

High School of Online Cello Playing:  
A Quantitative Analysis of Online Music Instruction  
via Video Conferencing Application

by  
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## ABSTRACT

Video conferencing applications, such as Skype, have long been used in classroom settings. Although musicians have been conducting online lessons for years, and institutions such as the Berklee School of Music and the Manhattan School of Music offer online music classes, scholarly research concerning online video conferencing music lessons is limited. Most studies of video conferencing lessons are based on subjective answers, making it difficult to yield conclusive results. As such, the only basis to evaluate the efficacy of video conferencing lessons are those from opinions. This study offers quantitative research on online video conferencing lessons. Between September and December 2017, 22 cello students from Muscatine High School received weekly private online lessons. Students filled out surveys using a Likert scale to rate these lessons and how they felt video and audio quality affected them. Students also received in-person lessons during October 23 or 24 to compare this experience to online lessons. The responses collected throughout the semester were compiled and sorted to reveal data trends. Using information derived from the data, this study concludes that online video conferencing lessons were less productive than in-person lessons but were still effective. In addition, average lesson ratings improved significantly after meeting in-person. In conclusion, this study found that online private lessons are feasible for high school students.

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## CHAPTER 1

### INTRODUCTION

The Internet has revolutionized communication by giving us the ability to share information faster than ever before. With new content being published daily, old archival works uploaded and stored, and even the ability to send and receive messages in real-time, the Internet has not only changed how we interact, but it has become a near-necessity of modern life.

For educators, online learning programs have grown steadily in the twenty-first century, providing new opportunities to reach students.<sup>1</sup> Because the content is delivered digitally, teachers and students are no longer bound by the barrier of having to be in the same room. Teachers can send written text and videos, and even communicate via live video conferencing platforms such as Skype and Facetime. Thanks to frequent improvements and increased access to these technologies, a student and teacher can now interact face-to-face without sharing the same physical space.

With the intrigue of online collaborations increasing, more studies are being published on this modern method of teaching. However, the vast number of these studies are founded on qualitative responses. While hearing the perceived experiences from others' trials and tribulations offers valuable insight, deriving answers from personal evidence would be inconclusive. Other studies that gathered numerical data to draw quantitative conclusions on the efficacy of lessons online used sample sizes too small to make a compelling statement.

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<sup>1</sup> John Watson et al., "Keeping Pace with K-12 Online Learning: An Annual Review of Policy and Practice," Evergreen Education Group (2011): 6, ERIC, ED. 53912.

The purpose of this study is to assess quantitatively the effectiveness of using online video conferencing technology, specifically Skype and Google Hangout, for long-distance cello lessons. By evaluating lessons numerically, this research document seeks to develop a statistics-based method to understand and improve the efficacy of online lessons.

### **Methodology**

This study is the first to collect substantial data in terms of both the number of participants and the duration of the study. Using Skype and Google Hangout for virtual cello lessons, video conferencing technology was evaluated for long-distance cello lessons in a public-school environment. In partnership with Dr. Jared Thompson and Mr. Jonathan Thoma from Muscatine High School in Muscatine, Iowa, I taught 22 high-school cellists weekly online private lessons between September 18, 2017, and December 15, 2017. Following each lesson, students were invited to fill out an anonymous Likert scale survey that aimed to assess their perceptions of the experience, including how they felt the technology impacted the lesson. To create a point of comparison, I also travelled to Muscatine and gave each student a lesson in person on October 23rd and 24th. Data gathered from lesson quality, video quality, audio fidelity, and student perception of technology affecting their lessons were compiled and sorted to analyze any correlations.

Chapter 2 of this study provides background on online education, including a brief history of the Internet, its integration into teaching, and a review of scholarly literature. Chapter 3 explains the procedures for gathering data for this study. Chapter 3 also details the procedures, recruiting process, and the logistics for this study. Chapter 4

explores relevant data gathered from the research and its potential implications. By sorting through data, this chapter presents observations and results. Chapter 5 provides questions for future studies, lessons learned, and concluding thoughts.

## CHAPTER 2

### BACKGROUND

#### **A Brief History of the Internet in Education**

The Internet, as we know it today, was created in 1989 when the World Wide Web (WWW) was released to the public. Prior to the WWW, network communication was done on ARPANET among scientific users at connected institutions.<sup>2</sup> While ARPANET was generally restricted to government business,<sup>3</sup> the World Wide Web was a decentralized way to post anything on the network. It gained in popularity once it was available cost-free in 1993.<sup>4</sup> It became so popular that 20 to 30 percent of classrooms were already utilizing the Internet as early as 1995.<sup>5</sup> Today, about 80 percent of Americans own a computer or portable device, the majority of which are connected to online servers.<sup>6</sup>

With the first online programs beginning in 1994,<sup>7</sup> music teachers soon followed suit. In 1996, the Manhattan School of Music's *Distance Learning Program* offered the first music classes via video conferencing technology.<sup>8</sup> A year later, renowned violinist

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<sup>2</sup> "Definition: ARPANET," *TechTarget*, <https://searchnetworking.techtarget.com/definition/ARPANET> (accessed February 27, 2019).

<sup>3</sup> Christopher Stacy wrote in the 1982 MIT Artificial Intelligence Laboratory guidelines that "it is considered illegal to use the ARPAnet for anything which is not in direct support of Government business," and "sending electronic mail over the ARPAnet for commercial profit or political purposes is both anti-social and illegal." (Source: Christopher Stacy, "Getting Started Computing at the AI Lab," *MIT Artificial Intelligence Laboratory Working Papers*, WP 295 (September 1982): 9, <http://hdl.handle.net/1721.1/41180> (accessed February 28, 2019).

<sup>4</sup> "History of the Web," *World Wide Web Foundation*, <https://webfoundation.org/about/vision/history-of-the-web/> (accessed February 27, 2019).

<sup>5</sup> Mel E Finkelberg and Noreen L Goggin, "Instructional technology in higher education teaching," *Quest*, Vol. 49 Issue 3, (August 1997): 280, EBSCOhost 9709233947 (accessed October 1, 2015).

<sup>6</sup> US Census, <https://www.census.gov/history/pdf/2013computeruse.pdf>, (accessed February 28, 2019)

<sup>7</sup> "History of Distance Learning," <https://www.worldwidelearn.com/education-articles/history-of-distance-learning.html> (accessed February 27, 2019).

<sup>8</sup> "About Us," Distance Learning @ Manhattan School of Music, <http://dl.msmnyc.edu/about> (accessed November 26, 2015).

and Manhattan School of Music (MSM) faculty member Pinchas Zukerman taught a masterclass from his New York office to students in Helsinki, Finland via video conferencing.<sup>9</sup> Outside of Manhattan, Berklee College of Music introduced Berklee Online in 2001, and while Manhattan's *Distance Learning Program* required participants to be connected live, Berklee Online offered both live and archived courses. With over 100 course offerings, classes from Berklee Online have even won University Professional & Continuing Education Association awards for "Best Online Course." Cincinnati's College Conservatory of Music violin faculty member Kurt Sassmanhaus began his Violin Masterclasses website in 2004 with a vast collection of short video webinars.<sup>10</sup>

One of the most successful examples of live video conferencing lessons was by Richard Aaron, Professor of Cello at the University of Michigan. Aaron first began teaching a family of cellists in Montana through a video system purchased for his office and the family's private home.<sup>11</sup> He accepted a position at the Juilliard School of Music several years later and installed a LifeSize Passport<sup>12</sup> into his teaching studio so he could teach at both institutions. This device allowed him to travel between two schools and work with one group of students in-person while teaching others online.<sup>13</sup> Aaron raved about the LifeSize service, saying:

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<sup>9</sup> Pirkko Juntunen, "Music Technology in Finnish String Instrument and Orchestra Instruction," *Fourth International Journal of Intercultural Arts Education: Design Learning and Well-Being*, (Helsinki: University of Helsinki, 2012), 5.

<sup>10</sup> Kurt Sassmanhaus, "Making of the site," Violinmasterclass.com, <http://www.violinmasterclass.com/en/about-us/making-of-the-site>, (accessed November 15<sup>th</sup>, 2015).

<sup>11</sup> NPR, "Big Talents Light Up Big Sky Country," *From the Top*, <http://www.npr.org/templates/story/story.php?storyId=92297624>, (accessed November 20<sup>th</sup>, 2015).

<sup>12</sup> A LifeSize Passport is a high-definition video conferencing system from LifeSize, a division of Logitech.

<sup>13</sup> LifeSize Communication, "World-Class Cello Professor from Juilliard Instructs Students Over HD Video," Logitech, Copyright 2011, <http://www.lifesize.com/~media/CB5910ED3DC34079A534C0DA0722AA82.ashx>, (accessed November 20<sup>th</sup>, 2015).

It's unbelievable... I can teach all day in Michigan in my office and go home and have dinner with my family... Life is much better... I really find no difference in teaching in person and teaching over video. After a couple lessons, I find that my students have totally adapted to the technology."<sup>14</sup>

The development of the Internet has revolutionized education. It has become an indispensable tool to send and receive information, thanks to countless resources on the Web and the capability to reach people through email or online video conferencing. Further, student/teacher interactions are no longer bound to a physical space and anyone can learn online.

### **Literature Review**

One of the earliest studies of video conferencing technology in education was published in 1997.<sup>15</sup> The article stated the numerous benefits of Desktop Video Conferencing (DVC) in the classroom, notably access to learning for those with geographical constraints. Software such as Enhanced CU-SeeMe connected computers through a local area network to send and receive video and audio, provided users had enough bandwidth. Unfortunately, the amount of compression required to make DVC possible reduced the quality of the image, making the video and audio received worse than those received via television.

In 2009, Richard Dammers evaluated the lessons of nine trumpet players from the Midwest who took lessons with a teacher from the East Coast using Skype. He concluded that while lessons were functional, specific elements of trumpet playing were difficult to evaluate and not "equivalent to face-to-face instruction."<sup>16</sup> Mario Ajero at Stephen F.

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<sup>14</sup> Ibid.

<sup>15</sup> Finkelberg, 281.

<sup>16</sup> Richard Dammers, "Utilizing Internet-Based Videoconferencing for Instructional Music Lessons," *Update: Applications of Research in Music Education* 28, no. 1 (November 2009), 23.

Austin State University in Texas connected pianos over the internet so that a student can play on one piano and the other remote keyboard would reproduce the movements of the keys, hammers, and pedals.<sup>17</sup> These lessons were thanks to Yamaha's pilot Remote Lesson Program, and Ajero said this came close to recreating an in-person piano lesson.<sup>18</sup>

Aaron Wilson designed a lesson plan similar to Berklee Online<sup>19</sup> by using asynchronous and synchronous instruction to teach a three-lesson course on basic trombone skills. He created a blog specifically for the study with multimedia content to rate a weekly lesson. Following each blog lesson, students had a video conferencing lesson. With nine students total, each participant received three lessons each, then answered a questionnaire, with questions 2-7 using a Likert scale (1=strongly agree and 5=strongly disagree):

1. Have you ever taken a private trombone lesson? (Y/N)
2. I was able to see the instructor.
3. I was able to hear the instructor speak.
4. I was able to hear the instructor play the trombone.
5. The delay in the video and sound did not keep me from learning.
6. I was able to access the website's instructional content (videos, pdf's, pictures) with ease.
7. The content on the website was beneficial to learning.<sup>20</sup>

The questionnaire was sent out at the conclusion of the study, with eight participants submitting a response.<sup>21</sup> While Wilson did use information gathered from participants to determine whether online trombone lessons were feasible, his data was

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<sup>17</sup> Mario Ajero, "Teaching Real-Time Music Lessons Over Videoconference," *American Music Teacher* 60.1 (2010): 45-46, ProQuest (accessed February 27, 2019).

<sup>18</sup> Ibid.

<sup>19</sup> Aaron Wilson, "Bridging the Virtual Gap in Internet Based Music Instruction: A Feasibility Study in Trombone Performance Education," (DMA thesis, University of North Carolina at Greensboro, 2013): 26, ProQuest Dissertation and Thesis Global.

<sup>20</sup> Wilson, 43.

<sup>21</sup> Ibid.



largely concerned with the logistics of online pedagogy. Because the survey was sent only at the end of the study, the sample size was limited.

Sarah Comerford in her thesis at Memorial University of Newfoundland concentrated on the development of effective online music pedagogy through analyzing data from the School of Music's 2011 E-Music Lesson Project. Research on distance learning is crucial for education in Newfoundland and Labrador due to their remote location, and the original project sought to answer the following questions:

- 1) To what extent, and by what means, can the nurturing pedagogical environment of traditional one-to-one music lessons be replicated through distance learning?
- 2) What are the best practices for teaching one-to-one music lessons through distance technologies?
- 3) What role might high school music teachers have in supporting their students who are studying an instrument via distance technologies?<sup>22</sup>

Using a special POLYCOM network, Comerford collected qualitative data from lessons taught between September 2011 and March 2012 with a team of twelve teachers working with twelve high school students on nine different instruments. Comerford's focus was on the pedagogical considerations of online video conferencing lessons based on the observations of the E-Music Lesson Project. Each teacher was paired with an observer to evaluate teaching and learning, technical setup, and rapport with students. Comerford wrote 22 recommendations for teachers considering individualized private lessons online, including protocol for lessons with poor connection, using asynchronous

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<sup>22</sup> Sarah Comerford, "Growing Musicians in the 21<sup>st</sup> Century: Recommendations for the Delivery of Online Music Education to Rural Communities," (Major Research Paper, Memorial University of Newfoundland, 2013): 35.

communication in between lessons, and discovering creative ways to adapt to teaching online.<sup>23</sup>

### **Internet Connection Speed**

While the Internet was expanding with content, concerns about accessibility began to increase. George Litterst wondered in 2003 in the *American Music Teachers Journal* whether online lessons would be feasible for people outside of academia.<sup>24</sup> In his journal article, he wrote that his cable modem connection speed was “1000 kbps to 1,700 kbps,” which was unsuitable for videoconferencing at home.

Latency, bandwidth, and routing directly relate to the quality of video data sent in conferencing.<sup>25</sup> When latency is low (10-20 milliseconds), the connection between computers will accept more data packets so that a computer can send more info. High latency (120-180 ms or more) means that the network can accept fewer packets at a time. In other words, higher latency means that video and audio quality drops off as information races through the network fibers between computers.<sup>26</sup>

According to a study by the Eastman School of Music, videoconferencing music performance was deemed achievable with latency levels below 86 ms.<sup>27</sup> Two common

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<sup>23</sup> For all recommendations, see Comerford, Chapter 6, 78-85.

<sup>24</sup> George Litterst, “I’ll See You Later: Teaching Long Distance, *Star Trek* Style,” *American Music Teachers*, 53.3 (2003): 52, EBSCOhost (accessed February 15, 2019).

<sup>25</sup> Latency refers to the delay during the transfer of data. Bandwidth is the amount of data that can be sent in a period of time. Routing is the process of selecting the path for network traffic.

<sup>26</sup> A good representation is shown in Aaron Wilson’s dissertation. He writes about sound delay in real time (chamber music, orchestra, marching band, etc) and face-to-face musical experiences. Sound travels approximately 1 foot per 1 millisecond, so latency level is low in chamber music but can be over 150 in marching band. Because light travels faster than the speed of sound, visual cues are paramount to ensemble precision. (Wilson, 18).

<sup>27</sup> Christopher Bartlette et al., “Effect of Network Latency on Interactive Musical Performance,” *Music Perception: An Interdisciplinary Journal*, Vol 24, no. 1 (September 2006): 49.

factors that determine the latency of a device include the quality of the modem and the distance the data has to travel.<sup>28</sup> Cable modem latency is typically 5 to 40 ms, Digital subscriber line (DSL) ranges from 10 to 70 ms, and dial-up is around 100 to 220 ms. As for data, it travels at roughly 120 miles per ms, and adds 1 ms of latency for every 60 miles.<sup>29</sup> For example, a video conferencing call over commercial Internet from Tempe, AZ to New York City, estimated to be 2,400 miles according to Google Maps, would add an additional 40 ms in the best case scenario. The additional latency will likely be greater as the data travels through multiple routers and modems, so the level of streaming is dependent on both the quality of devices and the strength of network.

A new network system called Internet2 emerged during the midst of the online revolution. Made up of large-capacity fiber-optic cables, Internet2 is now used by 317 US institutions of higher education and can connect to computers with an ethernet cable.<sup>30</sup> Internet2 led to the development of the LoLa project by the Conservatorio di Musica Giuseppe Tartini from Trieste in collaboration with GARR, the Italian Research and Academic Network in 2005.<sup>31</sup> LoLa, acronym for LOW LATency, is a free software for non-commercial academic uses that requires a high-end PC and a high-end bandwidth connection like Internet2. Primarily designed for real-time music collaboration, LOLA has also been used by institutions such as the New World Symphony in Miami for online lessons.<sup>32</sup>

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<sup>28</sup> “What’s Normal for Latency and Packet Loss?” Pingman Tools, <https://www.pingman.com/kb/article/what-s-normal-for-latency-and-packet-loss-42.html> (accessed November 1, 2015).

<sup>29</sup> This is because data must be sent to and back.

<sup>30</sup> Internet2, “The Internet2 Community: Enabling the Future,” <http://www.internet2.edu/about-us/> (accessed December 3, 2015.)

<sup>31</sup> “About,” *Lola*, <https://lola.conts.it/#about> (accessed April 7, 2018).

