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Design Factors Affecting Music Students' Practice Duration and Quality in Higher Education

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School of Human Ecology

By

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ABSTRACT

The purpose of this research is to help determine practice room design guidelines to increase music students' practice duration and quality in higher education. The Foy Building music practice rooms on the Statesboro campus of Georgia Southern University are being used as the basis for this research, as these spaces are used daily by music students to practice their instruments. The study population for this research was music majors and minors, as these individuals are the main users of the practice room spaces. The research design consisted of two phases- one qualitative and the other quantitative. An initial online questionnaire was conducted to gather user feedback about the practice room spaces. This was followed by a quantitative phase where acoustical and lighting measurements were taken of the practice room spaces based on participant feedback from the initial survey. Twelve participants took the online survey. Survey results showed that students preferred a larger room that included a window. Also, comfort levels and room size affected the quality of students' practice experience. Suggestions for improving the Foy Building practice rooms included adding more accompaniment pianos to the rooms, improving lighting in rooms without windows, and allowing students to personalize the rooms with items of their own. More research should be done on music practice room design for higher education settings based on user feedback in order to identify a broader range of design considerations that can help improve students' overall practice experience.

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Introduction

This project addresses music practice room design for higher education. The purpose of this research is to help determine practice room design guidelines to increase music students' practice duration and quality in higher education.

The Foy Building music practice rooms on the Statesboro campus of Georgia Southern University are being used as the basis for this research. These spaces are used daily by music students to practice their instruments, with some students even using the spaces for extended periods of time. According to Pop et. al (2019), music students can spend up to "40 hours per week in music practice and rehearsal rooms" and therefore "these rooms are very important in the daily activity of a music school or department" (p. 195). With this being the case, it would be expected that the design of these spaces would be carefully thought out to foster the needs of the occupants. This is an especially important issue to explore in regards to music students, as they need special design considerations such as those pertaining to acoustics. For instance, Gade (2015) emphasizes that elements like reverberance and fullness of sound are aspects that musicians appreciate in the acoustics of the room. Yet while acoustics is one of the major design factors to consider when designing practice room spaces for musicians, additional design factors such as those relating to wellbeing can often be overlooked. For instance, lighting design is an important factor to consider in any space, with Celai et. al (2019) stating that the quality "of light in living environments affects users' performance, mood and behaviour" (p. 974).

Literature Review

Previous research has identified key factors to consider not only in the design of music practice rooms but also in the design of music spaces in general. These factors include recommended decibel levels for individual practice spaces, as well as recommended Sound Transmission Class (STC) levels for music spaces listed by the Acoustical Society of America. User preferences from musicians have been accounted for in previous research, which includes aspects pertaining to acoustics and the overall practice room design. Previous research has also identified several strategies that can be used to gather data about user experience within a space, such as using a Post Occupancy Evaluation (POE) to gain knowledge of how an existing space is performing based on user feedback, as well as utilizing questionnaires, quantitative measurements of a space, and statistics.

Recommended Decibel and STC Levels

Acoustics are very important when it comes to the design of music spaces. Therefore, it is essential that acoustical guidelines for building design are met when designing for these spaces. According to Osman (2010), the recommended decibel levels for background noise in individual practice room spaces per ANSI. 2002 standards is 35 dBA. When it comes to more advanced acoustic measurements for music spaces, the Acoustical Society of America (n.d.) adds that the recommended STC levels for a music room are 60 for the interior walls and 45 for the exterior wall. The STC level of 45 for the exterior wall is specified to ensure that the music being heard by others outside of the area is faint.

User Preferences

User preferences from the perspective of musicians should be factored into the design of music spaces. For instance, according to Gade (2015), elements such as reverberance, fullness of sound, and timbre must be taken into consideration when designing spaces for classical musicians. Additionally, the space should not hinder the tonal range of the instrument. Scharer and Weinzierl (2015) add that tempo and dynamic strength, or how much strength a musician puts into their playing, are affected by room acoustics. For instance, tempo was significantly affected by reverberation time and musicians were able to have more liberty with their dynamic levels in rooms that they were satisfied with. Gade (2015) also identifies acoustic design materials to consider. For example, elements like exposed wooden surfaces can provide a sense of warmth in relation to the materials used in the production of certain instruments such as the wood found in stringed instruments.

