be used in combination with music study. This may include, YouTube videos, iPad apps, smartphone apps, online materials (music theory materials, metronomes, etc.) For the purposes of this study, technology does not include electronic keyboards.

One-to-One Technology - One-to-one technology refers to the trend of providing every student in a class with their own personal device (either an iPad, phone, laptop, or desktop computer), and using that device to share educational content. One-to-one devices can usually be used in class and at home.

Self-Learning Apps - Self-learning apps are applications designed to teach material without the necessity of a teacher. These apps can be used on iPads, phones, or other devices, and claim to teach the same material (in this case, piano skills), that a traditional piano lesson would include.

1). Have you ever used technology to practice piano?

1 - Never
2 - Rarely
3 - Occasionally
4 - Often
5 – All the time

2). How motivated are you to use technology to help you practice piano?

1 – Not at all motivated
2 – A little motivated
3 – Neither motivated or unmotivated
4 – Somewhat motivated
5 – Very motivated

3). Do you believe that technology can impact your level of motivation towards piano practice in a positive or negative way?

1 – Technology will have a very negative impact on my motivation to practice
2 – Technology will have a somewhat negative impact
3 – Technology will have no impact
4 – Technology will have a somewhat positive impact
5 – Technology will have a very positive impact

4). Do you believe that technology can impact your level of achievement in piano practice in a positive or negative way?

1 – Technology will have a very negative impact
2 – Technology will have a somewhat negative impact
3 – Technology will have no impact
4 – Technology will have a somewhat positive impact
5 – Technology will have a very positive impact

Post-Treatment Questionnaire

Consider these definitions and answer the following questions on a scale of 1 to 5.

1). Rate the level of achievement you demonstrated in playing this excerpt over the last 5 minutes.

1 – Low Achievement
2 – Okay Achievement
3 – Average Achievement
4 – Above Average Achievement
5 – High Achievement

2). Do you believe that the technology provided to you contributed to your level of achievement?

1 – Technology had no impact
2 – Technology had little impact
3 – Technology had some impact
4 – Technology had moderate impact
5 – Technology had a lot of impact

3). Rate your level of motivation in playing this excerpt over the last 5 minutes.

1 – Low Motivation
2 – Some Motivation
3 – Average Motivation
4 – Above Average Motivation
5 – High Motivation

4). Do you believe that the technology provided to you contributed to your level of motivation?

1 – Technology had no impact
2 – Technology had little impact
3 – Technology had some impact
4 – Technology had moderate impact
5 – Technology had a lot of impact

5). Do you believe that technology can impact your level of motivation towards piano practice in a positive or negative way?

1 – Technology will have a very negative impact
2 – Technology will have a somewhat negative impact
3 – Technology will have no impact
4 – Technology will have a somewhat positive impact
5 – Technology will have a very positive impact

6). Do you believe that technology can impact your level of achievement in piano practice in a positive or negative way?

1 – Technology will have a very negative impact
2 – Technology will have a somewhat negative impact
3 – Technology will have no impact
4 – Technology will have a somewhat positive impact
5 – Technology will have a very positive impact

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Funny Tests: Elementary Students' Performance and Outlook on a Music Test Employing Humor

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The purpose of this study was to examine elementary students' performance and outlook on a music test employing humor. The research questions were: (a) Will students who see a humorous picture at the end of test items 10, 20, 30, and 40 in the tonal portion of Gordon's Primary Measures of Music Audiation (PMMA) score significantly better than students who do not?,; (b) Will students in the treatment group significantly change their outlook on music tests?; and (c) Will students in the treatment group experience less cognitive fatigue on the tonal portion of Gordon's PMMA than students in the control group? The treatment group students scored significantly lower than the control group students, and I found no statistically significant difference between their outlooks on testing or levels of cognitive fatigue.

Introduction

Humor is an integral part of children's lives both at home and at school (Gervais & Wilson, 2005). Researchers have investigated diverse aspects of humor for five decades (e.g., Smith, Ascough, Ettinger, & Nelson, 1971) and there has been increased interest in and impact of humor research recently as evidenced by the appearance of several peer-reviewed journals and international societies for humor research (e.g., International Society for Humor Studies). Humor in educational contexts comprises a substantial amount of this recent surge in published research with investigations into instructional humor theories (Martin, 2007; Mottet, Frymier, & Bebee, 2006; Wanzer, Frymier, & Irwin, 2010), instructional humor frequency (Gorham & Christophel, 1990; Javidi & Long, 1989; Neuliep, 1991), classroom humor types (e.g., Frymier, Wanzer, & Wojtaszczyk, 2008), effects of humor on classroom environment (Bergin, 1999; Torok, McMorris, & Lin, 2004) as well as extensive literature reviews (Banas, Dunbar, Rodriguez, & Liu, 2011; Earleywine, 2011; Nilsen, 1993). Yet, among studies with children as participants, there are still relatively few investigations into humor compared to other essential parts of their lives such as social interaction or play.

Humor Studies in Educational Testing

Humor studies related to educational testing are most relevant to the current study and one of the oldest and most common methods in this facet of the

literature is inserting humorous items into exams to reduce test anxiety and improve performance (e.g., Blank, Tweedale, Cappelli, & Ryback, 1983; Deffenbacher, Deitz, & Hazaleus, 1981; McMorris, Urbach, & Connor, 1985). Some researchers have found incorporating humor to be detrimental to performance (Terry & Woods, 1975), whereas other have found no performance improvement (Berk & Nanda, 2006; McMorris, et al., 1985; McMorris, et al., 1997; Perlini, et al., 1999). Others have reported contradictory results, suggesting that humorous elements improved performance (Berk, 2000; Ford, Ford, Boxer, & Armstrong, 2012; Friedman, Friedman, & Amoo, 2002).

Students with high anxiety are a particularly studied subgroup in humor research, and several researchers have long predicted that test humor would be most effective with these students and least effective with relatively nonanxious students (e.g., Smith et al., 1971; Townsend & Mahoney, 1981; Townsend, Mahoney & Allen, 1983). With the exception of Smith et. al (1971), whose participants were undergraduate students seeing humorous multiple choice items for one third of a test, these researchers have not garnered support for this prediction. In fact, findings of several studies indicated that highly anxious students scored significantly better on nonhumorous tests than their relatively nonanxious colleagues (Blank et al, 1983; Townsend & Mahoney, 1981). Additionally, other researchers have found no significant interactions between instructional humor and test anxiety (Deffenbacher et al., 1981, Hedl, Hedl, & Weaver, 1981; McMorris et al., 1985).