<sup>32</sup> *Ibid.*

Gill Davies conducted a series of case studies for his dissertation, “The Effectiveness of LOLA (LOW LATency) Audiovisual Streaming Technology for Distributed Music Practice,” in which music students, music lecturers, and professional classical and jazz musicians rehearsed and performed using LoLa.<sup>33</sup> Davies wrote:

The study concludes that while LOLA is an effective tool for distributed education, rehearsal and performance, a range [sic] social, cultural and technical challenges have to be considered. It is important that music organisations [sic] recognize [sic] the practical advantages of using technologies that facilitate distributed music practice... Other musicians who would, perhaps, have practical reasons for LOLA are those who are unwilling or unable to travel, those who have a disability, or those who suffer from stage fright and would prefer to perform in a familiar place. If faster and more direct networks were to become available not only to Higher Education Institutions and schools, but also to concert halls, theatres and event spaces, more opportunities would be created for musicians to play together remotely. Looking ahead, an increase in environmental concern may be a driving force behind the wider development of distributed music practice. In a globalised [sic] world, technologies like LOLA have the potential to facilitate a better cultural understanding between musicians worldwide.<sup>34</sup>

In general, Internet speeds are increasing. Speedtest.net, a web service that offers free analysis of Internet access performance metrics, found that the average speed of home Internet in the US rose 35.8% in download speed and 22.0% in upload speed in 2018.<sup>35</sup> *Forbes Magazine* estimates that the gap between the fastest Internet countries and

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<sup>33</sup> Gill Davies, “The Effectiveness of LOLA (LOW LATency) Audiovisual Streaming Technology for Distributed Music Practice,” (MRes diss., Edinburgh Napier University, 2015): 1, Academia.edu, <https://www.academia.edu/28770528>.

<sup>34</sup> Davies, 99.

<sup>35</sup> Speedtest, “United States,” <https://www.speedtest.net/reports/united-states/2018/fixd/> (accessed February 21, 2019).

the slowest is decreasing.<sup>36</sup> And apart from the public sector of Internet providers, Internet2 is expanding its availability to more institutions. High schools in Arizona are even gaining access to Internet2 and LoLa, thanks to a collaboration with Sun Corridor, the Paradise Valley Unified School District, and Dr. Jason Caslor of Arizona State University.<sup>37</sup>

### Summary

Research on video conferencing music lessons is increasing as it garners more interest over time thanks to the willingness of educators to explore the capabilities of a new technological medium. Many of these studies examine how video conferencing lessons differ from an in-person lesson, exploring its advantages and challenges, or evaluate new teaching strategies through qualitative data. The most ambitious study in sheer magnitude is Sarah Comerford's E-Music Lesson Project. The general consensus from available scholarship is that private music lessons are more effective in-person than online, and that online video conferencing can be feasible for those unable to study with a teacher nearby. Unfortunately, much of the current scholarship on video conferencing lessons is based on subjective answers, making it difficult to yield conclusive results.

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<sup>36</sup> Kevin Murnane, "Here's How Internet Speeds Fare For the World's Fastest and Largest Countries in 2018," *Forbes*, <https://www.forbes.com/sites/kevinmurnane/2018/12/11/heres-how-internet-speeds-fared-for-the-worlds-fastest-and-largest-countries-in-2018/#204c98c74976> (accessed February 27, 2019).

<sup>37</sup> "High School Students Play Alongside ASU Orchestra Thanks to LoLA," *Internet2*, <https://www.internet2.edu/research-solutions/community-projects/lola-for-all/high-school-students-play-asu-orchestra-thanks-lola/> (accessed March 1, 2019).

## CHAPTER 3

### STUDY PROCEDURES

#### **Introduction**

When determining the parameters for this study, my advisors and I agreed to limit the study to students from one school. By working with a group of students from a single location, controlled variables were simplified. In partnership with Mr. Jonathan Thoma, the orchestra director of Muscatine High School (MHS) in Muscatine, Iowa, I taught 22 high school cellists weekly 25-minute private lessons online from September 18, 2017 through December 15, 2017, with most students using Skype.

The basic questions that were posed for this study were:

1. Are there significant differences between online lessons vs. in-person lessons?
2. How strong of a correlation exists between the strength of the technology and the quality of lessons?
3. Did meeting with the students in-person affect online lessons after?
4. Can online lessons be an effective tool in the public-school setting?

Following each lesson, the participants were instructed to fill out an anonymous survey via Survey Monkey. The survey used a simple Likert scale in order to assess their perception of the experience, including how they felt the technology impacted the lesson.

The questions were:

1. Rate the video in our lesson today  
(1-5, with 1 being very poor, and 5 being very favorable)
2. Rate the audio in our lesson today  
(1-5, with 1 being very poor and 5 being very favorable)
3. Rate the quality of your lesson experience today  
(1-5, with 1 being very poor, and 5 being very favorable)
4. How did the video and audio affect the quality of lesson?  
(1-5, with 1 being extremely disruptive, to 5 not affecting the lessons)

Comments: (150 character limit)

To compare the experience of online video conferencing lessons with that of in-person lessons, I flew to Muscatine to conduct live lessons on October 23 and 24, 2017. Again, a Likert scale was used to gather data from the participants. The questions asked were:

1. Rate the quality of your lesson experience today (1-5, with 1 being very poor and 5 being very favorable)
2. How different was the lesson experience in person in comparison to online? (1-5, with 1 being completely different and 5 being pretty similar)
3. Feel free to elaborate on question 2

Following the in-person lessons, the students resumed their online lessons and the first set of survey questions. During the final week of lessons, participants were invited to anonymously answer the following questions:

1. Rate the quality of your lesson experiences online for the semester (1-5, with 1 being very poor and 5 being very favorable)
2. Did you enjoy the online lessons? How were they similar to and different from in-person lessons?
3. Would you recommend others to take online lessons?
4. Feel free to write any additional thoughts you'd like to share.

Overall, 180 lessons were taught throughout the semester and 118 surveys were collected. Some students submitted incomplete questionnaires. However, it was determined that it was best to include their responses when tabulating results since the aim was to collect and aggregate mass amounts of data.

## **Recruiting**

Muscatine is a town in Iowa with an estimated population of 23,700 in 2017.<sup>38</sup> With limited access to private instructors, the orchestra director of Muscatine Middle School, Jessica Blanchard, is the only teacher offering private cello lessons in town. Anyone who wants to pursue private instruction elsewhere would have to travel to Iowa City or Davenport. As a former Iowa resident, I chose MHS's cello students under Mr. Jonathan Thoma because we were colleagues at Iowa State University; Mr. Thoma received his Bachelor of Music Education in Fall 2011 and I graduated two years later in Spring 2013. I formally contacted Mr. Thoma and Dr. Jared Thompson, Principal of MHS, in 2017 to seek their collaboration.

## **Participants**

All of the high school cello students selected for this study were current students of the MHS Orchestra program under Mr. Jonathan Thoma. Upon my obtaining my IRB approval and permission from the Principal, I contacted parents and guardians of the Muscatine cellists by email asking for their permission to provide lessons to their children. The students were subsequently contacted via email for their consent to the project. The goal of having between 15 and 19 participants was surpassed. In fact, all 22 cello students from MHS agreed to participate.

All students were between 14 and 18 years of age. The level of students varied from beginner (first year playing the cello) to advanced students preparing for the Iowa

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<sup>38</sup> "Muscatine IA Population (2018-06-12)", *World Population Review*, <http://worldpopulationreview.com/us-cities/muscatine-ia> (accessed March 03, 2019).



All-State Orchestra audition. Three of the students were concurrently taking private cello lessons with Ms. Blanchard. For many of the 22, this was their first time receiving private instruction.

### **Setting**

The students at MHS had their lessons in either a practice room or Mr. Thoma's office. I taught all my lessons in a practice room at Arizona State University. Because MHS students enrolled in orchestra also receive weekly lessons outside of rehearsal as part of their course requirement with Mr. Thoma, we scheduled the online lessons to take place during the same window to minimize scheduling issues. Each student at MHS owns a school-sponsored Chromebook, while I used my personal Lenovo Thinkpad. No external microphones were used, to keep equipment needs accessible for the students. Skype and Google Hangout were the two platforms used for video conferencing.

### **Challenges**

Neither Mr. Thoma nor I anticipated every cello student at MHS to participate, so it was impossible to accommodate all students using only the weekly lesson scheduled during school hours outside of rehearsal. Students were granted permission from Mr. Thoma to receive lessons during rehearsal once a week. One student expressed concern on this issue, saying that "having a lesson every week was a pain... we would have to leave our rehearsal... this is about missing rehearsal time."

The technology, particularly on the first week of lessons, proved to be a constant issue. The initial plan was to use Google Hangout since student servers were on a Google

system and Skype was restricted on the Muscatine High School campus. Apart from three students, none were able to access Hangout due to authorization issues. Tech support at MHS allowed Skype to be used after the first day of lessons. Even after the authorization of Skype, some students were unable to use the program on their Chromebooks. To combat this, students with working laptops that were able to run Skype would leave their computers in the practice room and allow their colleagues to use for their lesson.

Internet service was a regular issue. One participant said that the practice rooms were the place where “wifi goes to die” at the high school. There was also a three-day period when the Internet at the school was non-functional.

Make-up lessons were also difficult to schedule. Since I was not an employee of MHS, I could be notified of illness only by direct contact from the student via email or text. Early in the semester, students occasionally forgot that they had a lesson. After the first week, I would send students emails with time slots for make-up lessons for students who missed.

## CHAPTER 4

### DATA

#### Lessons

While collecting and evaluating data from survey responses, the results I was most curious to explore were the students' thoughts on the quality of the lesson experience via video conferencing. Between September 18<sup>th</sup> through December 15<sup>th</sup>, 114 responses regarding the overall quality of lessons through live video conferencing were collected. The average score for the lesson quality was 3.87. In comparison, 14 out of 15 students rated the in-person lessons at 4 or 5, with the average score 4.67.<sup>39</sup>

Table 1. Lesson Rated on 1-5 Likert Scale (1: very poor; 5: very favorable)

Lessons	Dates	5	4	3	2	1	Total	Average
<b>Before 10/23-24</b>	9/18-9/22	3	4	6	3	3	19	3.05
	9/25-9/29	2	10	3	0	1	16	3.75
	10/2-10/6	9	5	0	0	1	15	4.4
	10/16-10/20	3	3	3	2	0	11	3.64
<b>Total</b>		<b>17</b>	<b>22</b>	<b>12</b>	<b>5</b>	<b>5</b>	<b>61</b>	<b>3.67</b>
<b>After 10/23-24</b>	11/6-11/10	2	3	4	1	0	10	3.6
	11/13-11/17	4	5	2	0	0	11	4.18
	11/20-11/21	1	2	0	0	0	3	4.33
	11/27-12/01	4	5	1	0	0	10	4.3
	12/4-12/08	4	6	0	0	0	10	4.4
	12/11-12/15	2	5	1	1	0	9	3.89
<b>Total</b>		<b>17</b>	<b>26</b>	<b>8</b>	<b>2</b>	<b>0</b>	<b>53</b>	<b>4.09</b>
<b>Grand Total</b>		<b>34</b>	<b>48</b>	<b>20</b>	<b>7</b>	<b>5</b>	<b>114</b>	<b>3.87</b>

<sup>39</sup> See "SURVEY FOR MHS IN-PERSON LESSONS" under Appendix E, 86-87.

Comparing the average rating of lessons prior to meeting in-person and afterwards, the average quality of lessons was 3.67 between September 18th and October 20th (total lessons: 61) while the numbers from November 6 through December 15th rose to 4.09 (total lessons: 53).

Lesson ratings were sorted, then tallied to see the relation between the video quality, audio quality, and student perception of how the technology impacted lessons. The average values of video quality, audio quality, and the student perception of the technology’s affect on the lessons were calculated from the compiled data.

Table 2. Lessons Rated 5 Throughout the Study; 35 Total

	5	4	3	2	1
Video	14	15	4	1	0
Audio	14	13	7	0	0
Technology affected lesson	16	12	0	3	4

- Average video quality of a 5 lesson is 4.24
- Average audio quality of a 5 lesson is 4.21
- Average Tech affecting lessons is 4.03
- 17 lessons were before in-person (27% of lessons before Oct 23-24)
- 17 lessons were after in-person (31% of lessons after Oct 23-34)

Table 3. Lessons Rated 4 Throughout the Study; 48 Total

	5	4	3	2	1	Blan
Video	8	24	13	2	0	1
Audio	8	20	17	2	0	1
Technology affected lesson	10	14	19	5	0	0

- Average video 3.81 [-0.43 change]
- Average audio 3.72 [-0.49 change]

- Average tech affecting lesson 3.60 [-0.43 change]
- 22 lessons were before Oct 23-24 (36%)
- 26 lessons were after Oct 23-24 (49%)

Lessons rated 4 or 5 were the most productive lessons throughout the semester, with a combined total added to 82 out of 114 for the study (71.9%), with 39 out of 61 (63.9%) before meeting in-person and 43 out of 53 lessons (81.1%) after meeting in-person.

Video and audio for lessons rated 3 were fairly spread out in terms of concentration of their values. 18 out of 20 lessons had a video or audio quality of 2, 3, or 4, with an average of 6 per category. The drop-off of each category was greater from lessons rated 4 to 3, but the average drop-offs were at similar rates.

Table 4. Lessons Rated 3 Throughout the Study; 20 Total

	5	4	3	2	1
Video	1	7	6	5	1
Audio	1	6	5	7	1
Technology affected lesson	4	2	5	3	6

- Average video 3.10 [-0.71 change]
- Average audio 2.95 [-0.77 change]
- Average tech affecting lessons 2.75 [-0.85 change]
- 12 were before Oct 23-24 (19.6%)
- 8 were after Oct 23-24 (15.1%)

Table 5. Lessons Rated 2 Throughout the Study; 6 Total

	5	4	3	2	1
Video	1	0	0	4	2
Audio	0	0	1	2	3

Technology affected lesson	0	0	0	3	3
----------------------------	---	---	---	---	---

- Average video 2.14 [-0.96 change]
- Average audio 1.86 [-1.09 change]
- Average tech affecting lessons 1.43 [-1.32 change]
- 4 lessons were before Oct 23-24 (6.6%)
- 2 lessons were after Oct 23-24 (3.8%)

Unsurprisingly, lessons rated 2 had the largest change, with audio and the student perception of technology affecting lessons plummeting under a 2 rating. The one lesson that rated video as 5 occurred in the first week of the study (the participant’s response was as follows: video: 5; audio: 3; lesson: 2; technology affecting lesson: 2).

Lessons rated 1 occurred during the first three weeks of the study (3 between September 18-22, 1 on September 25-29, and 1 on October 2-6).

Table 6. Lessons Rated 1 Throughout the Study; 5 Total

	5	4	3	2	1
Video	0	0	0	2	3
Audio	0	0	2	0	3
Technology affected lesson	0	0	0	1	4

- Average video 1.40 [-0.74 change]
- Average audio 1.80 [-0.06 change]
- Average tech affecting lessons 1.20 [-0.23 change]
- 5 were all before Oct 23-24 (8.2%)

There was a near-linear relation in the ratings between both the technology and the student perception affecting lessons. The largest drop in value occurred between lessons rated 3 and 2.

## Average Ratings of Video, Audio, and How Students Felt Video and Audio Affected Quality of Lessons

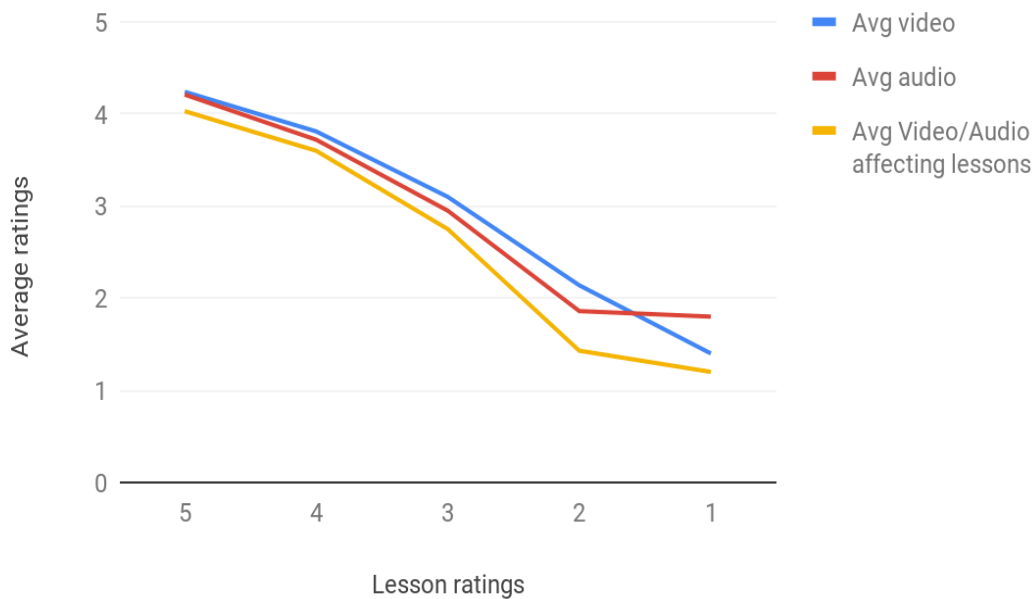


Figure 1. While video quality gradually declined, the audio quality and how students felt that video/audio affected lesson saw a large dip from lessons rated 3 to 2.

Figure 1 proves that the quality of technology and lessons were closely related. Whether video or audio had a stronger impact on the quality of lessons will be analyzed in-depth in subsequent sections of this chapter.

### **Did Meeting the Students In-Person Affect Lessons Afterwards?**

Charting the average rating of lessons per week and the breakdown of lesson categories before and after the in-person lessons provided preliminary information to test whether online lessons were affected by meeting face-to-face.

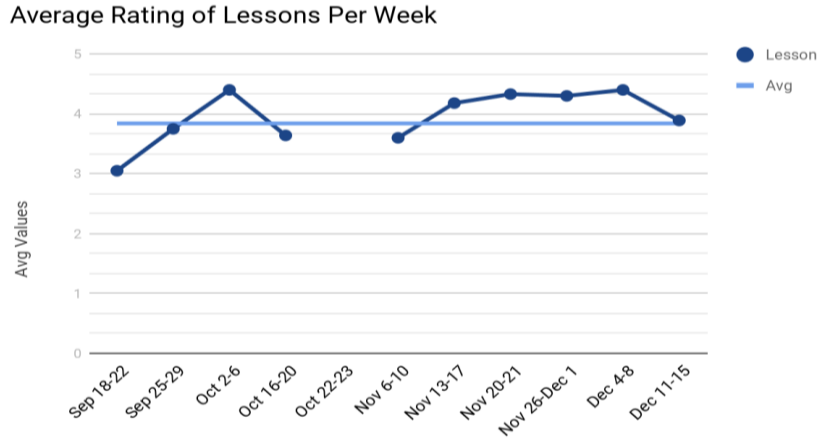


Figure 2. Online lessons before and after meeting in-person

The week of October 2-6 was the only week before meeting in-person on October 22-23 that the average lesson value scored above the overall semester lesson average; the week of November 6-10 was the only week after meeting in-person including the week's average lesson value was below the overall semester average.