Methods for Gathering User Preferences

One method of gathering user preferences for the design of a space is the use of a post occupancy evaluation (POE). Li et al. (2019) provides a general overview of post occupancy evaluation research. The authors note that POEs are usually conducted after the building has been in use for at least several years and can be very useful in terms of learning about elements such as occupants' satisfaction and productivity. POEs can also provide more informed decisions about future building designs as well as enhance the dialogue amongst design team members and partners. In this particular paper, the authors wanted to highlight a POE process that incorporated both qualitative and quantitative

methods, since previous papers have lacked the quantitative analysis of POE characteristics.

Questionnaires, quantitative measurements, and statistics can also be used to gather user preferences for a space. Compared to previous authors, Lachmann et al. (2019) focused their research on more recent building projects, specifically building projects for music spaces in universities. The authors' research dealt with the acoustic design of music spaces. They gathered answers from questionnaires taken by music students and faculty at the universities in addition to taking acoustic measurements of their test rooms. Like the previous authors, Lachmann et al. (2019) used both quantitative and qualitative methods to conduct their research.

Knofel et. al (2018) conducted a similar research project in terms of acoustics. The authors used a questionnaire taken by 41 musicians gathering feedback about demands for acoustics within music practice and rehearsal rooms. From this data, the authors made statistics that detailed the preferred acoustical values within the space, noting users' overall rating of the acoustics within the practice room spaces from poor to good, as well as the preferred decay times within a room based on instrument type, which ranged from 0.3 seconds on average for all of the instrument types. While both quantitative and qualitative methods were used in this research as well, the qualitative data was gathered from the questionnaire participants' answers rather than the authors going to specific music spaces and taking acoustical measurements.

Research Questions/Hypotheses

Four research questions are being addressed in this research, and there is one proposed hypothesis in regards to the data. The first research question addresses the

design modifications needed within the practice room spaces: What design modifications will need to be made to increase practice duration in the music practice rooms, both in terms of time spent inside of the rooms and the number of visits made to the rooms?

The second research addresses the decibel levels within the Foy Building practice rooms: What is the acoustic performance level of the interior and exterior facing practice rooms? This research question is addressed due to the fact that loud instrument playing can be heard within the hallways between the practice rooms.

The third and fourth research questions address user satisfaction with the practice room spaces: Will there be a mix of student satisfaction with the practice rooms based on instrument type? And will student satisfaction be affected by the location of the room- interior (room with no window) vs. exterior (room with a window) facing rooms? Many different instrumentalists use the practice room spaces throughout the day, so every practice room may not necessarily fit the needs of the user in terms of their instrumental sound quality since the music practice room spaces in the Foy Building are meant to accommodate a wide range of instrumentalists. In terms of room location, rooms that have natural light in them tend to be linked to wellbeing and high productivity amongst its users.

Lastly, two proposed hypotheses for this research are that high sound transmission between the walls of adjacent practice rooms will be directly correlated with low student satisfaction levels in terms of the acoustics within the spaces, and that higher satisfaction levels and longer practice times will be linked to certain room locations. For instance, students might find that they like rooms with more natural light since it is a design factor linked to increased wellbeing.

Method

Sample and Participant Selection

The study population for this research included music majors and minors on the Statesboro campus who use the Foy building practice rooms. It also included students of any college year (Freshmen-Senior and Graduate students), age 18 and over, and any musical ability (Beginner-Advanced) in order to get a broad range of feedback. For participant recruitment, initial contact with professors of music theory, composition, and orchestration was done via email. This was done to receive permission to share the flier image showing the survey link and/or QR code on Folio as a news item and during regularly scheduled class times for students to complete the survey. Additional recruitment included Zooming into the composition class. Extra fliers were posted in the Foy building as a form of snowball recruitment.

Assessments and Measures

Both quantitative and qualitative assessments were used as part of a sequential research design. A qualitative assessment via Qualtrics was initially used to gather perceptions of music students using the Foy building practice rooms. Students were first asked general information relating to what instrument they play, how many hours and days they usually practice, and what practice rooms they use and prefer the most. As the survey progressed, more detailed questions were asked pertaining to the students' personal experience and satisfaction with the design factors and conditions of the practice rooms. (See Appendix A).

The quantitative assessment involved the use of acoustical and lighting meters. Acoustical meters recorded decibel levels in the practice rooms and determined the

overall sound transmission coming from the spaces. Lighting meters were used to record horizontal measurements to determine the quality of the lighting hitting the work surface, or height where the students would stand and read their music, which was four feet above the finished floor, per Illuminating Engineering Society (IES) guidelines (See Appendices B-U).