Humor Studies in Music Education

Music education researchers have not focused on humor as a line of research, yet humor has appeared on the periphery of diverse facets of the literature for decades. LeBlanc, Sims, Malin, and Sherrill (1992) measured perceived humor in music and music preference of participants in grades three, seven, eleven, and college undergraduates. Listeners preferred music they thought was humorous, which LeBlanc et al. (1992) described as containing humorous lyrics and stories. The youngest and oldest participants perceived more humor and liked that music more, leading the researchers to conclude that the perception of humor was "largely a function of age" (p. 279). Teachout (1997) compared preservice and experienced teachers' responses to a list of forty important skills and behaviors practiced during their first three years of teaching. The sixth item read, "Have a pleasant affect, sense of humor." Preservice teachers ranked this item thirtieth while experience teachers ranked this twenty-fourth. Humor has also been a tool for improving musical performance. Brenner and Strand (2013) investigated teaching musical expression to young performers by studying five teachers of young musicians in diverse performance areas from violin to musical theatre. All of the teachers used humor in combination with other techniques during their modeling, and they listed the use of humor to help students relax with the audience, particularly in the realm of teaching creativity.

In practitioner literature, discussions of humor as a teaching tool are also slowly becoming more prevalent. Given (2015) has presented and published humor guides in peer-reviewed resources for practicing music teachers in which she argues that good teachers and good comedians share a common skillset in communication and delivery. In commercially available curricula such as "Quaver's K–8 Curriculum," humor is frequent in instructional episodes and advertising images as evidenced by silly costumes and graphics.

Need for the Study

In music education, teachers have relatively few published standardized tests from which to choose, even if they choose to do so. In some school districts, elementary school children take a standardized music test named Primary Measures of Music Audiation (PMMA) (Gordon, 1979). The PMMA is an eighty-item instrument for kindergarten, first, and second grade students in which they listen to two music patterns and decide whether the examples are the same or different. Students take a forty-item section, either tonal or rhythm, in one sitting. Music educators use Gordon's tests around the United States and they are the subject of many scholarly articles (e.g., Holahan, Saunders, & Goldberg, 2000). As part of my elementary music teaching responsibilities, I had employed the PMMA for six years and I noticed that students taking this forty-item test in one sitting were vulnerable to cognitive fatigue toward the middle of the test and test anxiety before the test, especially the first time they took it.

I found no published research on the effects of humor in combination with Gordon's PMMA. Given the prevalence of the PMMA in some school districts, however, it is reasonable to think that some practitioners are rewarding or encouraging their students during or after each forty-item test section, even if no one has studied their effects. The purpose of this study was to examine elementary students' performance and outlook on a music test employing humor. More specifically, the research questions of this study were: (a) Will students who see a humorous picture at the end of test items 10, 20, 30, and 40 in the tonal portion of Gordon's PMMA score significantly better than students who do not?; (b) Will students in the treatment group significantly change their outlook on music tests?; and (c) Will students in the treatment group experience less cognitive fatigue on the tonal portion of Gordon's PMMA than students in the control group?

Method

After securing IRB approval, participants (N = 128) were a convenience sample of four first-grade classes (n = 55) and five second-grade classes (n = 73) at a suburban elementary school in the northeastern United States. Out of all first and second-grade classes in the school, I selected two first-grade classes (n = 28) and three second-grade classes (n = 44) at random as treatment groups (n = 72). I also selected two first-grade classes (n = 27) and two second-grade classes (n = 29) at random as control groups (n = 56). I eliminated five participants'

responses because they were illegible. All students were taking the PMMA for the first time with no prior preparation or announcement.

Instrument

I used the tonal section of the PMMA in which students listen to two short tonal patterns and circle a response on an answer sheet to indicate if they think the excerpts were the same or different. Students respond to 40 items in one sitting, not including the four practice examples. According to its creator, the PMMA has test-retest reliability of .70 and split-halves reliability of .89 for students in grades one and two (Gordon, 1979). To measure students' outlook on testing, I used a five-point scale similar to the instruments used in LeBlanc, Sims, Siivola, & Obert (1996) and LeBlanc, Jin, Simpson, Stamou, & McCrary (1998) in which students circle one of five simple, cartoon faces after the directions, "How do you feel about music tests? Circle one face." The leftmost face was a frown, the second leftmost face was a slight frown, the center face was neither a frown nor smile, the second rightmost face was a slight smile, and the rightmost face was a smile.

Procedure

To ensure that the humorous pictures would be funny to most participants, I found ten images from the Internet that I thought first- and second-grade students would find humorous based on my experience as an elementary music teacher. Subsequently, I asked twelve elementary school teachers to pick the four images they felt the students would find most funny. I repeated this procedure with four classes of fourth-grade students. Finally, I asked six first-grade students who were not participants to complete the same task. On all occasions, I noticed spontaneous laughter in each group and there was consensus that four images were particularly funny. They were photographs of dogs making silly faces and posing with props such as sunglasses and electric guitars (see Figure 1). No selected image had text or captions below it. I recorded these images and used them with the participants.

During regularly scheduled music time, I informed each class that there was going to be a music test that day. All participants completed a five-point scale to describe their outlook on music tests. Then, I administered the tonal section of the PMMA. In the treatment group, I showed a humorous picture to participants after test items 10, 20, 30, and 40, after reading aloud the prompt, "Please look at this picture for ten seconds." The rationale for choosing to show humorous stimuli after these questions was simply to give a uniform amount of time between them. Students in the treatment group found the pictures very funny and some of them remained giggling long after the images were no longer visible. In the control group, I administered the test in the standard manner. Immediately after, all participants completed the identical five-point scale about their outlook on music tests, now that they had completed one. All testing took place in one school

week. After each class, to mitigate the internal threat of diffusion of treatment, I spent three minutes leading a discussion on the importance of not discussing the test with schoolmates until all students had completed it.