The percentage of lesson ratings before and after meeting in-person is charted in Figure 3. Lessons rated 5 and 4 rose after meeting in person, while lessons rated 3 or lower decreased.

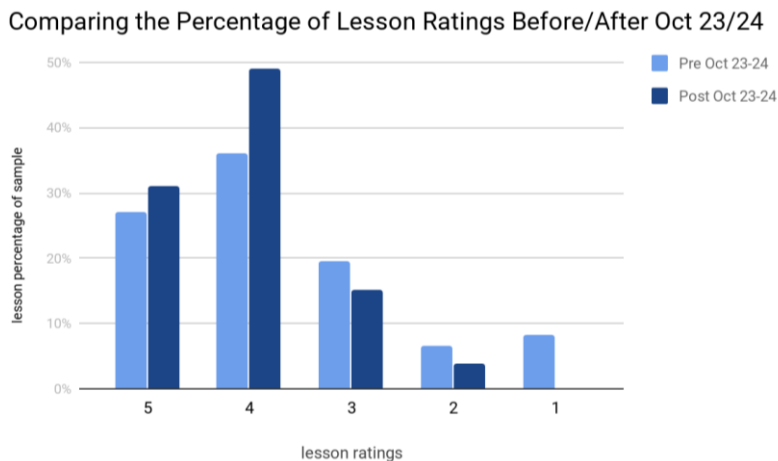


Figure 3. Ratings 5 and 4 rose while 3, 2, and 1 fell.



To test whether the increase in value was due to an external factor (e.g. meeting with the students in-person) or due to standard deviation, a T-Test was used to compare the data before and after the in-person lessons on October 23-24.<sup>40</sup> Using the calculator on GraphPad, the following was discovered:<sup>41</sup>

P value and statistical significance:

The two-tailed P value equals 0.0319

By conventional criteria, this difference is considered to be statistically significant.

Intermediate values used in calculations:

$t = 2.1724$

$df = 112$

standard error of difference = 0.194

Because the previous section showed a link between technology and perceived quality of lessons, T-Tests were also used to see whether their values fit within deviation.

### **T-Test of video before and after meeting in-person**

P value and statistical significance:

The two-tailed P value equals 0.3570

By conventional criteria, this difference is considered to be not statistically significant.

Intermediate values used in calculations:

$t = 0.9248$

$df = 115$

standard error of difference = 0.204

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<sup>40</sup> A T-Test is used to determine whether the differences in the averages of two groups are significantly different from one another. By running the T-Test between two sets of data, we can find the *P Value*, which determines the calculated probability. The general consensus is that the two sets of data are significant beyond the standard deviation when the *P Value* is less than 0.05.

<sup>41</sup> <https://www.graphpad.com/quickcalcs/ttest1/?Format=C> (accessed March 1, 2019).

### **T-Test of audio before and after meeting in-person**

P value and statistical significance:

The two-tailed P value equals 0.0448

By conventional criteria, this difference is considered to be statistically significant.

Intermediate values used in calculations:

$t = 2.0291$

$df = 113$

standard error of difference = 0.203

### **Lessons Summary**

Overall, the in-person ratings (4.67) rated higher than lessons online (3.87). In addition, lessons conducted after meeting in person (4.09) rated higher than the lessons done prior to meeting in person (3.67). The T-Test run on the data before and after meeting on October 23-24 shows that the increases in ratings was beyond the expected fluctuation from standard deviation.

To determine whether the deviation was a direct response to meeting face-to-face rather than due to an increase in technology quality, T-tests were used to compare video and audio ratings before/after October 23-24. The video ratings were within its deviation, but audio rating's boosts were considered statistically significant and potentially affected the lesson ratings.

Teaching students at Muscatine in-person had a positive effect on video conferencing lessons after the visit. Whether the increase in lesson ratings were due to the in-person interaction or due to change in technology was inconclusive.

## Video Throughout the Semester

To see whether a change in video or audio had a greater impact on lesson outcome, both categories were analyzed separately. Like the previous section with data from lesson ratings, video ratings will be shown first with overall ratings throughout the study to observe general trends through the study before investigating each video value thoroughly.

Table 7. Video rated on 1-5 Likert scale (1: very poor; 5: very favorable)

	Dates	5	4	3	2	1	Total	Average
<b>Before 10/23-24</b>	9/18-9/22	2	6	3	5	3	19	2.95
	9/25-9/29	4	10	1	1	0	16	4.06
	10/2-10/6	5	7	1	1	1	15	3.93
	10/16-10/20	2	2	3	3	1	11	3.09
<b>Total</b>		<b>13</b>	<b>25</b>	<b>8</b>	<b>10</b>	<b>5</b>	<b>61</b>	<b>3.51</b>
<b>After 10/23-24</b>	11/6-11/10	2	5	3	1	0	11	3.73
	11/13-11/17	3	2	4	1	0	10	3.7
	11/20-11/21	1	2	2	0	0	5	3.8
	11/27-12/01	2	5	2	1	0	10	3.8
	12/4-12/08	2	6	3	0	0	11	3.91
	12/11-12/15	1	3	3	1	1	9	3.22
<b>Total</b>		<b>11</b>	<b>23</b>	<b>17</b>	<b>4</b>	<b>1</b>	<b>56</b>	<b>3.7</b>
<b>Grand Total</b>		<b>24</b>	<b>48</b>	<b>25</b>	<b>14</b>	<b>6</b>	<b>117</b>	<b>3.6</b>

Unlike the lesson ratings, there was not much connection between the video quality ratings and whether the lessons occurred before or after October 23-24. As we did with the lessons earlier, a T-Test was used to confirm that the ratings were within standard deviation.

Average Video Ratings Throughout the Study

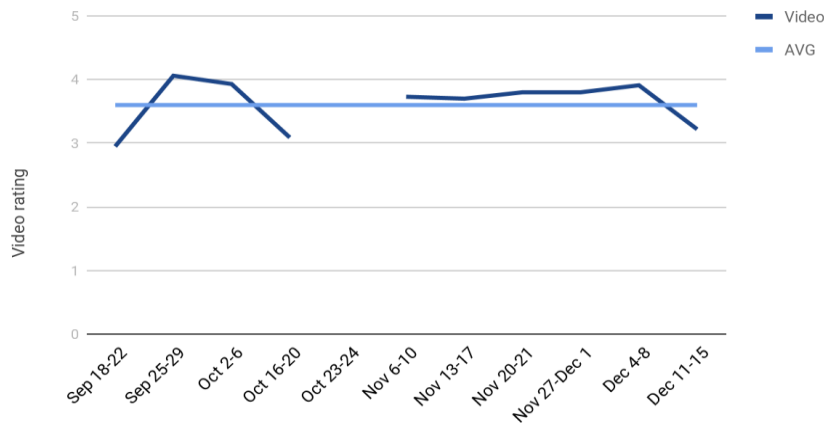


Figure 4. The average rating of video remained within standard deviation throughout the semester.

Similar to the lesson ratings, video ratings were compiled and sorted by rating to study their correlations to other categories. 20.5% of the lessons overall had a video rating of 5, 41% with a video rating of 4, 21.4% with video rating of 3, 12% with video rating of 2, and 5.1% with video rating of 1.

Table 8. Video Rated 5 Throughout the Study; 24 Total

	5	4	3	2	1
Audio	12	10	2	0	0
Lessons	14	8	1	1	0
Technology affected lesson	18	2	2	1	1

- AVG Audio 4.42
- AVG Lesson 4.46
- AVG Tech affecting lesson 4.46
- 13 were before Oct 23-24 (21.3%)
- 11 were after Oct 23-24 (19.6%)

Table 9. Video Rated 4 Throughout the Study; 48 Total

	5	4	3	2	1	Blank
Audio	5	23	16	2	0	2
Lessons	15	24	6	1	0	2
Technology affected lesson	13	18	10	4	2	1

- AVG Audio 3.67 [-0.75 change]
- AVG Lesson 4.17 [-0.29 change]
- AVG Tech affecting lesson 3.77 [-0.69 change]
- 25 were before Oct 23-24 (41.0%)
- 23 were after Oct 23-24 (41.1%)

Table 10. Video Rated 3 Throughout the Study; 25 Total

	5	4	3	2	1	Blank
Audio	5	6	9	3	1	1
Lessons	4	13	6	0	0	2
Technology affected lesson	0	8	10	4	2	1

- AVG Audio 3.46 [-0.21 change]
- AVG Lesson 3.91 [-0.26 change]
- AVG Tech affecting lesson 3 [-0.77 change]
- 8 were before Oct 23-24 (13.1%)
- 17 were after Oct 23-24 (30.4%)

There was a significant dip in the average audio value and how students felt that technology affected the quality of lessons as video rating went from 3 to 2, with student perception falling almost in half from 3 to 1.57. However, lessons were still functional, with 8 out of 14 lessons being rated 3 or higher.

Table 11. Video Rated 2 Throughout the Study; 14 Total

	5	4	3	2	1
Audio	1	0	6	5	2
Lessons	1	2	5	4	2
Technology affected lesson	0	0	1	6	7

- AVG Audio 2.5 [-0.96 change]
- AVG Lesson 3.29 [-0.62 change]
- AVG Tech affecting lesson 1.57 [-1.43 change]
- 10 were before Oct 23-24 (16.4%)
- 4 were after Oct 23-24 (7.1%)

Table 12. Video Rated 1 Throughout the Study; 6 Total

	5	4	3	2	1
Audio	0	1	0	1	4
Lessons	0	0	1	2	3
Technology affected lesson	0	0	1	0	5

- AVG Audio 1.89 [-0.61 change]
- AVG Lesson 2 [-1.29 change]
- AVG Tech affecting lesson 1.33 [-0.24 change]
- 5 were before Oct 23-24 (8.2%)
- 1 were after Oct 23-24 (1.8%)

### Average Values Affected by Change in Video Quality

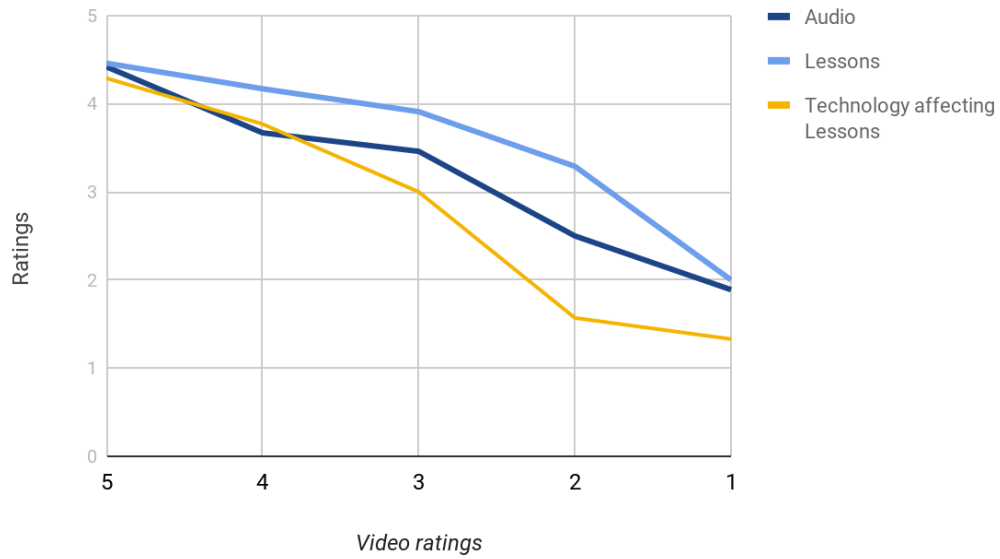


Figure 5. The largest change in lesson quality happened from 2 to 1.

### Comparing the Percentage of Video Ratings Before/After Oct 23/24

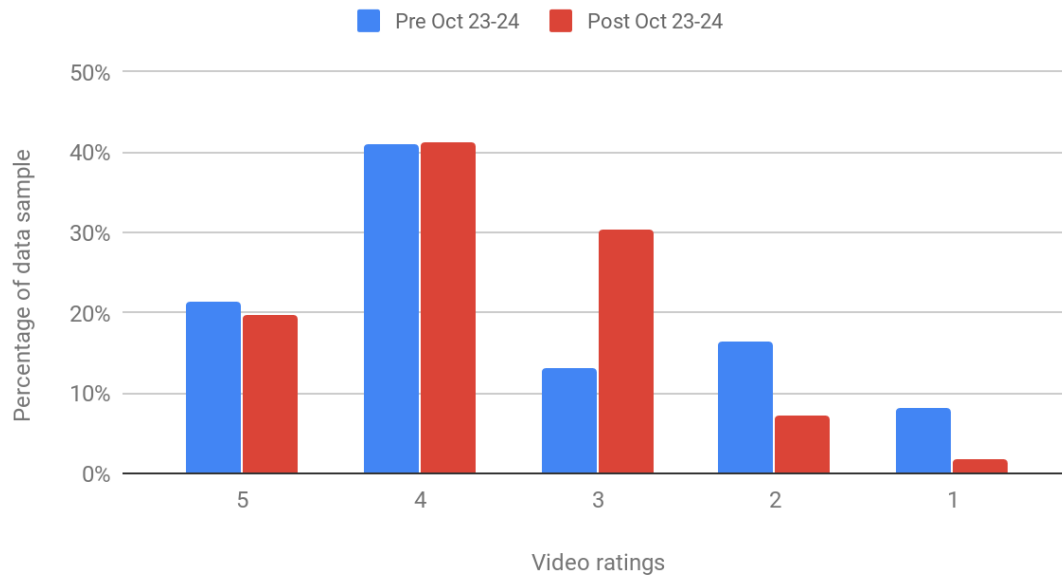


Figure 6. Except for Rating 3, the two samples remained similar.

Overall, there was a strong correlation between lesson rating and video rating. Student perception of technology disrupting lessons happened once video ratings dropped to 2, but productive lessons were still possible as lessons were rated above 3.

### Audio Ratings Throughout the Semester

Much like the presentation of data from the video ratings, audio statistics were compiled then sorted with an overview of ratings throughout the study, then broken down by rating category.

Table 13. Audio rated on 1-5 Likert scale (1: very poor; 5: very favorable)

	Dates	5	4	3	2	1	Total	Average
<b>Before 10/23-24</b>	9/18-9/22	1	4	8	1	4	18	2.83
	9/25-9/29	1	8	5	2	0	16	3.5
	10/2-10/6	4	9	1	0	1	15	4
	10/16-10/20	2	2	2	4	1	11	3
<b>Total</b>		<b>8</b>	<b>23</b>	<b>16</b>	<b>7</b>	<b>6</b>	<b>60</b>	<b>3.33</b>
<b>After 10/23-24</b>	11/6-11/10	3	4	1	2	0	10	3.8
	11/13-11/17	2	2	5	2	0	11	3.36
	11/20-11/21	1	3	1	0	0	5	4
	11/27-12/01	4	3	3	0	0	10	4.1
	12/4-12/08	2	4	4	0	0	10	3.8
	12/11-12/15	3	1	4	0	1	9	3.56
	<b>Total</b>		<b>15</b>	<b>17</b>	<b>18</b>	<b>4</b>	<b>1</b>	<b>55</b>
<b>Grand Total</b>		<b>23</b>	<b>40</b>	<b>34</b>	<b>11</b>	<b>7</b>	<b>115</b>	<b>3.53</b>

As discussed on page 25 regarding the T-Test, there was a significant change in audio ratings after the lessons that occurred after meeting in-person on October 23-24. Since lesson procedures remained constant, the cause for the change has yet to be



determined. One speculation is that students were more sympathetic towards audio after meeting in-person. However, proving that the rise in audio rating was due to shifting moods on technology or if the increase in audio acted as a catalyst to the change in student perception is beyond the scope of this study.

Table 14. Audio Rated 5 Throughout the Study; 23 Total

	5	4	3	2	1
Video	12	5	5	1	0
Lessons	14	8	1	0	0
Technology affected lesson	16	5	1	1	0

- AVG Video 4.22
- AVG Lesson 4.57
- AVG Tech affecting lesson 4.57
- 8 were before Oct 23-24 (13.3%)
- 15 were after Oct 23-24 (27.2%)

Table 15. Audio Rated 4 Throughout the Study; 40 Total

	5	4	3	2	1	Blank
Video	10	23	6	0	1	0
Lessons	12	27	1	0	0	0
Technology affected lesson	13	16	9	0	2	0

- AVG Video 4.03 [-0.75 change]
- AVG Lesson 4.28 [-0.07 change]
- AVG Tech affecting lesson 3.95 [-0.52 change]
- 23 were before Oct 23-24 (38.3%)
- 17 were after Oct 23-24 (30.9%)

While the average lesson rating went down 0.29 from 4.46 to 4.17 when the video quality changed from 5 to 4, the average lesson rating fell only 0.07 with the same change in audio. Similarly, student’s perception of technology affecting the quality of lessons declined less for audio (-0.52 change) than for video (-0.69 change).

Table 16. Audio Rated 3 Throughout the Study; 34 Total

	5	4	3	2	1	Blank
Video	2	16	9	6	0	0
Lessons	7	17	5	2	2	1
Technology affected lesson	2	7	14	8	3	0

- AVG Video 3.42 [-0.21 change]
- AVG Lesson 3.76 [-0.26 change]
- AVG Tech affecting lesson 2.91 [-0.97 change]
- 16 were before Oct 23-24 (26.7%)
- 18 were after Oct 23-24 (32.7%)

Table 17. Audio Rated 2 Throughout the Study; 11 Total

	5	4	3	2	1
Video	0	2	3	5	1
Lessons	0	2	7	2	0
Technology affected lesson	0	0	0	5	6

- AVG Video 2.55 [-0.87 change]
- AVG Lesson 3.00 [-0.76 change]
- AVG Tech affecting lesson 1.45 [-1.46 change]
- 7 were before Oct 23-24 (11.7%)
- 4 were after Oct 23-24 (7.3%)

Table 18. Audio Rated 1 Throughout the Study; 7 Total

	5	4	3	2	1
Video	0	0	1	2	4
Lessons	0	0	1	3	3
Technology affected lesson	0	0	0	1	6

- AVG Video 1.57 [-1.46 change]
- AVG Lesson 1.71 [-1.29 change]
- AVG Tech affecting lesson 1.14 [-0.12 change]
- 6 were before Oct 23-24 (10.0%)
- 1 were after Oct 23-24 (1.8%)

### Comparing the Percentage of Audio Ratings Before/After Oct/23/24

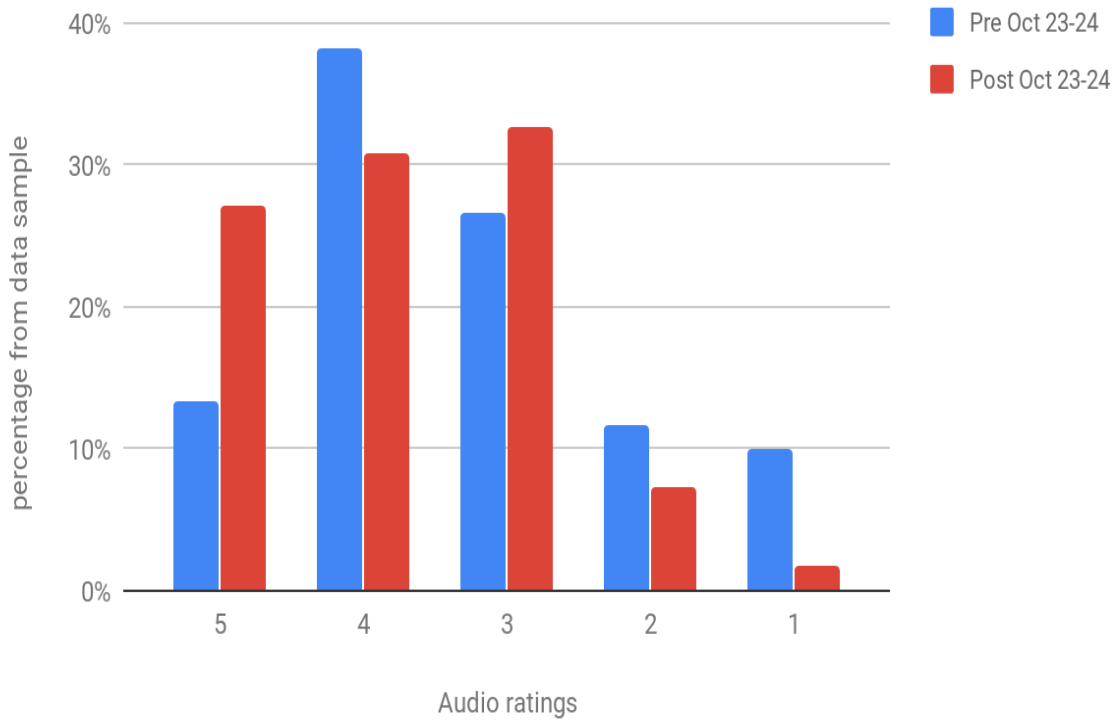


Figure 7. Rating 5 rose dramatically after meeting in-person

## Average Values Affected by Change in Audio Quality

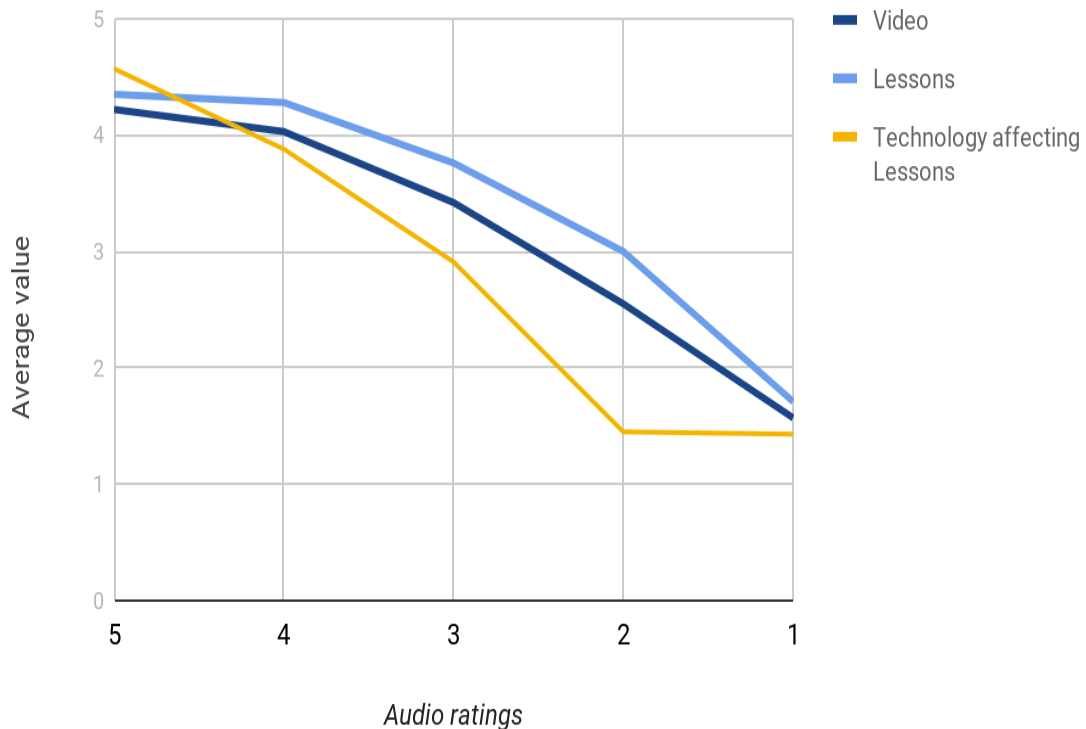


Figure 8. Like Figure 5, the largest drop in lesson ratings occurred between 2 and 1.

### Comparing Video Ratings to Audio Ratings

As indicated by the data gathered, audio quality affected lessons more than video for this study. The range of lesson averages had a larger disparity for audio (1.71 to 4.57) than for video (2 to 4.46). They both suffered a dip of 1.29 in lesson ratings when both video and audio values dipped from 2 to 1.

## Comparing Lesson Averages by Video and Audio Values

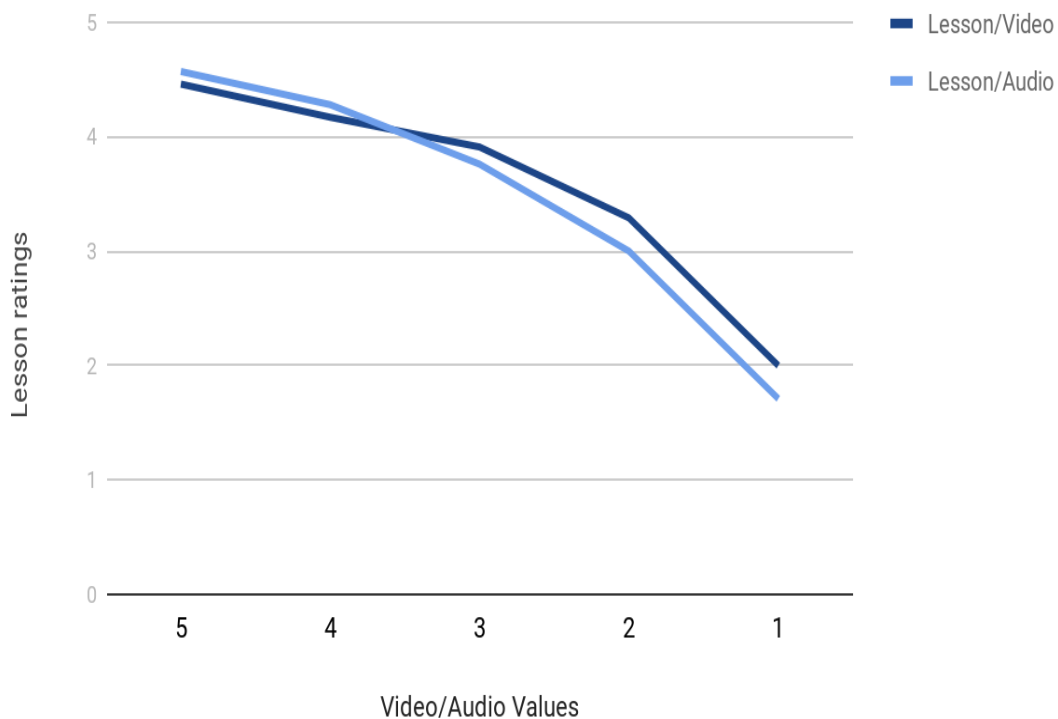


Figure 9. While the shape of the curves look similar, Audio had a wider range overall.

Since people's frustrations rise with technical difficulty, it was a relief that ratings of 1 or 2 were rare for both video and audio. However, the low sample size of video or audio data rated 1 or 2 meant that comparing the averages between video and audio failures have greater room for inaccuracy. For video and audio rated 3 and above, we have enough samples to determine that the strength of audio quality was more likely to positively impact the quality of lessons.

## Student Perception of Technology Affecting Lessons

Student’s perception of lessons affected by video and audio had the most balanced distribution of values compared to the other categories from this study, with the percentage of lessons with rating 5 of this category at 26.7%, rating 4 at 24.1%, rating 3 at 21.6%, rating 2 at 12.9%, and rating 1 at 14.7%.

Table 19. Quality of Video and Audio Affecting Quality of Lessons on 1-5 Likert Scale (1: very poor; 5: very favorable)

	Dates	5	4	3	2	1	Total	Average
<b>Before 10/23-24</b>	9/18-9/22	2	2	5	4	6	19	2.47
	9/25-9/29	5	3	5	1	2	16	3.5
	10/2-10/6	5	5	1	0	4	15	3.47
	10/16-10/20	3	2	1	2	3	11	3
<b>Total</b>		<b>15</b>	<b>12</b>	<b>12</b>	<b>7</b>	<b>15</b>	<b>61</b>	<b>3.08</b>
<b>After 10/23-24</b>	11/6-11/10	5	2	1	2	0	10	4
	11/13-11/17	3	2	3	2	1	11	3.36
	11/20-11/21	2	1	2	0	0	5	4
	11/27-12/01	2	5	1	2	0	10	3.7
	12/4-12/08	2	3	3	2	0	10	3.5
	12/11-12/15	2	3	3	0	1	9	3.56
<b>Total</b>		<b>16</b>	<b>16</b>	<b>13</b>	<b>8</b>	<b>2</b>	<b>55</b>	<b>3.65</b>
<b>Grand Total</b>		<b>31</b>	<b>28</b>	<b>25</b>	<b>15</b>	<b>17</b>	<b>116</b>	<b>3.35</b>

The two averages before and after meeting in-person had a significant jump after the T-Test revealed the P value at 0.0255. Similar to the rise in audio quality ratings discussed on page 26, the increase was not caused by any procedural change.

## Student Perception of Video and Audio Affecting Lessons Throughout the Study

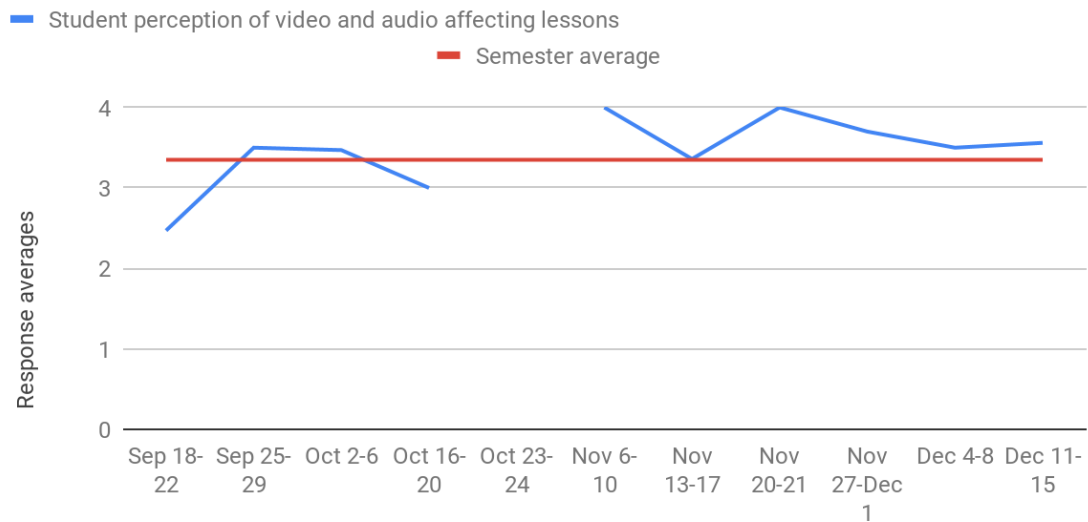


Figure 10. Weekly averages after meeting in person were higher than the semester average.

Each rating of technology affecting the lesson was compiled and sorted to understand how video, audio, and lesson ratings related to their perceived disruption.

Table 20. Technology Affecting Lessons Rated 5 Throughout the Study; 31 Total

	5	4	3	2	1	Blank
Video	18	13	0	0	0	0
Audio	16	13	2	0	0	0
Lesson	16	10	4	0	0	1

- AVG Video 4.58
- AVG Audio 4.45
- AVG Lesson 4.40
- 15 were before Oct 23-24 24.6%
- 16 were after Oct 23-24 29.1%

Table 21. Technology Affecting Lessons Rated '4' Throughout the Study; 28 Total

	5	4	3	2	1
Video	2	18	8	0	0
Audio	5	16	7	0	0
Lesson	12	14	2	0	0

- AVG Video 3.78 [-0.80 change]
- AVG Audio 3.93 [-0.48 change]
- AVG Lesson 4.36 [-0.04 change]
- 12 were before Oct 23-24 19.7%
- 16 were after Oct 23-24 29.1%

Table 22. Technology Affecting Lessons Rated '3' Throughout the Study; 25 Total

	5	4	3	2	1	Blank
Video	2	10	10	1	1	0
Audio	1	9	14	0	0	0
Lesson	0	19	5	0	0	2

- AVG Video 3.46 [-0.22 change]
- AVG Audio 3.46 [-0.47 change]
- AVG Lesson 3.79 [-0.57 change]
- 12 were before Oct 23-24 19.7%
- 13 were after Oct 23-24 23.6%

Table 23. Technology Affecting Lessons Rated '2' Throughout the Study; 15 Total

	5	4	3	2	1
Video	1	4	4	6	0
Audio	1	0	8	5	1
Lesson	3	5	3	3	1

- AVG Video 3.00 [-0.46 change]
- AVG Audio 2.67 [-0.79 change]
- AVG Lesson 3.40 [-0.39 change]



- 7 were before Oct 23-24 11.5%
- 8 were after Oct 23-24 14.5%

Table 24. Technology Affecting Lessons Rated '1' Throughout the Study; 17 Total

	5	4	3	2	1
Video	1	2	2	7	5
Audio	0	2	3	6	6
Lesson	3	0	6	4	4

- AVG Video 2.24 [-0.76 change]
- AVG Audio 2.06 [-0.61 change]
- AVG Lesson 2.65 [-0.75 change]
- 15 were before Oct 23-24 24.6%
- 2 were after Oct 23-24 3.6%

### Average Values Affected by the Perception of Technology Affecting Lessons

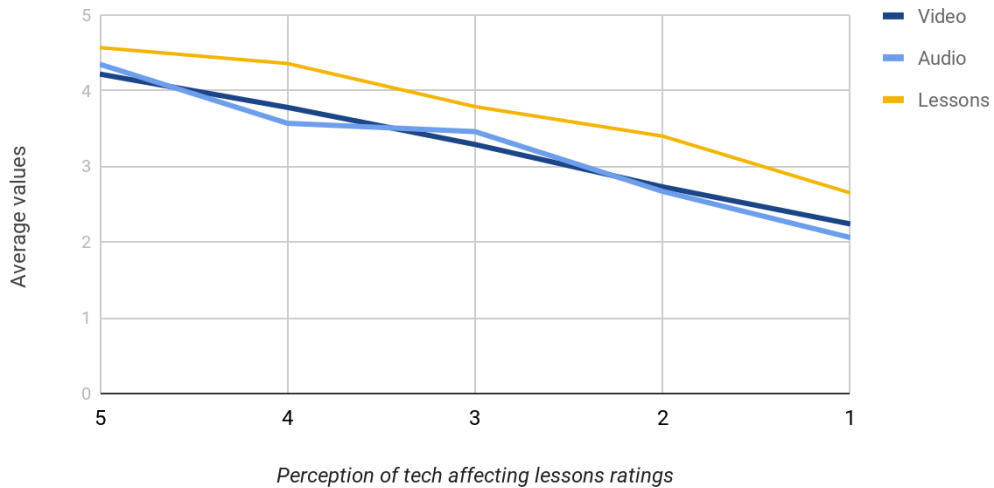


Figure 11. The values of each category remained nearly linear; none experienced a significant dip.

Unlike the other categories analyzed for this study, none of the averages changed by a factor of 1 or greater. In fact, the student perception of how video and audio affected

lessons were the only categories where its counterpart category averages remained above 2, even with the student perception valued at its lowest. From the data provided, a salvageable lesson experience was still possible even when students thought that video and audio qualities were deemed ‘very disruptive.’

### How Did the Weekly Student Perceptions Align with Other Categories?

Weekly average ratings of lessons, video, and audio was charted alongside the weekly average ratings of student’s perception of technology to study which category shared the strongest resemblance to how students felt video and audio affected the quality of lessons.