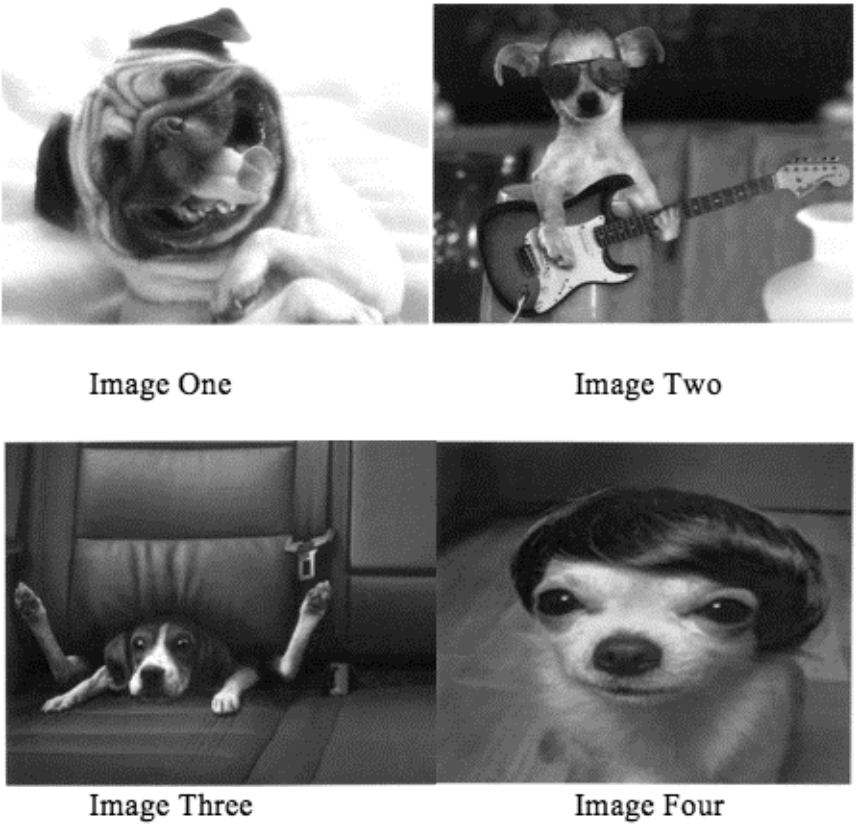

Figure 1. Funny Images for Treatment Groups

Results

To answer the first research question, if seeing humorous pictures after every ten test items affected standardized PMMA percent rank scores, I conducted an independent samples t-test. Using Levene's Test for Equality of Variances, I established that equal variances existed (F = 1.72, df = 126, p = .19). The treatment group students (M = 58.45, SD = 26.00) scored lower than the control group students (M = 69.51, SD = 22.79), and these results were statistically significant (t = -2.53, df = 126, p = .013). In order to examine the effect size of this difference, I computed Cohen's d and found an effect size of .45, suggesting medium magnitude of the difference, but not practical significance.

Table 1. PMMA Percentile Ranks and Outlook on Testing Results

Group	*n*	PMMA Percentile Rank (*M, SD*)	Pre-Test Outlook (*M, SD*)	Post-Test Outlook (*M, SD*)
Total	$N = 128$	(63.38, 25.14)	(3.85, 1.24)	(3.73, 1.40)
Treatment	71	(58.45, 26.00)	(4.26, 1.12)	(3.93, 1.36)
Control	57	(69.51, 22.79)	(3.39, 1.22)	(3.47, 1.43)

To answer the second research question, if seeing humorous pictures after every ten test items affected student outlook on music tests, I conducted an independent samples t-test using treatment as the independent variable and outlook change (mean gain score) as the dependent variable. Using Levene's Test, I determined equal variances ($f = .00$, $df = 126$, $p = .99$). Although the treatment group students ($M = -.29$, $SD = 1.54$) changed their outlook more negatively than control group students did ($M = .09$, $SD = 1.38$), these results were not statistically significant ($t = -1.46$, $df = 126$, $p = .15$).

To answer the third research question, if seeing humorous pictures after every ten test items affected cognitive fatigue, I conducted a mixed repeated measures ANOVA for the treatment and control groups using the raw scores of test items 1–10, 11–20, 21–30, and 31–40 as observation points one, two, three, and four respectively to see if scores were significantly lower as the test went on (see Table 2). I used the Box *M* test and found that the data did not meet the assumption of equal variances (Box $M = 29.23$, $p = .002$). In conducting the omnibus test, I used Pillai's Trace because it is the most conservative option and found a significant difference between means of the different observations ($F = 90.35$, $df = 3$, $p < .001$, partial $\eta^2 = .69$), with both groups' raw scores lowering in the third observation (see Figure 2). I used Mauchly's test and found that these data did not meet the assumption of sphericity (Mauchly = .998, $\chi^2 = 14.57$, $p = .01$). Therefore, using Greenhouse-Geisser, I found no interaction between the within-subjects variables ($F = 2.35$, $df = 2.78$, $p = .077$, partial $\eta^2 = .018$).

Table 2. PMMA Scores for Every Ten Questions

Section	Group	Mean	Standard Deviation	*n*
PMMA 1–10	Control	9.47	0.98	57
	Treatment	8.96	1.60	71
	Total	9.19	1.38	$N = 128$
PMMA 11–20	Control	8.53	0.98	57
	Treatment	8.11	1.34	71
	Total	8.30	1.21	$N = 128$
PMMA 21–30	Control	6.93	1.39	57
	Treatment	6.92	1.72	71
	Total	6.92	1.58	$N = 128$
PMMA 31–40	Control	8.49	1.34	57
	Treatment	7.76	1.72	71
	Total	8.09	1.59	$N = 128$

Discussion

The results of this study indicated that viewing humorous pictures after every ten items in the PMMA had a statistically significant negative effect on participants' percentile ranks. I found no statistical difference between the outlook change of the treatment and control group students. Similarly, I found no statistical difference between the groups with regard to cognitive fatigue. However, students' standard deviations became higher in both groups as the test was administered further (see Table 2). This increase means there was less agreement about the correct answers as the students progressed through the test. One explanation for this finding may be distraction.

In a similar effect to fatigue, distraction in this study could mean students may not have given their full attention to the test. The fact that the treatment group students scored more poorly than control group students did is unusual. The added humorous pictures may have distracted students. Perhaps they were thinking about the pictures long after viewing them, as evidenced by the spontaneous laughing I noticed when the pictures were not visible. The fact that the treatment group students did not have a statistically different outlook change than did the control group students is a curious finding. One explanation could be that the students disliked returning to the test after laughing, whereas control group students had no idea that taking a music test could be humorous. Another explanation could be that the students did not like the frequent mood changes in the classroom.