#### Average Values Affected by the Perception of Technology Affecting Lessons

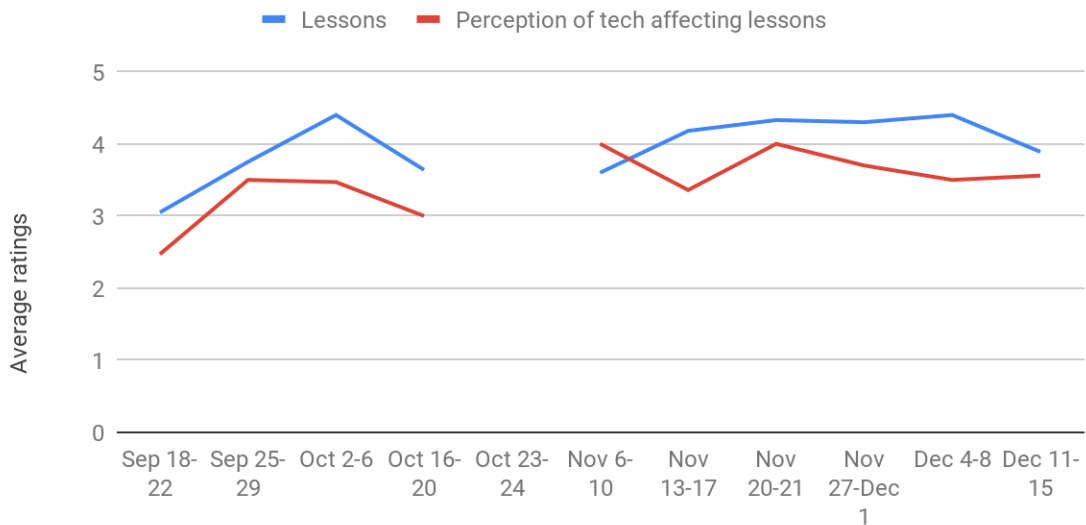


Figure 12. Lesson ratings were higher overall, with somewhat similar shapes.

### Weekly Video Average Compared to Student Perception of Technology Affecting Lessons

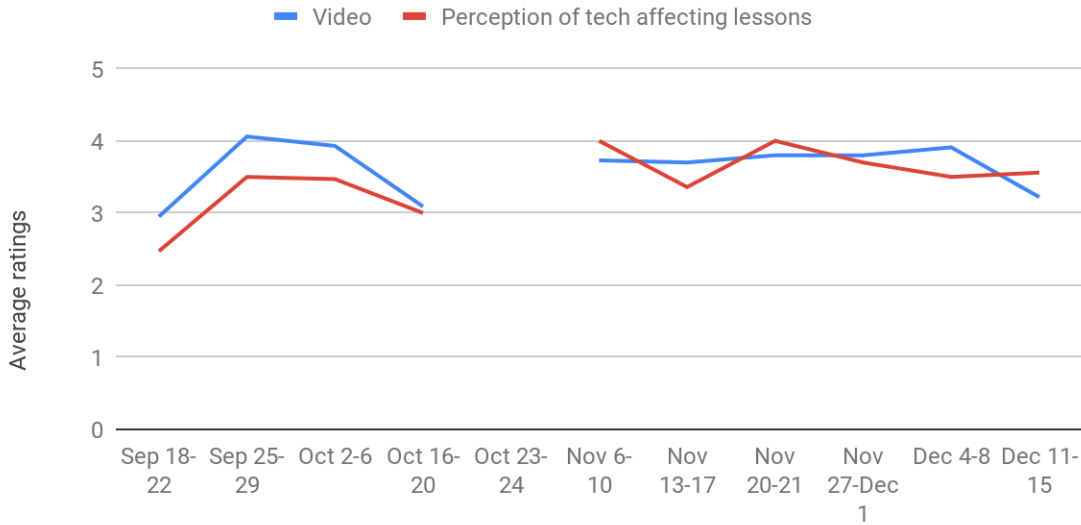


Figure 13. Video and audio share a stronger resemblance compared to the lesson chart

### Weekly Audio Average Compared to Student Perception of Technology Affecting Lessons

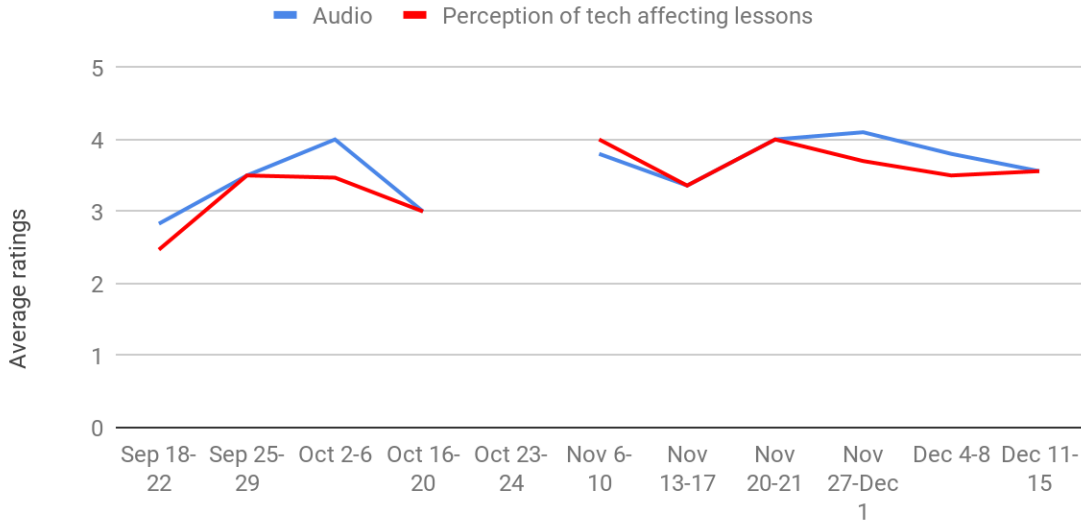


Figure 14. Audio ratings and how students felt video/audio affected lessons look nearly identical.

Comparing Figures 12, 13, and 14 showed that audio quality had the strongest correlation to how students perceived technology to affect the quality of lessons. This finding is like the result in Figure 9 comparing video and audio ratings in relation to their lesson ratings.<sup>42</sup> This concludes that audio was more important to the participants for both the quality of lessons students received, and the technological seamlessness of lessons.

### **Student Feedback**

While the primary focus of this study was to gather large amounts of quantitative data, students also wrote comments on the weekly surveys for the online lessons, in-person lessons, and during the final wrap-up of the study. Comments were optional for the weekly portion of the study, and 31 of the 118 participants left a response in addition to answering the Likert scale questions. twelve of the responses came from the first week of the study. Two students commented on the logistics of the lesson, saying that “the quality itself wasn’t difficult, but the angle of my camera at times caused issues,” and “there is only one computer...that works with Skype...Other than that the lesson went well!” Much of the feedback was about either video, audio, or the Internet during the first week,<sup>43</sup> and 22 comments overall involved technology-related grievances.

Despite the disruption caused by video, audio, or Internet failure, students offered encouragement as the weeks progressed. In the week of October 2 to 6, one student wrote: “I think that Mr. Park is helping immensely with the cellos because it has become quite noticeable that the whole section is improving on their technique and shifting...I feel

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<sup>42</sup> Figure 9 showed that audio affected lessons more than the video, 37.

<sup>43</sup> “I think we should find a new spot. Thoma’s office is a WiFi dungeon.” was the response of one participant.

more confidently [sic] in my performing now than I did before we started this study.” Students would intermittently write comments such as “the video did cut out once, but other than that the lesson was good.” and “it’s just the wifi’s fault. Great lesson.”

The in-person lessons on October 23-24 had the most positive feedback, as the average rating of lessons was 4.67. The second question from the October 23-24 surveys asked to rate numerically how similar or different the experience felt (1 being very different and 5 being very similar) and the average score was 2.84.<sup>44</sup>

Based on feedback gleaned from the surveys, the comments were divided into three categories: technology-related, kinesthetically-related, and general communication.

#### TECHNOLOGY RELATED

Students commenting on the technology felt that in-person lessons were somewhat different from those done online. Without the distraction of the Internet, lessons could go smoothly. Otherwise, lesson procedures were similar to online lessons.

- (5,2)<sup>45</sup> It was a lot better [sic] I thought, and we could understand each other and I learned quicker and more easily. The distractions of mishaps with technology were not there which made for a much better quality lesson
- (2,4) there wasn’t anything different in the lesson [sic] online
- (5,5) We could focus on the material of the lesson rather than be distracted with the technology issues with such as bad wifi at MHS
- (4,3) He could tell us where to put our hands on the fingerboard and he could look and see the music we were playing. Maybe if he had a copy of our music? He also had brownies, which were very good. But it was kind of

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<sup>44</sup> One student told me while in person that they “were expecting me to be taller.”

<sup>45</sup> The numbers in parentheses refer to lesson ratings, then how similar or different they felt lessons were compared to the ones online.

similar because we were still taught, and in the same lesson format as online.<sup>46</sup>

## KINESTHETIC

Most of the feedback comparing in-person lessons to online lessons commented on the physical presence. For many of these students, we had been working on posture and form so I used this lesson to confirm that their motions were fluid with limited tension.

- (5,2) It was a lot easier for him to show me the correct techniques.
- (5,3) It was better to have a lesson in person because you were more easily able to help with our positioning than over Skype
- (5,3) It was a little easier for him to show me and move my hands around to the right spots on the cello
- (5,2) Being present in a physical form allowed for much clearer instruction
- (5,4) It felt very similar. The only real difference was that in person you could adjust posture.
- (4,3) It was nice to have the teacher there, in person. The ability to have a teacher physically take your bow or use your cello is something very valuable. Online lessons don't have this. Though online lessons are easier if a student is shy, and does not like playing right in front of a person
- (5,1) It was a lot more helpful! He could help me with my form, and put my hands in a certain place! But Online, he only got to show me what he did, and told me where to put my fingers and stuff! It was a lot better! :))))
- (5,2) It was different by the fact that you were there in person. It was nice not having internet issues. I understood the drop angle of my hand a lot better because you physically could move my fingers where [they sic] needed to go.
- (5,2) It was so much easier to make corrections to my playing etiquette.

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<sup>46</sup> Mr. Thoma did send me music that students were working for in the school orchestra, but much of my focus with this student was with scales. Also, I promised this student that I would bake brownies from scratch the prior week if their scales improved.

## COMMUNICATION

There were not as many students commenting on general communication, but the students felt that lessons were somewhat similar.

- (5,4) Things were covered mostly the same, skills were explained more clearly  
(5,3) It was similar but much more easy to follow now that he could explain things more thoroughly in person

### End of Semester Review

For the final survey, I asked students their overall rating for the online lessons, whether they enjoyed the lessons, similarities and differences of the lessons compared to the ones in-person, their recommendations, and any additional thoughts. Eighteen students participated in the final survey and the overall experience was rated 4.11.<sup>47</sup> Among the responses, 15 students enjoyed the online lessons, 12 students thought they were similar compared to in-person lessons, and 12 students would recommend others to try online lessons. Five people said it would depend, and 1 student said no.

Students who said it would depend shared their thoughts:

- Student 2* - If there wasn't another option for in-person lessons then yes. But as a first option then no.
- Student 6* - Depends on what is going on in their school or place, If there is someone that knows the cello or any instrument at their school then online lessons is no [sic] recommended
- Student 7* - Depends.. if they are really dedicated and are in need of extra lessons then yes
- Student 12* - Depending on the person who is interested. This specific online lessons are great to get feedback from a person who has a different musical background and can give tips on technique and answers questions that a teacher could not do. By a teacher outside of the program it gives the

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<sup>47</sup> This rating was slightly higher than the average lesson ratings after the in-person lessons (4.09).

student a fresh perspective on their music, different from their conductor's opinion. In summary, people who want to strictly be guided by their conductor and what their interest is should stay with in person lessons. On the other hand, people who want to be taught by teachers with different experiences, and can be asked to evaluate and give feedback to someone focusing on their playing as an individual, not just looking at him/her as a part of the section then they should choose to take online lessons.

*Student 15* - It would depend on the teacher and the student wanting to take online lessons. If the student has access to advanced technology and learn well through words and the teacher was competent at teaching through a screen then yes I would recommend it. If the student however needed one on one time with an instructor online lessons would not be the best fit.

#### Some highlights of additional comments

*Student 4* - Wifi problems are annoying, but I think the lessons were good and taught me a lot

*Student 12* - Thank you so much for the lessons! I've really enjoyed hearing a different perspective with different experiences and background. I appreciate how much hard work you have put in to rescheduling [sic] my lessons when needed and your individual comments and focus to me and my instrument :)

*Student 13* - Thanks for taking the time out of your week to teach us!! I know we all enjoyed it and learned a lot!

*Student 15* - I have more [sic] about cello in the past 3 months than I have in the past 4 years I have spent playing it. I have learned better bow hold and technics [sic]. While online lessons might not be the best for everyone they helped me considerably

Participants believed that students with access would recommend in-person lessons if possible. That being said, the students found that online lessons were beneficial and were able to learn productively from this study. In addition, connecting with new students and bonding on a personal level was possible. Even if lessons cannot be successful for every student, online video conferencing was feasible.



## Data Summary

This study used quantitative research to answer the following questions stated at the beginning of Chapter 3:

1. Were there significant differences between online lessons vs in-person lessons?
2. How strong of a correlation exists between the strength of technology vs. the quality of lessons?
3. Did meeting with the students in-person affect online lessons after?
4. Can online lessons be an effective tool in the public-school setting?

After evaluating the data gathered between September 18 to December 15, lessons with students in-person were more successful than through online video conferencing. Student responses from both surveys conducted after meeting in-person and at the end of the study indicated that lessons were similar, but different due to the physical presence. The numerical responses confirmed this difference with online lessons averaging 3.87 and in-persons 4.67.

The common denominator for the success of online lessons was the quality of video or audio throughout the study; the average rating of lessons suffered as video or audio failed to varying degrees. When comparing the results of video and audio results, changes in audio ratings influenced lesson quality more than changes in video. This difference was also reflected in how students felt technology impacted the quality of lessons. If video and/or audio were rated 2 or above, lessons were deemed productive, even with perceived disruptions.

Meeting with the students in-person improved perceptions of subsequent online lessons. The average increases in audio, lesson, and student perception of technology affecting lessons were significantly above the standard deviation. Since nothing changed

in the way lessons were taught, it can be assumed that the lesson in-person positively impacted the perception of the online lessons.

This study recommends a reliable source of Internet for successful video conferencing music lessons. Sporadic network connection caused much of the disruption in video and audio fidelity. Having access to stronger broadband speeds would likely prevent disturbances caused by latency and allow for smoother lessons. Even using standard devices and regular Internet, online video conferencing lessons are feasible for high school music programs.

## CHAPTER 5

### CONCLUSIONS

#### **Questions for Future Studies**

Question 1: How did the experiences of individual students change over time?

This study's primary focus was the compilation of a large sample size of data. Because student responses were anonymous, individual response over time was not included. To see how the surveys changed with each person over time could show how quickly, if at all, participants grew comfortable with online video conferencing lessons.

Question 2: How much would the lesson ratings be affected with regular in-person contact with students?

The T-Test comparing the average lesson data before and after meeting the students in Muscatine showed enough change to conclude that the rise in ratings may have been due to the in-person interaction. Due to the geographical challenge, scheduling conflicts, and the time limitation of this study, I could visit only once. My hypothesis would be that video conferencing students who also regularly meet in-person with their teacher would have an overall better lesson experience, even if it was monthly or bi-weekly.

Question 3: How much would responses change if both students and teachers had access to faster Internet such as Internet2? Better equipment?

Thanks to programs such as LoLa, video conferencing technology is capable of life-like synchronicity. How close to in-person lessons would video conferencing lessons be with the boosted Internet and an upgrade in equipment?

Question 4: Most of the student responses regarding audio referred to verbal communication. How different would the results be if sound and tone quality of the cello were the primary focus of audio?

My thoughts prior to the study were that the difference in compressed sound compared to live sound would contribute most to the feasibility of video conferencing lessons. After collecting results, I was curious to read that the vast majority of student response about audio discussed verbal instruction and not the transmission of the actual cello tone.

Question 5: Would the numbers drastically change with different instrument(s) or voice?

One of the advantages of private cello lessons was the ability to visually detect problems such as hand posture and bow positioning. How different would the lesson results be for aerophone instruments or for singers? How much does audio compression affect piano lessons on Skype in comparison to an in-person lesson?

Question 6: How different would the results be if the study was replicated with students and professionals at varying levels?

I chose not to focus on musical colors and nuances online due to the participants being high school students. For university-level students and professionals, how similar would the results of quantified research on lessons be to those of this study?

### **Lessons Learned From the Study**

#### 1. Be confident

Video and audio quality on both Skype and Google Hangout never approached the clarity and fidelity of a video found on YouTube. However, my pedagogical training and teaching instincts were reliable despite technological barriers. Even with audio disruption, I could judge a student's tone quality based on their bow movement on video. To my surprise, intonation was always noticeable. Lessons became more dependent on my abilities as a teacher once online video conferencing grew comfortable for both participants and me.

#### 2. Be flexible

Certain technical problems on cello were addressed with a different approach when I was teaching through video conferencing. It was impossible for me to move my student's hands without being in the same room, so certain exercises were altered to work in this medium. For instance, I asked students to practice shifting with a quarter placed on their left hand to maintain stability in motion. Students would also play 'tug-o-war' with themselves to learn to pull the bow and learn fluid wrist motion from the momentum of weight change.

### 3. Be concise

Verbally describing which parts of the body are controlling the action and how it should feel was my main mode of cello technique instruction. Constant feedback from students was necessary to ensure the lesson was successful. Especially when discussing muscular tension, asking specific questions about shoulder, arm, and thumb raised their awareness of their movement. This also allowed me to offer solutions after listening to the students' responses.

### 4. Be creative

Video conferencing lessons allowed me to demonstrate cello playing from a different perspective. To show the right-hand thumb while using my bow, I moved the camera to focus on the backside of my hand. I would also change my position to the camera to specifically show my left hand while playing.

## **Final Thoughts**

Technology has rapidly evolved since the days of the printing press with inventions such as the gramophone, radio, video, television, computers, and the Internet. Today, widespread growth of the Internet has opened new avenues for information. With high-speed Internet becoming more readily available throughout various institutions along with software systems such as LoLa, technology is fast approaching the experiences of an in-person interaction.

Critics have long bemoaned the integration of new technology with music, with John Philip Sousa in 1906 declaring that recorded sound would lead to “a marked deterioration in American music and musical taste.”<sup>48</sup> With more teachers implementing modern innovations such as Skype into their instruction, scholars have studied both the effects and concerns of teaching via video conferencing.

Widespread access to the Internet and developments in audio and video technology have led to teachers using video conferencing programs for instruction. Through a survey of scholarship regarding the efficacy of online video conferencing music lessons, current research displays both optimism and skepticism in teaching online. With the majority of the findings based on qualitative research, results cannot reveal the nature of online instruction, its relation to technology, and comparison to lessons conducted in person. Therefore, it is difficult to come to an objective conclusion.

By gathering substantial data from weekly lessons with 22 high school students taught between September 22nd until December 15, quantified measures were used to determine the feasibility of online video conferencing lessons. One hundred eighteen survey responses were collected from over 180 lessons taught; 15 survey responses were collected from 22 in-person lessons on October 23 to 24; and 18 out of 22 survey responses were submitted at the conclusion of the study. Through analysis of the gathered data, the study concluded that in-person lessons were better than lessons done online, and that lessons were more successful after meeting face-to-face.

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<sup>48</sup> John Philip Sousa, “The Menace of Mechanical Music (1906),” as found in Timothy Taylor, Mark Katz, and Tony Grajeda’s *Music, Sound, and Technology in America*, Durham: Duke University Press, 2012, 113.

Not everyone has the luxury to study music privately. Two common reasons for this are geography and lack of resources. Some students never receive individualized attention because where they live denies them access to a teacher. Once the Internet became commonplace in schools and American households, students had the potential to access a new medium for learning. Institutions without the connection to broadband network service such as Internet2 will likely experience disruption from lag due to higher latency. Even with household computers and Internet speeds, online video conferencing was a feasible and effective way to teach private music lessons.

I am optimistic that teachers and students will be encouraged to try lessons online as scholarship on its impact expands. Even with breakthroughs such as LoLa and Internet2, I am unsure how close current innovation will come to replicating in-person interaction. However, the Internet was never meant to replace human interaction; it was created to share information and connect people globally. Every student deserves access to quality education, and video conferencing offers the potential for musicians to teach anyone connected online. I hope this study will encourage others to conduct similar research to further understand the effectiveness of online video conferencing lessons. By understanding its effects, educators can confidently utilize modern technology to teach the world.



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APPENDIX A

SURVEY QUESTIONS SENT VIA SURVEY MONKEY

## Lessons October 9-13

PAGE TITLE

1. Rate the video in our lesson today (1 being poor, 5 being very favorable)

- |                         |                         |
|-------------------------|-------------------------|
| <input type="radio"/> 1 | <input type="radio"/> 4 |
| <input type="radio"/> 2 | <input type="radio"/> 5 |
| <input type="radio"/> 3 |                         |

2. Rate the audio in our lesson today (1-5, with 1 being very poor and 5 being very favorable)

- |                         |                         |
|-------------------------|-------------------------|
| <input type="radio"/> 1 | <input type="radio"/> 4 |
| <input type="radio"/> 2 | <input type="radio"/> 5 |
| <input type="radio"/> 3 |                         |

3. Rate the quality of your lesson experience today  
(1-5, with 1 being very poor and 5 being very favorable)

- |                         |                         |
|-------------------------|-------------------------|
| <input type="radio"/> 1 | <input type="radio"/> 4 |
| <input type="radio"/> 2 | <input type="radio"/> 5 |
| <input type="radio"/> 3 |                         |

4. How did the quality the video and audio affect the quality of lesson?  
(1-5, with 1 being extremely disruptive, to 5 not affecting the lesson)

- |                         |                         |
|-------------------------|-------------------------|
| <input type="radio"/> 1 | <input type="radio"/> 4 |
| <input type="radio"/> 2 | <input type="radio"/> 5 |
| <input type="radio"/> 3 |                         |

Comments

1. Rate the quality of your lesson experience today  
(1-5, with 1 being very poor and 5 being very favorable)

- |                         |                         |
|-------------------------|-------------------------|
| <input type="radio"/> 1 | <input type="radio"/> 4 |
| <input type="radio"/> 2 | <input type="radio"/> 5 |
| <input type="radio"/> 3 |                         |

2. How different was the lesson experience in person in comparison to online?  
(1-5, with 1 being completely different and 5 being pretty similar)

- |                         |                         |
|-------------------------|-------------------------|
| <input type="radio"/> 1 | <input type="radio"/> 4 |
| <input type="radio"/> 2 | <input type="radio"/> 5 |
| <input type="radio"/> 3 |                         |

3. Please elaborate on Question 2.

## Evaluation of Online Lessons

⊕ PAGE TITLE

1. Rate the quality of your lesson experiences online for the semester (1-5, with 1 being very poor and 5 being very favorable)

1

4

2

5

3

2. Did you enjoy the online lessons? How were they similar to and different from in-person lessons?

3. Would you recommend others to take online lessons?

4. Feel free to share any additional thoughts you'd like to share

APPENDIX B

PARENT LETTER OF PERMISSION



**Cello Lessons via the Internet: Using videoconferencing technology to enhance the public school music curriculum**

PARENTAL LETTER OF PERMISSION

Dear Parent/Legal Guardian:

My name is Yeil Park and I am currently a candidate for the Doctor of Musical Arts in Cello Performance degree at Arizona State University, working under Dr. Jason Caslor. In hopes of enhancing the great music education your child is already receiving, I am conducting a research study to evaluate the use and effectiveness of online videoconferencing lessons (Skype, Facetime, Google Hangout, etc.) I aim to determine if such online, one-on-one instruction can be a successful alternative to conventional private lessons. I am excited to collaborate with Jon Thoma and students of Muscatine High School Orchestra and would like to ask for your permission to teach your child weekly online lessons. For those interested in knowing more about me, go to [yeilparkcellist.com](http://yeilparkcellist.com).

For participating in the project, your child will receive:

1. A 25 minute online lesson every week from September 18 - December 15.
2. An in person lesson with me at Muscatine High School on October 23-24.

Students participating in the study will complete a feedback survey after each lesson. The survey will rate the quality of video and audio in the lesson. There will be a separate survey for the in-person lesson in October, and at the end of the semester.

Your child's participation in this study is voluntary. **These lessons will be free of charge.** Students who do not participate will still receive the bi-weekly technique lessons from Mr. Thoma at Muscatine High School. If you choose not to have your child participate or to withdraw your child from the study at any time, there will be no penalty and it will not affect your student's grades. Likewise, if your child chooses not to participate or to withdraw from the study at any time, there will be no penalty. The results of the research study may be published, but your child's name will not be used. There are no foreseeable risks or discomforts to your child's participation.

Responses to the feedback survey will be anonymous, and all data will be stored safely in a password-protected cloud. The results of this study may be used in reports, presentations, or publications but your child's name will remain anonymous.

If you have any questions concerning the research study or your child's participation in this study, please email me at [ypark57@asu.edu](mailto:ypark57@asu.edu) or Dr. Caslor at [jcaslor@asu.edu](mailto:jcaslor@asu.edu).

Sincerely,

Yeil Park  
DMA Candidate  
Arizona State University  
515.450.3588  
[ypark57@asu.edu](mailto:ypark57@asu.edu)

Dr. Jason Caslor  
Assistant Professor of Music  
Arizona State University  
[jcaslor@asu.edu](mailto:jcaslor@asu.edu)  
[jasoncaslor.com](http://jasoncaslor.com)

APPENDIX C  
LETTER TO STUDENTS

**Cello Lessons via the Internet: Using videoconferencing technology to enhance the public school music curriculum**

My name is Yeil Park, and I am a cellist and doctoral student under the guidance of Dr. Jason Caslor in the School of Music at Arizona State University. In hopes of enhancing the great music education you are already receiving, I am conducting a research study to evaluate the use and effectiveness of online videoconferencing lessons (Skype, Facetime, Google Hangout, etc.) I am excited to collaborate with Jon Thoma and students of Muscatine High School Orchestra to conduct my research and would like to offer you free weekly online lessons. For those interested in knowing more about me, go to yeilparkcellist.com.

For participating in the project, your child will receive:

1. A 25 minute online lesson every week from September 18 - December 15
2. An in person lesson with me at Muscatine High School on October 23-24.

Students participating in the study will complete a feedback survey after each lesson. The survey will rate the quality of video and audio in the lesson. There will be a separate survey for the in-person lesson in October, and at the end of the semester.

Your participation is voluntary and these lessons will be free of charge. In the event you choose to stop your participation in the project, you will still receive bi-weekly technique lessons from Mr. Thoma at Muscatine High School. If you choose not to participate or to withdraw from the study at any time, there will be no penalty and it will not affect your grades.

The results of the research study may be published in reports, presentations, or publications but your name will not be used and you will remain anonymous. There are no foreseeable risks or discomforts to your participation. Responses to the feedback surveys will also be anonymous, and all data will be stored safely in a password-protected cloud.

If you have any questions concerning the research study or your participation in this study, please email me at [ypark57@asu.edu](mailto:ypark57@asu.edu) or Dr. Caslor at [jcaslor@asu.edu](mailto:jcaslor@asu.edu). If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the Arizona State University Office of Research Integrity and Assurance, at (480) 965-6788.

Please let me know if you wish to be part of the study.

Sincerely,

Yeil Park  
DMA Candidate  
Arizona State University  
515.450.3588  
[ypark57@asu.edu](mailto:ypark57@asu.edu)

Dr. Jason Caslor  
Assistant Professor of Music  
Arizona State University  
[jcaslor@asu.edu](mailto:jcaslor@asu.edu)  
[jasoncaslor.com](http://jasoncaslor.com)

By signing below you are agreeing to be part of the study.

Name:

Signature:

Date:

APPENDIX D  
SORTED DATA

Lessons by participants:

Participant	video	audio	lesson	lesson vs technology	Dates
1	1	4	3	3	Sep 18-22
2	5	5	5	5	Sep 18-22
3	4		4	3	Sep 18-22
4	4	3	3	3	Sep 18-22
5	4	4	3	5	Sep 18-22
6	2	1	2	1	Sep 18-22
7	1	1	1	1	Sep 18-22
8	5	3	2	2	Sep 18-22
9	4	3	4	3	Sep 18-22
10	4	4	5	4	Sep 18-22
11	3	4	3	4	Sep 18-22
12	2	2	3	1	Sep 18-22
13	3	3	4	3	Sep 18-22
14	1	1	1	1	Sep 18-22
15	3	1	3	1	Sep 18-22
16	4	3	5	2	Sep 18-22
17	2	3	2	1	Sep 18-22
18	2	3	1	2	Sep 18-22
19	2	3	4	2	Sep 18-22
20	2	3	1	1	Sep 25-29
21	5	3	4	3	Sep 25-29
22	4	4	4	3	Sep 25-29
23	4	5	4	5	Sep 25-29
24	5	4	3	3	Sep 25-29
25	4	4	5	4	Sep 25-29
26	4	3	4	4	Sep 25-29
27	4	3	4	4	Sep 25-29
28	4	4	4	3	Sep 25-29
29	4	3	3	5	Sep 25-29
30	3	4	4	3	Sep 25-29
31	4	4	4	5	Sep 25-29
32	4	2	4	2	Sep 25-29
33	5	4	4	5	Sep 25-29
34	5	4	5	5	Sep 25-29
35	4	2	3	1	Sep 25-29
36	1	1	1	1	Oct 2-6
37	4	4	5	4	Oct 2-6
38	4	4	5	4	Oct 2-6
39	4	4	4	5	Oct 2-6

40	4	5	5	5	Oct 2-6
41	5	5	5	5	Oct 2-6
42	4	4	5	4	Oct 2-6
43	5	4	5	1	Oct 2-6
44	5	4	4	4	Oct 2-6
45	4	4	5	1	Oct 2-6
46	4	5	4	4	Oct 2-6
47	5	5	4	5	Oct 2-6
48	3	4	4	3	Oct 2-6
49	5	4	5	5	Oct 2-6
50	2	3	5	1	Oct 2-6
51	2	1	2	2	Oct 16-20
52	2	2	3	1	Oct 16-20
53	1	2	2	1	Oct 16-20
54	2	2	3	1	Oct 16-20
55	5	5	5	5	Oct 16-20
56	3	3	4	3	Oct 16-20
57	5	5	4	5	Oct 16-20
58	3	2	4	2	Oct 16-20
59	4	3	5	4	Oct 16-20
60	4	4	3	5	Oct 16-20
61	3	4	5	4	Oct 16-20
62	4	4	4	5	Nov 6-10
63	4				Nov 6-10
64	5	4	4	4	Nov 6-10
65	3	2	3	2	Nov 6-10
66	4	4	5	5	Nov 6-10
67	4	5	4	5	Nov 6-10
68	5	5	5	5	Nov 6-10
69	3	3	3	3	Nov 6-10
70	4	5	3	5	Nov 6-10
71	3	4	3	4	Nov 6-10
72	2	2	2	2	Nov 6-10
73	5	4	4	5	Nov 13-17
74	2	2	3	2	Nov 13-17
75		3	4	3	Nov 13-17
76	3	5	5	4	Nov 13-17
77	3	3	4	2	Nov 13-17
78	5	4	5	5	Nov 13-17
79	3	2	3	1	Nov 13-17
80	4	3	5	4	Nov 13-17
81	5	5	5	5	Nov 13-17

82	4	3	4	3	Nov 13-17
83	3	3	4	3	Nov 13-17
84	3	3		3	Nov 20-21
85	4	4	4	4	Nov 20-21
86	5	5	5	5	Nov 20-21
87	3	4	4	3	Nov 20-21
88	4	4		5	Nov 20-21
89	2	3	3	2	Nov 27-Dec 1
90	4	4	4	4	Nov 27-Dec 1
91	4	3	5	2	Nov 27-Dec 1
92	3	5	5	4	Nov 27-Dec 1
93	4	4	4	3	Nov 27-Dec 1
94	3	5	4	4	Nov 27-Dec 1
95	4	3	4	4	Nov 27-Dec 1
96	4	4	4	4	Nov 27-Dec 1
97	5	5	5	5	Nov 27-Dec 1
98	5	5	5	5	Nov 27-Dec 1
99	4	4	4	4	Dec 4-8
100	4	3	4	2	Dec 4-8
101	5	5	5	5	Dec 4-8
102	4	4	4	3	Dec 4-8
103	4	3	4	3	Dec 4-8
104	3	5	5	2	Dec 4-8
105	3	3	4	3	Dec 4-8
106	4	4	5	4	Dec 4-8
107	5	4	4	5	Dec 4-8
108	4	3	5	4	Dec 4-8
109	3				Dec 4-8
110	4	4	4	4	Dec 11-15
111	4	3	3	3	Dec 11-15
112	2	5	4	3	Dec 11-15
113	4	3	5	5	Dec 11-15
114	3	3	4	3	Dec 11-15
115	3	5	4	4	Dec 11-15
116	1	1	2	1	Dec 11-15
117	5	5	5	5	Dec 11-15
118	3	3	4	4	Dec 11-15



Lessons sorted by Video Quality (High to Low)

Participant	video	audio	lesson	lesson vs technology	Dates
2	5	5	5	5	Sep 18-22
41	5	5	5	5	Oct 2-6
55	5	5	5	5	Oct 16-20
68	5	5	5	5	Nov 6-10
81	5	5	5	5	Nov 13-17
86	5	5	5	5	Nov 20-21
97	5	5	5	5	Nov 27-Dec 1
98	5	5	5	5	Nov 27-Dec 1
101	5	5	5	5	Dec 4-8
117	5	5	5	5	Dec 11-15
47	5	5	4	5	Oct 2-6
57	5	5	4	5	Oct 16-20
34	5	4	5	5	Sep 25-29
43	5	4	5	1	Oct 2-6
49	5	4	5	5	Oct 2-6
78	5	4	5	5	Nov 13-17
33	5	4	4	5	Sep 25-29
44	5	4	4	4	Oct 2-6
64	5	4	4	4	Nov 6-10
73	5	4	4	5	Nov 13-17
107	5	4	4	5	Dec 4-8
24	5	4	3	3	Sep 25-29
21	5	3	4	3	Sep 25-29
8	5	3	2	2	Sep 18-22
40	4	5	5	5	Oct 2-6
23	4	5	4	5	Sep 25-29
46	4	5	4	4	Oct 2-6
67	4	5	4	5	Nov 6-10
70	4	5	3	5	Nov 6-10
10	4	4	5	4	Sep 18-22
25	4	4	5	4	Sep 25-29
37	4	4	5	4	Oct 2-6
38	4	4	5	4	Oct 2-6
42	4	4	5	4	Oct 2-6
45	4	4	5	1	Oct 2-6
66	4	4	5	5	Nov 6-10
106	4	4	5	4	Dec 4-8
22	4	4	4	3	Sep 25-29
28	4	4	4	3	Sep 25-29

31	4	4	4	5	Sep 25-29
39	4	4	4	5	Oct 2-6
62	4	4	4	5	Nov 6-10
85	4	4	4	4	Nov 20-21
90	4	4	4	4	Nov 27-Dec 1
93	4	4	4	3	Nov 27-Dec 1
96	4	4	4	4	Nov 27-Dec 1
99	4	4	4	4	Dec 4-8
102	4	4	4	3	Dec 4-8
110	4	4	4	4	Dec 11-15
5	4	4	3	5	Sep 18-22
60	4	4	3	5	Oct 16-20
88	4	4		5	Nov 20-21
16	4	3	5	2	Sep 18-22
59	4	3	5	4	Oct 16-20
80	4	3	5	4	Nov 13-17
91	4	3	5	2	Nov 27-Dec 1
108	4	3	5	4	Dec 4-8
113	4	3	5	5	Dec 11-15
9	4	3	4	3	Sep 18-22
26	4	3	4	4	Sep 25-29
27	4	3	4	4	Sep 25-29
82	4	3	4	3	Nov 13-17
95	4	3	4	4	Nov 27-Dec 1
100	4	3	4	2	Dec 4-8
103	4	3	4	3	Dec 4-8
4	4	3	3	3	Sep 18-22
29	4	3	3	5	Sep 25-29
111	4	3	3	3	Dec 11-15
32	4	2	4	2	Sep 25-29
35	4	2	3	1	Sep 25-29
3	4		4	3	Sep 18-22
63	4				Nov 6-10
76	3	5	5	4	Nov 13-17
92	3	5	5	4	Nov 27-Dec 1
104	3	5	5	2	Dec 4-8
94	3	5	4	4	Nov 27-Dec 1
115	3	5	4	4	Dec 11-15
61	3	4	5	4	Oct 16-20
30	3	4	4	3	Sep 25-29
48	3	4	4	3	Oct 2-6
87	3	4	4	3	Nov 20-21