These results both corroborate and contradict previous researchers' findings, which lends credence to the idea that more research about the effects of humor is needed. The current study corroborates the minority of humor studies that document detriment to scores (see Terry & Woods, 1975), but contradicts researchers who found no performance improvement when humorous items were added (see Berk & Nanda, 2006; McMorris, et al., 1985; McMorris, et al., 1997; Perlini, et al., 1999). The findings of the current study contradict more recent research indicating that humorous elements improved performance (see Berk, 2000; T. E. Ford, B. L. Ford, Boxer, & Armstrong, 2012; H. Friedman, L. W. Friedman, & Amoo, 2002). Such differences invite speculation about all possible variables that could account for different results, including year of the study, personality traits of the students, and context specific situations such as school culture. In the current study, there were limitations that included my dual role as researcher and instructor, and the relatively small sample size that may have resulted in a Type II statistical error. Furthermore, there is the possibility that there were preexisting differences in the already formed classes which, combined with the lack of baseline data, necessitates caution in interpreting the data.

In the future, researchers should consider designing a study with three groups. The first group would take the PMMA in the standard manner, the second group would have a ten-second pause after every ten test items, and the third group would have ten seconds of viewing a humorous picture after every ten test items. This would help distinguish between the effect of ten seconds away from the test

material and ten seconds of laughter. One may also consider the intensity of the humorous pictures in future studies. In the current study, treatment group students laughed a great deal, perhaps to the point of distraction. The results may have been different if I had included pictures that were only moderately humorous to students. To control for this variable of humor intensity, future researchers may wish to conduct a pilot study in which participants rate potential humorous pictures on a Likert-type scale. Then, the researcher could use pictures or other humorous items that participants in similar populations thought were moderately humorous and not extremely humorous. Another variable to consider is students' age. LeBlanc et al. (1992) described the perception of humor in music as "largely a function of age" (p. 279), so it would be interesting to see if similar results happen with older students taking music tests with humorous stimuli.

More researchers would need to replicate and expand upon this study to produce reliable implications for practice, but the results of this study offer some preliminary thoughts about the relationship between humor and testing in music education practice. Incentivizing students with humor in a test may negatively affect performance, particularly if students find the stimuli very funny, because students may not be able to refocus their attention once they begin laughing. Humorous stimuli may be a tempting way to alleviate a perceived tedious task such as a forty-item binary-choice test, but unlike incentives such as treats or candy, humor's effects can last longer than the desired alleviation time. Similarly, inserting humorous pictures in a test may not increase students' outlook on testing. One may not wish to create a room full of laughter during testing unless one allows for time for the laughter to subside and for students to refocus their attention on the test. From the students' perspective, the work it takes to refocus after laughter may not be worth the initial laughter itself.

As an implication for both practice and future research, music education stakeholders may wish to more closely examine the relationship between humorous instruction (including assessment) and student achievement at all ages. Many music teachers want students to enjoy themselves in music class for a variety of reasons, not least of which is teacher accountability to administrators and students' families in K–12 teaching or student evaluations of professors in higher education. Many music teachers simply want all stakeholders to like them, and in North American culture, laughing is symptomatic of a good time. An entire industry exists to satisfy this demand as evidenced by the advertisements and catalogs of silly or humorous classroom posters, props, instructional toys, incentives, method books, and curricula which are sent to public school music teachers every year. However, the results of the current study indicate that excessive or very intense humor may lead to distraction and lower student achievement, which could then lead to student frustration and all the ills that entails. Therefore, music teachers who dedicate a large amount of their effort trying to make their instruction entertaining would be wise to put that effort into making better or more varied pedagogical choices. In such cases, sacrificing short-term enjoyment in the form of laughter for the long-term satisfaction in the form of higher achievement should be an easy choice for any music teacher.

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Effect of Related Instruction on Student Perceptions of Behavioral Characteristics and Instructional Patterns of an Expert Teacher

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The purpose of this study was to investigate the effect of related instruction on student perceptions of behavioral characteristics and instructional patterns of an expert teacher. Participants (N = 53) viewed video segments from four consecutive swim lessons between an expert teacher and a new student. The first viewing of these videos occurred prior to a series of classroom experiences over the course of a semester. Participants then viewed the videos a second time following the completion of the classroom coursework (15 weeks later). During both viewings, participants wrote observational comments. Results of a content analysis of 3,958 comments noticeably changed from surface-oriented observations to specific teacher and student behaviors and interactions as well as resultant change in the student's behavior and affect. Additional qualitative analysis of those same comments indicated a shift from surface level statements to comments regarding purpose and effectiveness.

Introduction

The primary goal of teacher education is to produce exemplary teachers. Significant time and resources are spent providing students with opportunities to develop teaching behaviors that they might employ to that end. One of the primary barriers to becoming an excellent teacher, however, is the effective and purposeful application of newly acquired knowledge and skills as effective teaching behaviors in various contexts. One might hope that students would obtain these characteristics of excellence from watching their daily models, but if students do not learn to adequately discriminate and/or perceive the presence of truly masterful teaching characteristics, it is unlikely that they will develop those skills in such a way that they might internalize these concepts and behaviors themselves.

When asked to describe what makes an effective teacher, students may be able to identify behaviors of teachers that they have had, but these will likely be surface level observations without the background, perspective, or ability to recognize and understand what exemplifies good teaching. Examples of great teaching are unlikely to serve as the models they should. In the field of music teacher education, the literature is replete with high-quality research investigating what exemplifies good teaching. However, there is not nearly as much information about students' ability to identify and define those examples.

Among the attributes contributing to effective teaching, it seems evident that students exhibit better learning and more willingness to learn in environments where teachers offer contingent feedback with an emphasis on approval, good eye contact, and well-paced instruction (Duke, & Henninger, 1998; Forsythe, 1975; Hendel, 1995; Jellison & Kostka, 1987; Joseph, Gregory, Mikami, Janetta, Hamre, & Pianta, 2013; Kostka,1984; Price, 1983; Sims, 1986; Yarbrough, 1975; Yarbrough, Price & Bowers, 1991). Though the maxim "good teaching is good teaching" generally applies across disciplines, the specific situational aspects of the environment will undoubtedly modify delivery of reinforcement (Forsythe, 1975) and relate differently to instructor personas (Schmidt, 1989). There is also little doubt that different activities impact the instructional environment even in the same classroom (Yarbrough & Price, 1981), and teacher experience (Goolsby, 1996; Hedden & Johnson, 2008; Moore & Bonney, 1987; Wagner & Struhl, 1979). It should be noted that while these independent attributes seem like common sense, this seemingly *prima facies* truth is the result of decades of substantial research.