11	3	4	3	4	Sep 18-22
71	3	4	3	4	Nov 6-10
13	3	3	4	3	Sep 18-22
56	3	3	4	3	Oct 16-20
77	3	3	4	2	Nov 13-17
83	3	3	4	3	Nov 13-17
105	3	3	4	3	Dec 4-8
114	3	3	4	3	Dec 11-15
118	3	3	4	4	Dec 11-15
69	3	3	3	3	Nov 6-10
84	3	3		3	Nov 20-21
58	3	2	4	2	Oct 16-20
65	3	2	3	2	Nov 6-10
79	3	2	3	1	Nov 13-17
15	3	1	3	1	Sep 18-22
109	3				Dec 4-8
112	2	5	4	3	Dec 11-15
50	2	3	5	1	Oct 2-6
19	2	3	4	2	Sep 18-22
89	2	3	3	2	Nov 27-Dec 1
17	2	3	2	1	Sep 18-22
18	2	3	1	2	Sep 18-22
20	2	3	1	1	Sep 25-29
12	2	2	3	1	Sep 18-22
52	2	2	3	1	Oct 16-20
54	2	2	3	1	Oct 16-20
74	2	2	3	2	Nov 13-17
72	2	2	2	2	Nov 6-10
6	2	1	2	1	Sep 18-22
51	2	1	2	2	Oct 16-20
1	1	4	3	3	Sep 18-22
53	1	2	2	1	Oct 16-20
116	1	1	2	1	Dec 11-15
7	1	1	1	1	Sep 18-22
14	1	1	1	1	Sep 18-22
36	1	1	1	1	Oct 2-6
75		3	4	3	Nov 13-17

Lesson Sorted by Audio

Participant	video	audio	lesson	lesson vs technology	Dates
2	5	5	5	5	Sep 18-22
41	5	5	5	5	Oct 2-6
55	5	5	5	5	Oct 16-20
68	5	5	5	5	Nov 6-10
81	5	5	5	5	Nov 13-17
86	5	5	5	5	Nov 20-21
97	5	5	5	5	Nov 27-Dec 1
98	5	5	5	5	Nov 27-Dec 1
101	5	5	5	5	Dec 4-8
117	5	5	5	5	Dec 11-15
40	4	5	5	5	Oct 2-6
76	3	5	5	4	Nov 13-17
92	3	5	5	4	Nov 27-Dec 1
104	3	5	5	2	Dec 4-8
47	5	5	4	5	Oct 2-6
57	5	5	4	5	Oct 16-20
23	4	5	4	5	Sep 25-29
46	4	5	4	4	Oct 2-6
67	4	5	4	5	Nov 6-10
94	3	5	4	4	Nov 27-Dec 1
115	3	5	4	4	Dec 11-15
112	2	5	4	3	Dec 11-15
70	4	5	3	5	Nov 6-10
34	5	4	5	5	Sep 25-29
43	5	4	5	1	Oct 2-6
49	5	4	5	5	Oct 2-6
78	5	4	5	5	Nov 13-17
10	4	4	5	4	Sep 18-22
25	4	4	5	4	Sep 25-29
37	4	4	5	4	Oct 2-6
38	4	4	5	4	Oct 2-6
42	4	4	5	4	Oct 2-6
45	4	4	5	1	Oct 2-6
66	4	4	5	5	Nov 6-10
106	4	4	5	4	Dec 4-8
61	3	4	5	4	Oct 16-20
33	5	4	4	5	Sep 25-29

44	5	4	4	4	Oct 2-6
64	5	4	4	4	Nov 6-10
73	5	4	4	5	Nov 13-17
107	5	4	4	5	Dec 4-8
22	4	4	4	3	Sep 25-29
28	4	4	4	3	Sep 25-29
31	4	4	4	5	Sep 25-29
39	4	4	4	5	Oct 2-6
62	4	4	4	5	Nov 6-10
85	4	4	4	4	Nov 20-21
90	4	4	4	4	Nov 27-Dec 1
93	4	4	4	3	Nov 27-Dec 1
96	4	4	4	4	Nov 27-Dec 1
99	4	4	4	4	Dec 4-8
102	4	4	4	3	Dec 4-8
110	4	4	4	4	Dec 11-15
30	3	4	4	3	Sep 25-29
48	3	4	4	3	Oct 2-6
87	3	4	4	3	Nov 20-21
24	5	4	3	3	Sep 25-29
5	4	4	3	5	Sep 18-22
60	4	4	3	5	Oct 16-20
11	3	4	3	4	Sep 18-22
71	3	4	3	4	Nov 6-10
1	1	4	3	3	Sep 18-22
88	4	4		5	Nov 20-21
16	4	3	5	2	Sep 18-22
59	4	3	5	4	Oct 16-20
80	4	3	5	4	Nov 13-17
91	4	3	5	2	Nov 27-Dec 1
108	4	3	5	4	Dec 4-8
113	4	3	5	5	Dec 11-15
50	2	3	5	1	Oct 2-6
21	5	3	4	3	Sep 25-29
9	4	3	4	3	Sep 18-22
26	4	3	4	4	Sep 25-29
27	4	3	4	4	Sep 25-29
82	4	3	4	3	Nov 13-17
95	4	3	4	4	Nov 27-Dec 1
100	4	3	4	2	Dec 4-8
103	4	3	4	3	Dec 4-8
13	3	3	4	3	Sep 18-22

56	3	3	4	3	Oct 16-20
77	3	3	4	2	Nov 13-17
83	3	3	4	3	Nov 13-17
105	3	3	4	3	Dec 4-8
114	3	3	4	3	Dec 11-15
118	3	3	4	4	Dec 11-15
19	2	3	4	2	Sep 18-22
75		3	4	3	Nov 13-17
4	4	3	3	3	Sep 18-22
29	4	3	3	5	Sep 25-29
111	4	3	3	3	Dec 11-15
69	3	3	3	3	Nov 6-10
89	2	3	3	2	Nov 27-Dec 1
8	5	3	2	2	Sep 18-22
17	2	3	2	1	Sep 18-22
18	2	3	1	2	Sep 18-22
20	2	3	1	1	Sep 25-29
84	3	3		3	Nov 20-21
32	4	2	4	2	Sep 25-29
58	3	2	4	2	Oct 16-20
35	4	2	3	1	Sep 25-29
65	3	2	3	2	Nov 6-10
79	3	2	3	1	Nov 13-17
12	2	2	3	1	Sep 18-22
52	2	2	3	1	Oct 16-20
54	2	2	3	1	Oct 16-20
74	2	2	3	2	Nov 13-17
72	2	2	2	2	Nov 6-10
53	1	2	2	1	Oct 16-20
15	3	1	3	1	Sep 18-22
6	2	1	2	1	Sep 18-22
51	2	1	2	2	Oct 16-20
116	1	1	2	1	Dec 11-15
7	1	1	1	1	Sep 18-22
14	1	1	1	1	Sep 18-22
36	1	1	1	1	Oct 2-6
3	4		4	3	Sep 18-22
63	4				Nov 6-10
109	3				Dec 4-8

## Lessons Sorted by Lesson Quality

Participant	video	audio	lesson	lesson vs technology	Dates
2	5	5	5	5	Sep 18-22
34	5	4	5	5	Sep 25-29
41	5	5	5	5	Oct 2-6
43	5	4	5	1	Oct 2-6
49	5	4	5	5	Oct 2-6
55	5	5	5	5	Oct 16-20
68	5	5	5	5	Nov 6-10
78	5	4	5	5	Nov 13-17
81	5	5	5	5	Nov 13-17
86	5	5	5	5	Nov 20-21
97	5	5	5	5	Nov 27-Dec 1
98	5	5	5	5	Nov 27-Dec 1
101	5	5	5	5	Dec 4-8
117	5	5	5	5	Dec 11-15
10	4	4	5	4	Sep 18-22
16	4	3	5	2	Sep 18-22
25	4	4	5	4	Sep 25-29
37	4	4	5	4	Oct 2-6
38	4	4	5	4	Oct 2-6
40	4	5	5	5	Oct 2-6
42	4	4	5	4	Oct 2-6
45	4	4	5	1	Oct 2-6
59	4	3	5	4	Oct 16-20
66	4	4	5	5	Nov 6-10
80	4	3	5	4	Nov 13-17
91	4	3	5	2	Nov 27-Dec 1
106	4	4	5	4	Dec 4-8
108	4	3	5	4	Dec 4-8
113	4	3	5	5	Dec 11-15
61	3	4	5	4	Oct 16-20
76	3	5	5	4	Nov 13-17
92	3	5	5	4	Nov 27-Dec 1
104	3	5	5	2	Dec 4-8
50	2	3	5	1	Oct 2-6
21	5	3	4	3	Sep 25-29
33	5	4	4	5	Sep 25-29
44	5	4	4	4	Oct 2-6
47	5	5	4	5	Oct 2-6

57	5	5	4	5	Oct 16-20
64	5	4	4	4	Nov 6-10
73	5	4	4	5	Nov 13-17
107	5	4	4	5	Dec 4-8
3	4		4	3	Sep 18-22
9	4	3	4	3	Sep 18-22
22	4	4	4	3	Sep 25-29
23	4	5	4	5	Sep 25-29
26	4	3	4	4	Sep 25-29
27	4	3	4	4	Sep 25-29
28	4	4	4	3	Sep 25-29
31	4	4	4	5	Sep 25-29
32	4	2	4	2	Sep 25-29
39	4	4	4	5	Oct 2-6
46	4	5	4	4	Oct 2-6
62	4	4	4	5	Nov 6-10
67	4	5	4	5	Nov 6-10
82	4	3	4	3	Nov 13-17
85	4	4	4	4	Nov 20-21
90	4	4	4	4	Nov 27-Dec 1
93	4	4	4	3	Nov 27-Dec 1
95	4	3	4	4	Nov 27-Dec 1
96	4	4	4	4	Nov 27-Dec 1
99	4	4	4	4	Dec 4-8
100	4	3	4	2	Dec 4-8
102	4	4	4	3	Dec 4-8
103	4	3	4	3	Dec 4-8
110	4	4	4	4	Dec 11-15
13	3	3	4	3	Sep 18-22
30	3	4	4	3	Sep 25-29
48	3	4	4	3	Oct 2-6
56	3	3	4	3	Oct 16-20
58	3	2	4	2	Oct 16-20
77	3	3	4	2	Nov 13-17
83	3	3	4	3	Nov 13-17
87	3	4	4	3	Nov 20-21
94	3	5	4	4	Nov 27-Dec 1
105	3	3	4	3	Dec 4-8
114	3	3	4	3	Dec 11-15
115	3	5	4	4	Dec 11-15
118	3	3	4	4	Dec 11-15
19	2	3	4	2	Sep 18-22



112	2	5	4	3	Dec 11-15
75		3	4	3	Nov 13-17
24	5	4	3	3	Sep 25-29
4	4	3	3	3	Sep 18-22
5	4	4	3	5	Sep 18-22
29	4	3	3	5	Sep 25-29
35	4	2	3	1	Sep 25-29
60	4	4	3	5	Oct 16-20
70	4	5	3	5	Nov 6-10
111	4	3	3	3	Dec 11-15
11	3	4	3	4	Sep 18-22
15	3	1	3	1	Sep 18-22
65	3	2	3	2	Nov 6-10
69	3	3	3	3	Nov 6-10
71	3	4	3	4	Nov 6-10
79	3	2	3	1	Nov 13-17
12	2	2	3	1	Sep 18-22
52	2	2	3	1	Oct 16-20
54	2	2	3	1	Oct 16-20
74	2	2	3	2	Nov 13-17
89	2	3	3	2	Nov 27-Dec 1
1	1	4	3	3	Sep 18-22
8	5	3	2	2	Sep 18-22
6	2	1	2	1	Sep 18-22
17	2	3	2	1	Sep 18-22
51	2	1	2	2	Oct 16-20
72	2	2	2	2	Nov 6-10
53	1	2	2	1	Oct 16-20
116	1	1	2	1	Dec 11-15
18	2	3	1	2	Sep 18-22
20	2	3	1	1	Sep 25-29
7	1	1	1	1	Sep 18-22
14	1	1	1	1	Sep 18-22
36	1	1	1	1	Oct 2-6
63	4				Nov 6-10
88	4	4		5	Nov 20-21
84	3	3		3	Nov 20-21
109	3				Dec 4-8

Lessons sorted by How Students felt video and audio affected quality of lessons (High to Low)

Participant	video	audio	lesson	lesson vs technology	Dates
117	5	5	5	5	Dec 11-15
113	4	3	5	5	Dec 11-15
107	5	4	4	5	Dec 4-8
101	5	5	5	5	Dec 4-8
98	5	5	5	5	Nov 27-Dec 1
97	5	5	5	5	Nov 27-Dec 1
88	4	4			Nov 20-21
86	5	5	5	5	Nov 20-21
81	5	5	5		Nov 13-17
78	5	4	5		Nov 13-17
73	5	4	4		Nov 13-17
70	4	5	3		Nov 6-10
68	5	5	5		Nov 6-10
67	4	5	4		Nov 6-10
66	4	4	5		Nov 6-10
62	4	4	4		Nov 6-10
60	4	4	3		Oct 16-20
57	5	5	4		Oct 16-20
55	5	5	5		Oct 16-20
49	5	4	5		Oct 2-6
47	5	5	4		Oct 2-6
41	5	5	5		Oct 2-6
40	4	5	5		Oct 2-6
39	4	4	4		Oct 2-6
34	5	4	5		Sep 25-29
33	5	4	4		Sep 25-29
31	4	4	4		Sep 25-29
29	4	3	3		Sep 25-29
23	4	5	4		Sep 25-29
5	4	4	3		Sep 18-22
2	5	5	5		Sep 18-22
118	3	3	4		Dec 11-15
115	3	5	4		Dec 11-15
110	4	4	4		Dec 11-15
108	4	3	5		Dec 4-8
106	4	4	5		Dec 4-8
99	4	4	4		Dec 4-8
96	4	4	4		Nov 27-Dec 1

95	4	3	4	4	Nov 27-Dec 1
94	3	5	4	4	Nov 27-Dec 1
92	3	5	5	4	Nov 27-Dec 1
90	4	4	4	4	Nov 27-Dec 1
85	4	4	4	4	Nov 20-21
80	4	3	5	4	Nov 13-17
76	3	5	5	4	Nov 13-17
71	3	4	3	4	Nov 6-10
64	5	4	4	4	Nov 6-10
61	3	4	5	4	Oct 16-20
59	4	3	5	4	Oct 16-20
46	4	5	4	4	Oct 2-6
44	5	4	4	4	Oct 2-6
42	4	4	5	4	Oct 2-6
38	4	4	5	4	Oct 2-6
37	4	4	5	4	Oct 2-6
27	4	3	4	4	Sep 25-29
26	4	3	4	4	Sep 25-29
25	4	4	5	4	Sep 25-29
11	3	4	3	4	Sep 18-22
10	4	4	5	4	Sep 18-22
114	3	3	4	3	Dec 11-15
112	2	5	4	3	Dec 11-15
111	4	3	3	3	Dec 11-15
105	3	3	4	3	Dec 4-8
103	4	3	4	3	Dec 4-8
102	4	4	4	3	Dec 4-8
93	4	4	4	3	Nov 27-Dec 1
87	3	4	4	3	Nov 20-21
84	3	3		3	Nov 20-21
83	3	3	4	3	Nov 13-17
82	4	3	4	3	Nov 13-17
75		3	4	3	Nov 13-17
69	3	3	3	3	Nov 6-10
56	3	3	4	3	Oct 16-20
48	3	4	4	3	Oct 2-6
30	3	4	4	3	Sep 25-29
28	4	4	4	3	Sep 25-29
24	5	4	3	3	Sep 25-29
22	4	4	4	3	Sep 25-29
21	5	3	4	3	Sep 25-29
13	3	3	4	3	Sep 18-22

9	4	3	4	3	Sep 18-22
4	4	3	3	3	Sep 18-22
3	4		4	3	Sep 18-22
1	1	4	3	3	Sep 18-22
104	3	5	5	2	Dec 4-8
100	4	3	4	2	Dec 4-8
91	4	3	5	2	Nov 27-Dec 1
89	2	3	3	2	Nov 27-Dec 1
77	3	3	4	2	Nov 13-17
74	2	2	3	2	Nov 13-17
72	2	2	2	2	Nov 6-10
65	3	2	3	2	Nov 6-10
58	3	2	4	2	Oct 16-20
51	2	1	2	2	Oct 16-20
32	4	2	4	2	Sep 25-29
19	2	3	4	2	Sep 18-22
18	2	3	1	2	Sep 18-22
16	4	3	5	2	Sep 18-22
8	5	3	2	2	Sep 18-22
116	1	1	2	1	Dec 11-15
79	3	2	3	1	Nov 13-17
54	2	2	3	1	Oct 16-20
53	1	2	2	1	Oct 16-20
52	2	2	3	1	Oct 16-20
50	2	3	5	1	Oct 2-6
45	4	4	5	1	Oct 2-6
43	5	4	5	1	Oct 2-6
36	1	1	1	1	Oct 2-6
35	4	2	3	1	Sep 25-29
20	2	3	1	1	Sep 25-29
17	2	3	2	1	Sep 18-22
15	3	1	3	1	Sep 18-22
14	1	1	1	1	Sep 18-22
12	2	2	3	1	Sep 18-22
7	1	1	1	1	Sep 18-22
6	2	1	2	1	Sep 18-22
109	3				Dec 4-8
63	4				Nov 6-10

APPENDIX E

WEEKLY DATA BY PARTICIPANTS

All of the results were from the Survey Monkey surveys. As of this study, Survey Monkey does not allow researchers to sort the responses from all individuals into one page so I took the data from each participant and formatted as such:

(Video, Audio, Lesson, How Video/Audio affected lesson)

**SEP 18-22**

- (1,4,3,3)
- (5,5,5,5) 'The quality itself wasn't difficult, but the angle of my camera at times caused issues'
- (4,\_,4,3) 'The audio did cut out a little at times, but I just asked Mr. Park to repeat what he said.'
- (4,3,3,3) 'The lesson was fun, but it needed some audio assistance.'
- (4,4,3,5)
- (2,1,2,1)
- (1,1,1,1)
- (5,3,2,2)
- (4,3,4,3)
- (4,4,5,4) 'There is only one computer...that works with Skype...Other than that the lesson went well!'
- (3,4,3,4)
- (2,2,3,1) 'He seems so cool it is just the internet clunked out on us! Hopefully it will work this week.'
- (3,3,4,3) 'The video would keep stopping, but I was still able to hear the instructor and learned well.'
- (1,1,1,1) Internet did not work and website was blocked
- (3,1,3,1) 'I think we should find a new spot. Thoma's office is a WiFi dungeon.'
- (4,3,5,2) 'Audio and video would cut out and would be very delayed.'
- (2,3,2,1) 'I did not have a lesson, so...'
- (2,3,1,2) 'In my lesson the video wasn't working but the sound was. We tried to get the video to work the whole time and we weren't able to practice anything'
- (2,3,4,2) 'There were times the screen went blank and I could not see what you were doing or the audio was delayed.'