While the aforementioned teacher behaviors have proven critical in the teacher/student paradigm, other researchers have looked at the gestalt of this interaction under the auspices of the descriptor "intensity." Teacher intensity was "defined as (1) *sustained* control of the student/teacher interaction with (2) efficient, accurate presentation of subject matter combined with (3) enthusiastic affect and pacing" (Madsen, 1990, p. 38). Research findings in this line have shown that intensity is situation-specific and related to the perception of a teacher's effectiveness (Madsen & Geringer, 1989; Madsen, Standley, & Cassidy, 1989; Standley & Madsen, 1987). Just as important, intensity can be taught, learned, measured, and identified by observers (Byo, 1990; Cassidy, 1990; Cassidy & Madsen, 1987; Madsen, 1988; Madsen, Standley, & Cassidy, 1989). However, similar to the quantification of "good teaching" itself, there was little agreement on the elements that went into creating the intensity even though subjects could agree on overall intensity evaluations (Madsen, Standley, Byo & Cassidy, 1992).

Another set of researchers examined the sequence of student/teacher interactions. While acknowledging that student behavioral change is more likely to occur when students receive information in a declarative manner at an age-appropriate level with a high ratio of positive to negative feedback, it seems clear that the *order* in which a teacher chooses to organize curricular activities is also extremely important (Duke, 1999). However, sequencing learning events was not original to music education research. Experimental studies in this area of

sequencing and direct instruction focused originally on mathematics instruction (Rosenshine, 1976). The component aspects of this direct instruction were (a) antecedent events, (b) instruction and student activity, and (c) reinforcement which were based on work by Becker, Englemann, and Thomas (1971). Subsequent researchers in the music education field then investigated the effectiveness of a lightly modified patterns of sequential instruction (i.e. *teaching cycles*: teacher instruction – student response – teacher feedback) and how that paradigm directly affects the teaching/learning process in a musical setting (Bowers, 1990; Duke, 1994; Goolsby, 1997; Hendel, 1995; Price, 1989; Price, & Yarbrough, 1994; Speer, 1994; Yarbrough & Price, 1981; 1989). This work has been done in the context of controlled experiments as well as in research that has examined expert teaching more qualitatively (Duke & Simmons, 2006; Johnson, Williams, Parisi, & Brunkan, 2015). Other researchers have categorized the components of observed elements of the teacher/student interaction in somewhat different ways. Much of the extant research has categorized these elements based on interaction function with sensitivity to the sequence of events. These researchers have tried to take very complex exchanges and reduce them down to their broadest components. In creating elements that have a comprehensive viewpoint, these models have been applied more widely.

In the area of observation, several researchers have examined students' behavior with regard to evaluating the teacher/student paradigm. In four studies specifically reviewed, it was found that highly positive, cheerfully intense delivery of instruction was perceived of as being the most effective by observers (Hamann, Baker, McAllister, & Bauer, 2000; MacLeod, & Napoles, 2012; Madsen, 2003; Redding, 2011). Three of these studies purposely counterbalanced excellent delivery and poor delivery with correct/good academic content and incorrect/bad academic content. Hamann et al. (2000) used 4-minute teaching segments with participants (511 music students from freshmen through graduate students). They found that each grouping of students was more positive in their evaluation of the teaching segments the older they were, and that good presentation coupled with poor content was preferred unanimously over poor presentation coupled with good content. Madsen (2003) examined the variables of delivery and content, but also added the element of student on-task/off-task behavior to the model. She also widened her participant demographics to include middle school students and experienced teachers. Her findings indicated that excellent delivery mattered more than any other variable and that experienced teachers were more affected by correct academic information than any other group, whereas middle school students were more affected by student on-task behavior than the other groups.

A review of what *constitutes* elements and models of effective teaching is not the same thing as *identifying* and *observing* effective teachers. It should follow that one cannot prepare students to be effective teachers without providing opportunities for students to discriminate between good and poor teaching. It is perhaps easier to become an effective teacher if someone has had an effective teacher as a model, but the key is having the awareness that the teacher is a

someone to copy while they had the model. Further, if students can identify those aspects of an excellent teacher's work that make him/her a master, the students may be much more likely to emulate those specific qualities.

The ability to clearly identify masterful teaching is not simply a byproduct of having experienced myriad teaching approaches over the course of one's academic life. It would most likely require one to actively and reflectively compare and contrast the various teachers one has had, and to identify specific characteristics and behaviors one might want to emulate, and do all of this *in situ*. Further, one would need to simultaneously observe the sequence and tempo of instruction as it has been found that the differences between good teachers and expert teachers might not be so much in what they do, but in when they do it (Duke, 2005). Of course, this observation is not on the same continuum as students who cannot even tell that the teacher is delivering misinformation. Clearly this is not a likely occurrence for even the most astute young person as they lack the benefit of the "big picture" perspective that the teacher is likely to have. Previous research findings have indicated that the observer needs to be extremely sophisticated in order to perceive all of the subtleties that occur in a teaching event. If we could get all students to the point where they are able to perceive and identify, we could then argue that they would have a better chance in being able to emulate great teaching. If that, then perhaps instruction of music teachers could be improved.

The question then becomes, how do we get students to move toward a more refined perception? The traditional fix for identified shortcomings has commonly been to have a class that addresses it. However, there has been little documentation of how related instruction, such as that provided by a class, might help students become more refined in their ability to perceive, identify, and emulate great teaching. For the purposes of this study, related instruction refers to academic activities that facilitate the understanding and implementation of teaching/learning concepts in a successive approximation model. These experiences, in turn, will require the student to transfer these concepts and skills into varied teaching situations. The purpose of this study was to investigate the effect of such related instruction in undergraduate music education training on student perceptions of behavioral characteristics and instructional patterns of expert teaching in a nonmusic situation.