**AVERAGE**

(2.95, 2.83, 3.05, 2.47)

**SEP 25-29**

- (2,3,1,1) 'The Connection wasn't very good'
- (5,3,4,3)
- (4,4,4,3)
- (4,5,4,5)

- (5,4,3,3)
- (4,4,5,4)
- (4,3,4,4)
- (4,3,4,4)
- (4,4,4,3)
- (4,3,3,5)
- (3,4,4,3) 'Video cut out a couple times. Other than this the lesson was as desired!'
- (4,4,4,5) 'It would be helpful if Mr. Park would be aware of the time...so we can get to class'
- (4,2,4,2) 'It was a little bit frustrating trying to hear...because the audio kept cutting out.'
- (5,4,4,5)
- (5.4.5,5)
- (4,2,3,1)

AVG

(4.06, 3.50, 3.75, 3.50)

**Oct 2-6**

- (1,1,1,1)
- (4,4,5,4)
- (4,4,5,4)
- (4,4,4,5) 'This has been helpful with my bowhold'
- (4,5,5,5)
- (5,5,5,5)
- (4,4,5,4)
- (5,4,5,1)
- (5,4,4,4)
- (4,4,5,1)
- (4,5,4,4) 'The video did cut out once, but other than that the lesson was good.'
- (5,5,4,5) Another good lesson thanks for the help on my music!
- (3,4,4,3)
- (5,4,5,5) 'I think that Mr. Park is helping immensely with the cellos because it has become quite noticeable that the whole section is improving on their technique and shifting...I feel more confidently in my performing now than I did before we started this study.'
- (2,3,5,1)

AVG:

(3.93, 4.00, 4.40, 3.47)

**OCT 16-20**

- (2,1,2,2)

(2,2,3,1)

(1,2,2,1)

(2,2,3,1)

(5,5,5,5)

(3,3,4,3)

‘Everything went really well and smooth with a few, minor exceptions.’  
‘It’s just the wifi’s fault. Great lesson. Looking forward to seeing you in person!’

(5,5,4,5)

(3,2,4,2)

(4,3,5,4)

(4,4,3,5)

(3,4,5,4)

‘Wish the wifi would just work already! Man.’

#### AVERAGE

(3.09, 3.00, 3.64, 3.00)

#### **SURVEY FOR MHS IN-PERSON LESSONS**

#### **(Q1 RATE THE QUALITY OF YOUR LESSON 1-5,**

#### **Q2 HOW DIFFERENT WAS THE LESSON EXPERIENCE IN PERSON IN COMPARISON TO ONLINE? 1-5)**

(5,2)

It was a lot better I thought, and we could understand each other and I learned quicker and more easily. The distractions of mishaps with technology were not there which made for a much better quality lesson

(5,3)

It was better to have a lesson in person because you were more easily able to help with our positioning than over Skype

(5,3)

It was a little easier for him to show me and move my hands around to the right spots on the cello

(5,3)

It was similar but much more easy to follow now that he could explain things more thoroughly in person

(5,2)

It was a lot easier for him to show me the correct techniques.

(5,2)

Being present in a physical form allowed for much clearer instruction

(5,4)

It felt very similar. The only real difference was that in person you could adjust posture.

(4,3)

It was nice to have the teacher there, in person. The ability to have a teacher physically take your bow or use your cello is something very valuable. Online lessons don’t have this. Though online lessons are easier if a student is shy, and does not like playing right in front of a person (in person)

(5,1)

It was a lot more helpful! He could help me with my form, and put my hands in a certain place! But Online, he only got to show me what he did, and told me where to put my fingers and stuff! It was a lot better! :))))

(5,2)

It was different by the fact that you were there in person. It was nice not having internet issues. I understood the drop angle of my hand a lot better because you physically could move my fingers where [sic] needed to go.

(5,2)

It was so much easier to make corrections to my playing etiquette.



- (4,3) He could tell us where to put our hands on the fingerboard and he could look and see the music we were playing. Maybe if he had a copy of our music? He also had brownies, which were very good. But it was kind of similar because we were still taught, and in the same lesson format as online.
- (2,4) there wasn't anything different in the lesson [than sic] online
- (5,4) Things were covered mostly the same, skills were explained more clearly
- (5,5) We could focus on the material of the lesson rather than be distracted with the technology issues with such as bad wifi at MHS

AVG

4.67

2.87

**NOV 6-10**

(4,4,4,5)

(4,\_,\_,\_)

(5,4,4,4)

'Fun.'

(3,2,3,2)

(4,4,5,5)

(4,5,4,5)

(5,5,5,5)

(3,3,3,3)

(4,5,3,5)

'Fun lesson'

(3,4,3,4)

'The lesson was very good, even though I had to leave early'

(2,2,2,2)

'bad signal'

AVG:

(3.73, 3.80, 3.60, 4.00)

**NOV 13-17**

(5,4,4,5)

(2,2,3,2)

(\_,3,4,3)

'The video lagged about 5 seconds behind the sound'

(3,5,5,4)

(3,3,4,2)

(5,4,5,5)

(3,2,3,1)

(4,3,5,4)

'It was hard to hear at some points, but I feel like this lesson was one of our most productive.'

(5,5,5,5)

(4,3,4,3)

(3,3,4,3)

Avg:

(3.70, 3.36, 4.18, 3.36)

**NOV 20-21**

(3,3,\_,3)  
(4,4,4,4)  
(5,5,5,5)  
(3,4,4,3)  
(4,4,\_,5)

Avg:

(3.80, 4.00, 4.33, 4.00)

**NOV 27-DEC 1**

(2,3,3,2)  
(4,4,4,4)  
(4,3,5,2)  
(3,5,5,4)  
(4,4,4,3)  
(3,5,4,4)  
(4,3,4,4)  
(4,4,4,4)  
(5,5,5,5)  
(5,5,5,5)

Avg:

(3.80, 4.10, 4.30, 3.70)

**DEC 4-8**

(4,4,4,4)  
(4,3,4,2)  
(5,5,5,5)  
(4,4,4,3)  
(4,3,4,3)  
(3,5,5,2)  
(3,3,4,3)  
(4,4,5,4)  
(5,4,4,5)      'Good fun'  
(4,3,5,4)  
(3,\_,\_,\_)

Avg:

(3.91, 3.80, 4.40, 3.50)

**DEC 11-15**

(4,4,4,4)  
(4,3,3,3)  
(2,5,4,3)

(4,3,5,5)  
(3,3,4,3)  
(3,5,4,4)  
(1,1,2,1)  
(5,5,5,5)  
(3,3,4,4)

‘we could barely cover the desired topics, because of internet disruptions.’

Avg:  
(3.22, 3.56, 3.89, 3.56)

## SEMESTER SUMMARY

### **Q1. RATE THE QUALITY OF YOUR LESSON EXPERIENCES ONLINE FOR THE SEMESTER (1-5, WITH 1 BEING VERY POOR AND 5 BEING VERY FAVORABLE)**

*Student 1 - 5*  
*Student 2 - 3*  
*Student 3 - 3*  
*Student 4 - 4*  
*Student 5 - 5*  
*Student 6 - 4*  
*Student 7 - 4*  
*Student 8 - 4*  
*Student 9 - 4*  
*Student 10 - 5*  
*Student 11 - 3*  
*Student 12 - 4*  
*Student 13 - 4*  
*Student 14 - 4*  
*Student 15 - 4*  
*Student 16 - 4*  
*Student 17 - 5*  
*Student 18 - 5*

3's = 3          4's = 10          5's = 5  
Average score: 4.11

### **Q2. DID YOU ENJOY THE ONLINE LESSONS? HOW WERE THEY SIMILAR TO AND DIFFERENT FROM IN-PERSON LESSONS?**

*Student 1 -* I enjoyed them a lot. I'm a very awkward person so I could blame a lot of my awkwardness on Skype. Sometimes it was harder to tell what Yeil was doing because I couldn't see the cello as well. I was surprised by how easy

- it was to hear the cello over Skype though at times the audio made it difficult to hear instructions.
- Student 2* - They were ok. They were different because if something wasn't going right then it was harder to adjust it correctly in a timely matter
- Student 3* - Yes/ He couldn't show as if he was in person/ He had to really explain, which has its pros and cons.
- Student 4* - Yes, they were good. They were still a lot like the in-person lessons, but the only difference is that mistakes were harder to correct, and there were always those Wi-Fi problems.
- Student 5* - I liked them quite a bit, there wasn't much of a difference between online and in-person lessons which I really liked. The biggest difference is the lack of actual physical interaction; for example it is much harder to explain how to articulate a note than it is to show how to articulate a note through physical instruction.
- Student 6* - Online lesson is similar because of the communication and teaching wise. It's different because since you know the cello real well, it's cool to have someone that knows what they are doing
- Student 7* - Yes, they were harder to understand however, and it was more difficult to understand what I was supposed to do.
- Student 8* - Sometimes the video was bad but it never really affected the lesson
- Student 9* - Personally I enjoyed the online lessons. Online lessons are very similar to in person lessons, except they have some delay and sometimes the internet just will not cooperate
- Student 10* - I enjoyed the online lessons. It was different than in-person lessons.
- Student 11* - I like in person lessons better because it's easier for me to see and hear what the teacher is wanting you to do
- Student 12* - Yes! The lessons were similar to in-person lessons because it was a face to face practice. The teacher had the same capability to identify the student's playing techniques and in turn teach and say how to adjust their tone, rythmm [sic], and bowings to help improve their play [sic]. The teacher on the screen had the same intellect to correct and fairly adjust the student's playing as a teacher that could be in the same room. In contrast, however, information from a certain person could not successively communicate to the other person because of glitched auto sound due to the poor internet connection. Likewise sometimes the internet had also affected how the screen looked, freezing in parts where the teacher demonstrated how he wanted the student to mimmick [sic]. This problem did not occur much, but when it did, it usually resulted in confused sides and sometimes even a stoppage [sic] of the lesson because of poor quality on the screen.
- Student 13* - I liked the in-person lessons better because the internet and connecting issues were not a problem. The lessons online were great too!
- Student 14* - I enjoyed the lessons because they taught me technique things that I may not have learned in class with Mr. Thoma since we often focus on the music we are playing. In person was similar because we still worked

constantly on things, but it was different because Yeil could actually show things in person that I might have not understood as well through video.

- Student 15* - I did enjoy my lessons. I think that the downfall of online lessons is simply that words have to [sic] used to teach instead of actions. That being said if the teacher is has a mastery of language there is only a very small difference between in-person lessons and online lessons.
- Student 16* - Yes, they were similar to the in-person lessons because you always helped us with what we needed to do?work on, but in-person lessons were different because you could actually guide us, and help us and fix our corrections.
- Student 17* - I enjoyed [Yeil] he was cool and funny, and they are similar because the person teaching can still teach some techniques, just without hands one learning. [Yeil] was pretty good at describing stuff though. They are different because sometimes things take a little longer to understand or process.
- Student 18* - Yes I enjoyed them. Similar because I was learning things and being taught one on one. Different because it was face to face literally and sometimes the internet was bad.

### **Q3. WOULD YOU RECOMMEND OTHERS TO TAKE ONLINE LESSONS?**

- Student 1* - Yes, definitely
- Student 2* - If there wasn't another option for in-person lessons then yes. But as a first option then no.
- Student 3* - Yes. Definitely a learning experience.
- Student 4* - Yes, it was good.
- Student 5* - Yes, it helped me understand the music on a much deeper level so I would definitely suggest it to those interested.
- Student 6* - Depends on what is going on in their school or place, If there is someone that knows the cello or any instrument at their school then online lessons is no [sic] recommended
- Student 7* - Depends.. if they are really dedicated and are in need of extra lessons then yes.
- Student 8* - Yes, it is a great experience and really helped me
- Student 9* - Yes, but I would recommend in person lessons first, as you have the ability to get more done
- Student 10* - I would recommend others taking on line lessons if they do not have a teacher close to them.
- Student 11* - No
- Student 12* - Depending on the person who is interested. This specific online lessons are great to get feedback from a person who has a different musical background and can give tips on technique and answers questions that a teacher could not do. By a teacher outside of the program it gives the student a fresh perspective on their music, different from their conductor's opinion. In summary, people who want to strictly be guided by their conductor and what their interest is should stay with in person lessons. On

the other hand, people who want to be taught be [sic] teachers with different experiences, and can be asked to evaluate and give feedback to someone focusing on their playing as an individual, not just looking at him/her as a part of the [sic] section then they should choose to take online lessons.

*Student 13* - Yes, I think it's a good experience.

*Student 14* - Yes!

*Student 15* - It would depend on the teacher and the student wanting to take online lessons. If the student has access to advanced technology and learn well through words and the teacher was competent at teaching through a screen then yes I would recommend it. If the student however needed one on one time with an instructor online lessons would not be the best fit.

*Student 16* - YES!

*Student 17* - Yes, but you should have pretty good listening and watching skills.

*Student 18* - Yes it's a great benefit on both ends.

#### **Q4. FEEL FREE TO SHARE ANY ADDITIONAL THOUGHTS YOU'D LIKE TO SHARE**

*Student 1* - omitted

*Student 2* - Thanks

*Student 3* - omitted

*Student 4* - Wifi problems are annoying, but I think the lessons were good and taught me a lot.

*Student 5* - Nice job.

*Student 6* - Having a lesson every week was a pain because that means we would have to leave our rehearsal once a week. If for some reason we have a lesson Friday then one a [sic] Monday again, that's two rehearsal times we are missing. The time of the lessons, if it could be during a period besides orchestra, again it's just about missing rehearsal time.

*Student 7* - Yeah it's super cool and it's been fun

*Student 8* - omitted

*Student 9* - Some lessons were cut short, because of internet difficulties.

*Student 10* - The lessons were fun. I learned a lot from Mr. Park.

*Student 11* - Thanks for including me in your experiment, hope it turns out good

*Student 12* - Thank you so much for the lessons! I've really enjoyed hearing a different perspective with different experiences and background. I appreciate how much hard work you have put in to rescheduling [sic] my lessons when needed and your individual comments and focus to me and my instrument :)

*Student 13* - Thanks for taking the time out of your week to teach us!! I know we all enjoyed it and learned a lot!

*Student 14* - omitted

*Student 15* - I have learned more about cello in the past 3 months than I have in the past 4 years I have spent playing it. I have learned better bow hold and

technics. While online lessons might not be the best for everyone they helped me considerably

*Student 16* - I had a great time learning from you, thanks for working with us!!!!!!

*Student 17* - Yale [sic] on a scale.

Also Yale [sic] is super good at cello.

*Student 18* - omitted

APPENDIX F  
IRB APPROVAL





EXEMPTION GRANTED

Jason Caslor  
 Music, School of  
 480/965-4393  
 Jason.Caslor@asu.edu

Dear Jason Caslor:

On 9/11/2017 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Cello Lessons via the Internet: Using videoconferencing technology to enhance the public school music curriculum
Investigator:	Jason Caslor
IRB ID:	STUDY00006645
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	<ul style="list-style-type: none"> <li>• Muscatine 3.pdf, Category: Off-site authorizations (school permission, other IRB approvals, Tribal permission etc);</li> <li>• Yeil Park Consent Form.Student.pdf, Category: Consent Form;</li> <li>• Muscatine 5.pdf, Category: Off-site authorizations (school permission, other IRB approvals, Tribal permission etc);</li> <li>• Muscatine 6.pdf, Category: Off-site authorizations (school permission, other IRB approvals, Tribal permission etc);</li> <li>• Email with Jon.pdf, Category: Off-site authorizations (school permission, other IRB approvals, Tribal permission etc);</li> <li>• Yeil Park Consent Form.doc.pdf, Category: Consent Form;</li> <li>• Muscatine 1.pdf, Category: Off-site authorizations (school permission, other IRB approvals, Tribal</li> </ul>

	permission etc); • Muscatine 4.pdf, Category: Off-site authorizations (school permission, other IRB approvals, Tribal permission etc); • Yeil Park IRB Application.docx, Category: IRB Protocol; • Muscatine 2.pdf, Category: Off-site authorizations (school permission, other IRB approvals, Tribal permission etc); • Yeil Park Surveys.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);
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The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (1) Educational settings on 9/11/2017.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Yeil Park  
Yeil Park