Method

Participants

Participants ($N = 54$) were junior and senior music education students from two universities in the Midwestern USA. Participants included 53 music education students from two sections of the same class at one university and 11 music education students in one section of a similar class at the second university. The project was IRB approved, and while all students in all sections participated in the reported activity, only students who volunteered had their data included in

this study, resulting in a total of 53 students who began the project and finished both the pretest and the posttest.

Stimulus Recordings

In a previous study, Claudine, a swimming teacher, was documented to be an exceptional teacher (Johnson, Williams, Parisi, & Brunkan, 2016). Claudine teaches swim lessons in a one-on-one paradigm at a pool in her back yard. She does not give students the typical one-hour lesson, but instead schedules lessons for 15 minutes over four consecutive days. The lessons recorded for that study were with Nicky, a two-year-old boy with no swimming experience. Each lesson was videotaped by Nicky's parents using a handheld camera unobtrusively as possible.

In the previous research project, researchers viewed the lessons and a number of characteristics in Claudine's teaching were documented. Her pacing was remarkably quick, and her actions were extremely efficient in reaching target-learning behaviors. Perhaps the most striking characteristic of her instruction was the stable consistency of visual and verbal reinforcement. Until the student reacted appropriately to her instruction (not until the third lesson), Claudine's behavior was focused exclusively on the activity that needed to occur. She reinforced but did not waver from the task at hand. At first, her reinforcement was constant, but not contingent. As trust was developed between teacher and student, the reinforcement became much more contingent on the child's behavior. Teaching cycles (as outlined by Yarbrough and Price, 1989) were recorded using Scribe 4.2 (available from The Center for Music Learning at the University of Texas at Austin). Our analysis of data gathered from the Scribe program indicated that teaching cycle number increased as the lessons progressed. Researchers also found that individual physical tasks were more fully linked in subsequent lessons. The amount of time swimming also increased from lesson to lesson, while the time spent reinforcing decreased. Teaching cycle data are presented in Table 1.

Table 1. Teaching Cycles for Swim Lessons

Total Teaching Cycles	Lesson 1	Lesson 2	Lesson 3	Lesson 4
Complete Cycles	23	23	37	49
Linked Cycles	6	8	17	36
% time Instruction	12	8	15	17
% time Behavior	37	41	45	45
% time Reinforcement	50	51	40	38
Total time of lesson	10:38	13:30	13:35	16:22

For the current study, sample segments of 150 seconds were taken from each of the four recorded lessons. Each clip was selected approximately 35 seconds into each total lesson to remove any initial parent/teacher interactions (e.g., salutations). These segments were placed in chronological order so that participants could observe the progress of the swimming student over time.

Each 150-second segment was followed by 90 seconds of blank time (black screen, no sound) for continued reflection and data collection. The total time for the complete stimulus was 16 minutes in length, with four teaching episodes, each followed by time for reflection.

Independent Variable

The independent variable for this study was essentially instruction that consisted of a series of lectures and course activities designed to teach students classroom management, behavioral observation, and behavioral psychology techniques specifically in a music setting. To ensure that students from the two universities received nearly identical instruction, the two instructors agreed upon a set of goals and objectives. In order to meet these goals and objectives, every attempt was made to assure instruction was consistent including periodic check-ins to make sure instructors were complying with the agreed upon instructional techniques, goals and objectives, and calendars. The instructors used the same syllabus, course calendar, textbook, lecture notes, classroom activities, behavioral observation training, self-actualizing activities, and assessments. Lectures totaled approximately 44 hours of instruction. Stated objectives focused on classroom management through a behavioral approach. Higher order, or critical thinking skills, were also embedded throughout, as were objectives directed at aspects of systematic observation and scientific method.

Many class lectures were standard delivery of information regarding the theoretical aspects of behavioral psychology and how that can be applied to formal musical settings. Classroom activities included reviewing published behavioral research, reading condensed behavioral study synopses, and writing transfers of class lecture topics into experiences in students' academic preparation. The class also included behavioral observation time sampling training. During behavioral observation time sampling training, students watched videos of classrooms and were directed to attend to student social and academic behaviors both appropriate and inappropriate, teacher behaviors including giving approval and disapproval for appropriate and inappropriate student behaviors, and finally the combination of attending to both student and teacher behaviors. Following the behavioral observation time sampling training, students completed at least four formal observation experiences in actual public-school music classrooms. Self-actualizing activities included a self-shaping project where students were asked to collect data on and change a personal behavior over 26 days and a time log where students were asked to document their daily activities. These assignments were used to help students become more aware of their own behavioral patterns. In addition, students also completed IRB training and a small sample study of their own. Instructors intended that through all of these activities, students would become sensitized to recognizing and replicating outstanding instruction.

Dependent Variable

Participants recorded all of their observations and impressions during and between each of the four recorded teaching episodes. They were expressly told to include anything and everything that they observed. Each comment served as a data point for analysis.

Design

The design for this study was standard pretest/posttest with all subjects receiving the independent variable. Logic for the validity of not having a control group stems from the magnitude of the independent variable. Although a single group design in this case could lead to internal validity issues in terms of both history and maturation (Campbell & Stanley, 1963), the researchers still chose this design because the only way to have identical paired groups would require having some delay with the independent variable, which would have serious academic curricular ramifications. Therefore, all students were used in a single group design, without a traditional control group per se, for programmatic reasons with the pretest/posttest design utilized as an "own control" setting. This design allowed for comparisons between pretest and posttest, controlling posttest gains with pretest scores.

Procedure

The first viewing of these videos (pretest) occurred prior to the implementation of the independent variable. Participants were given a packet requesting their names (for matching purposes) and majors, and four blank sheets of paper for recording their observations. They were then read the following instructions:

> *You are about to see a DVD of four teaching episodes. The lessons are the first four swim lessons for a 2-year-old child. They are in chronological order. Each excerpt is 150 seconds long. For each lesson, please write your observations of the event. You may write about anything and everything you see. You may include any of your impressions. Please know that there are no correct or incorrect responses. Anything you write is indeed correct. There will be a 90 second break between lessons for you to write or write more. If you have any questions, please feel free to ask them now.*

Participants then viewed the four teaching episodes and wrote comments regarding their observations both during and after each observation. They were permitted to write during the teaching episodes, or to wait until each episode was over and then record comments. Comment packages were collected right after the 90-second blank time that followed the fourth teaching example. After the implementation of the independent variable (15 weeks later) participants viewed the videos a second time (posttest) following the same procedures as the pretest.

Results

All participant comments were typed verbatim into an Excel spreadsheet by the third author on this investigation. Subsequently, each comment was coded by the subjects' identification number, school of matriculation, major, pretest/posttest condition, and the teaching episode viewed. Two researchers independently analyzed and coded comments looking for patterns and themes, and developed a unique category system for these participants. Though previous research (Johnson, Williams, Parisi, & Brunkan, 2016) informed the project's starting point, researchers were free to interpret the comments as patterns emerged (Patton, 2002).

There were 3,958 comments classified using the categories in Table 2. As a means of triangulating the results, the researchers independently read the comments and created categories. They then met and negotiated a single group of categories for the submitted observations. All comments were then independently reviewed and assigned to a classification. After initial categorizations were assigned, all discrepancies were then viewed together until 100% agreement was reached on every comment. Example comments from participants can be found in Table 2.

Table 2. Comment Categories and Example Comments

Category	Participant Comment Example
Teacher Behaviors	
Behaviors – general	"(Teacher) is comforting child when screaming"
Approval	"(Teacher gives) positive and encouraging verbal feedback"
Disapproval	"(Teacher) will not let him quit the activity, he tries to turn over, she says "no not yet," gives disapproval of wrong behavior"
Attitude/Affect	"(Teacher) is smiling and staying patient"
Swimmer Behaviors	
Behaviors – general	"(Student) is constantly trying to cling to the guard/swim instructor"
Feedback	"Child screaming for Daddy"
Attitude/Affect	"(Student) likes to jump in the water, seems excited about it"
Participant Comments	
Observer Opinion	"The boy will have a lifetime fear of water"
Activity Identification	"Every time he goes under water he is put on his back"
Activity Intent	"(Teacher) is trying to teach baby to be comfortable in water"
Miscellaneous	
Pacing, Activity Order, Relative Comments, Setting, Student/Teacher Relationship	**"**Other children are in the pool" "Lady has sunglasses"

The number of comments for each category for both the pretest and posttest observations can be seen in Table 3. The total number of pretest comments categorized was 1,430. The total number of posttest comments was 1,462. Careful analysis of the response patterns reveals some striking pretest to posttest changes. One important difference noted in the nature of the comments was the dramatic increase in the number of comments directly related to Teacher Behavior overall and Teacher Approval to a lesser degree. Other differences noted in the posttest were decreased numbers of comments regarding Swimmer Behaviors, Observer Opinion, and Activity Identification.

Table 3. Pretest and Posttest Comment Classification

Category	Pretest		Posttest	
Teacher Behaviors				
Behaviors - general	229	16.0%	398	27.2%
Approval	105	7.3%	183	12.5%
Disapproval	1	0.1%	10	0.7%
Attitude/Affect	47	3.3%	58	4.0%
Swimmer Behaviors				
Behaviors – general	292	20.4%	153	10.5%
Feedback	19	1.3%	28	1.9%
Attitude/Affect	228	15.9%	277	18.9%
Participant Comments				
Observer Opinion	228	15.9%	156	10.7%
Activity Identification	225	15.7%	142	9.7%
Activity Intent	26	1.8%	21	1.4%
Miscellaneous	30	2.1%	36	2.5%
Pacing, Activity Order, Relative Comments, Setting Student/Teach Relationship				
Total Comments	1430	100.0%	1,462	100.0%

Differences in the nature of the participant comments were also noted when examining the four different lessons (see Table 4). Though differences from lesson to lesson were expected as each lesson contained its own elements, the patterns of change were interesting. These patterns might indicate shifts of attention paralleling activity shifts. For instance, categories of Teacher Behaviors had fewer and fewer comments progressively across the lessons, as Student Behaviors and Student Attitude/Affect showed a concomitant increase. Participant Opinions also proportionally increased. Though these patterns held for both pretest and posttest comments, it should be noted that the differences between pretest and posttest are also illustrated here. The percentage of comments regarding teacher behaviors are about 15% higher in the posttest overall, but higher by far in Lesson One, and decreasing across the four lessons.

Table 4. Comment Classification Pretest and Posttest Percentages by Lesson

Categories	1		2		3		4	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Teacher Behaviors								
Behaviors - general	23.3%	37.8%	22.5%	34.5%	13.6%	22.8%	10.9%	22.5%
Approval	9.9%	15.4%	7.5%	12.9%	7.9%	11.4%	6.2%	10.5%
Disapproval	0.2%	0.2%	0.0%	1.0%	0.0%	0.6%	0.2%	0.6%
Attitude/Affect	4.4%	7.9%	1.9%	5.3%	3.4%	3.2%	0.9%	1.9%
Swimmer Behaviors								
Behaviors - general	15.2%	3.0%	19.2%	9.5%	25.5%	12.4%	29.1%	16.5%
Feedback	2.7%	1.8%	1.7%	0.8%	0.8%	3.0%	0.6%	1.1%
Attitude/Affect	10.1%	15.4%	12.7%	16.6%	19.4%	26.8%	19.9%	18.6%
Participant Comments								
Observer Opinion	11.7%	5.9%	14.6%	7.5%	15.2%	9.5%	15.6%	15.4%
Activity Identification	15.9%	9.5%	16.1%	8.7%	11.5%	6.1%	13.7%	9.2%
Activity Intent	2.4%	1.6%	1.9%	1.6%	1.2%	0.8%	1.1%	1.7%
Miscellaneous	4.2%	1.6%	1.9%	1.6%	1.4%	3.4%	1.9%	1.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Discussion

Although the number of comments participants wrote in the pretest and posttest were similar in number (1,974 comments in the pretest and 1,984 comments in the posttest), the nature of the comments took a definitive shift between the pretest and posttest. Participants' comments shifted from an opinion and activity centered narrative to one that was more focused on teacher behavior, teacher reinforcement, and the impact these had on the swimmer's behavior. The shift in focus of participant perceptions from the pretest to posttest seems to indicate that the classroom instruction modified student observational behaviors.

During the pretest, participants tended to describe what they saw and how they felt about it. One of our favorite comments was "Maybe he is a little nervous because some strange woman is almost letting him drown." While perhaps a legitimate concern from one perspective, this comment may be limited because of particular student experience or perspective. Most of the participants reacted by creating a laundry list of activities with their corresponding opinions of how they felt about that list at any given time. The comments tended to be superficial, such that almost anyone not in the teaching profession could have written them. While previous research findings have indicated that topics crucial to good teaching include contingent feedback with an emphasis on approval, good eye contact, well-paced instruction (Duke, & Henninger, 1998; Forsythe, 1975; Hendel, 1995; Jellison & Kostka, 1987; Joseph, Gregory, Mikami, Janetta, Hamre, & Pianta, 2013; Kostka,1984; Price, 1983; Sims, 1986; Yarbrough, 1975; Yarbrough, Price & Bowers, 1991), delivery of reinforcement (Forsythe, 1975), intensity (Madsen & Geringer, 1989; Madsen, Standley, & Cassidy, 1989; Standley & Madsen, 1987), and sequential patterns of instruction (Bowers, 1990; Duke, 1994; Goolsby, 1997; Hendel, 1995; Price, 1989; Price, & Yarbrough, 1994; Speer, 1994; Yarbrough & Price, 1981, 1989), very few participants noted these topics

in their pretest comments. The majority of pretest comments seemed to indicate that participants were not aware of the actual cause and effect of behavior and reinforcement, much less teacher intensity, on/off-task, sequencing of instruction, or even eye contact.

Participants' posttest comments indicated a very different awareness from pretest comments. The comments focused more on topics of purpose and effectiveness. They were more specific to the task and/or teacher behaviors and used more technical terminology, and indicated understanding or intent as opposed to reacting or listing. For example, one participant stated "the teacher used a positive tone and approved behavior by the child." Yet another participant commented that "the teacher uses verbal positive reinforcement." There were many references to sequences as well as many comments that illustrated a viewing of the process, instead of a list of random observations. Participants saw patterns of behavior and sequences of instruction. The comments seemed to show a shift from outside observer to an instructor's point of view. For example, one participant first stated, "the child is very uncomfortable" whereas when viewing the same lesson in the posttest, the same participant's view seemed to shift with the comment "the teacher uses proper reinforcement and approval responses." It should be acknowledged that eventually, as documented by research literature, it is very important that the preservice professionals start viewing this teaching/learning event from the students' point of view. But at this point, the shift of attention to the teacher in this study was extremely encouraging.

The patterns of comments noted from lesson to lesson (Table 3) are interesting. Certainly, each lesson had different goals – which the swimming instructor anticipated based on prior experience. In her words, "the beginning of the second lesson is always the worst. In the first lesson the child does not know what is coming. The second lesson, they are not happy about what is about to happen." She also shared that usually by the third lesson things start to really break through. The student observations reflected this differing set of goals. Though there are some steady differences noted in the comments from lesson to lesson, these differences are most notable from the second to third lesson, particularly in the posttest observations. This observation seemed to document an "aha" moment that was recognized and mentioned by almost all participants in the posttest observations. It is important to note that these observations regarding progress of the student may have been the result of the student's ability to complete the task with more ease over time.

Previous research into the identification of great teaching has demonstrated that observers seeing excellent presentation of material will often evaluate that as excellent teaching, even when the material being presented is grossly wrong (Hamann, et al., 2000; MacLeod, & Napoles, 2012; Madsen, 2003). This study did nothing to control for the quality of the instruction being delivered. As demonstrated in previous research (Johnson, Williams, Parisi, & Brunkan, 2016), Claudine was noted to be a teacher of the highest quality, exhibiting many of the previously cited behaviors associated with excellent teaching. Her use of consistent and contingent feedback, reinforcement, intensity, eye contact, pacing,

and the fact that she let the goals of each lesson guide her teaching make the stimulus for this study of the highest possible quality. While there was clearly a shift in the perception level of the participants, the ability of participants to discriminate the quality of the academic information was not investigated, and warrants future investigation.

Another very pronounced limitation of this investigation was the potential for a pretest effect. The progression of the swimming student's experience in the stimulus video is somewhat dramatic. It is unlikely that students completely forgot the lessons, and the transformation that took place, after the pretest. One possible explanation for the shift in participant comments from mildly offended outsider watching these lessons to insightful observer is that when participants were writing the posttest comments, they had seen the sequences of the lessons before, and knew how the outcomes looked. Therefore, participants may have found it easier to understand the beginning, knowing the end. A future investigation might examine this differently by adding a posttest only group. However, part of the identified process in helping students to become excellent teachers is getting them to identify an effective teaching sequence and the ability to produce a lesson with the end in mind. Although the pretest/posttest design may have produced a pretest effect, it was no doubt beneficial for participants to have seen the sequence twice in terms of developing their observation skills. The change in depth of the observations, and identification of some of the teaching mechanisms operating in the teacher/student interactions, likely originated from the interim instruction.

A primary reason for using a setting removed from music was to attempt to see if participants could identify teacher behaviors in a setting outside the primary context of the course materials, discussions, and activities. Duke (2007) commented on the necessity for developing an understanding for basic principles of a specific skill or concept such that they can be transferred to myriad contexts and situations. It seems that if we are to educate and develop excellent practitioners of music education, we need them to be able both identify the component parts of instruction, regardless of subject context, and to understand what is going on at a level more discriminating than listing the activities. They need to infer the inner workings of the relationships – the behavioral causes and effects. If those inner workings are apparent to them, it then follows that they will have a chance to eventually understand those complexities. Only then may they be able to purposefully and meaningfully use those techniques to become more effective educators. It is very unclear if this series of lectures and activities was able to get participants to that level of sophistication. However, the apparent change in the type and depth of written comments from pretest to posttest imply that the participants were further down that road after receiving instruction as a result of coursework than prior to it.

Implications for Music Teacher Education

This study focused on the pre and posttest observations of students observing one expert teacher teaching a series of swimming lessons. The change of the

sophistication of those observations has substantial implications. At the onset of the project, students could only demonstrate a superficial level of understanding regarding the teaching event. After weeks of direct instruction on how to comprehend the aspects of teaching and learning that are present in every learning episode, students evidenced an increased level of discrimination. It is hypothesized that once students can observe, note, and identify the components of good teaching in a setting where they are not a part of the event, they will be able to take that ability and review their own teaching and determine the types of behavioral causes and effects that are occurring when they are instructing. This will then allow them to assess their own teaching with accuracy and give them the tools to modify their own instruction in such a way as to be more effective for their students.

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