Procedure

The online questionnaire conducted via Qualtrics had a qualitative inquiry into the perceptions of music students using the Foy building practice rooms. At the beginning of the survey, participants were asked to complete the informed consent. For anonymity purposes, the Qualtrics settings were set to not record respondents' IP Address, location data, and contact info. As participants took the survey, data about their responses was collected through Qualtrics which would later be coded to determine common design solutions that students preferred in the Foy Building practice rooms.

A quantitative assessment of the Foy Building practice rooms followed the initial survey to gather data pertaining to acoustical and lighting design based off of the participants' feedback from the initial survey. The quantitative assessment of the practice rooms in the Foy Building initially involved taking acoustical and lighting measurements of the two most preferred practice rooms in the Foy Building, which included both an interior and exterior facing room. Lighting and acoustical measuring tools were used for this part of the data collection, with the rooms being measured when no other person was using them to avoid incorrect readings. Acoustical measurements gathered information about how much sound was being transmitted between one room to the other, while

lighting measurements were used to see what amount and quality of lighting was present within the practice rooms.

Lighting measurements were taken in rooms 2032 and 2011- an interior facing room with no windows and an exterior facing room with a window respectively. Lighting measurements were taken at one foot increments throughout the room and were recorded at four feet above the finished floor, which is the work surface height or height at which students read their music in the practice room spaces and the standard set by the Illuminating Engineering Society. For room 2011, two sets of measurements were taken for the space which included measurements from a sunny day with both the window blinds open and closed and an overcast day with both the window blinds open and closed. This was done in order to get a better range of the lighting conditions in the room on days that had either ideal or less ideal weather conditions. The foot candle readings were recorded for each room and were then placed in a grid to determine the average foot candle readings for the practice room spaces. The foot candle averages were then compared to the IES recommendation for music practice room spaces, which is fifteen foot candles. Finally, the foot candle readings for each room were placed into ranges and translated into isolux diagrams, which showed the distribution of light throughout the practice room spaces.

Acoustic measurements were also taken in rooms 2032 and 2011. The acoustic measurements taken in these rooms were compared to the acoustic measurements in the adjacent rooms next to these practice spaces to determine how much sound was being transferred between the walls that separated them. The acoustic measurements involved using a similar test for each recording. Recordings were first taken in the rooms adjacent

to rooms 2032 and 2011. A certified Piccolo II acoustic meter was used for the recordings, and dbA was the unit of measure used to accommodate for the human hearing range of 20-20,000 hz. The acoustic meter was placed at a point in the middle of the practice room in order to get an adequate general acoustical reading for the space. Acoustic measurements were recorded at 10 second intervals for more accurate decibel averages. For the acoustic test, an ascending chromatic scale was played three times on baby grand pianos, each with differing dynamic levels with the first time being played forte (loud volume), the second being played mezzoforte (medium volume), and the third being played piano (quiet volume). This was done to record a wide range of frequencies within the room and to record those frequencies at different volume levels, as well as to account for the frequencies that may be produced by the semi-tones (black keys) on the pianos. After the chromatic scales were played, an excerpt of a piece that used a wide range of the piano and had alternating dynamic levels throughout its duration was played. This was done to simulate an actual practice session and to get a more realistic representation of what students are hearing when they practice in the adjacent rooms. These same steps for the acoustic test were repeated, except the acoustic meter was placed in rooms 2032 and 2011 next to the wall that those rooms shared with the adjacent rooms. In practice room 2032 in particular, there were two 4' x 4' acoustical wall tiles on the wall that separated it from the adjacent room. The acoustical meter was placed on a spot of the wall that didn't have acoustical wall tiles on it just to get a reading of the raw sound being transmitted through the existing wall material, which was painted concrete block.

Results

There were twelve participants for the online survey. Demographics in terms of primary instruments consisted mostly of vocalists, but other primary instruments included brass, woodwinds, strings, and guitar (See Figure 1). Questions three and four pertained to practice duration and frequency for participants during a typical week. Most students stated that they practiced either five or six days a week and most stated they practiced two hours a day (See Figures 2 and 3). Based on the heat map in questions six and seven, the most used and preferred practice rooms were exterior facing rooms that included a window (See Figures 4 and 5).

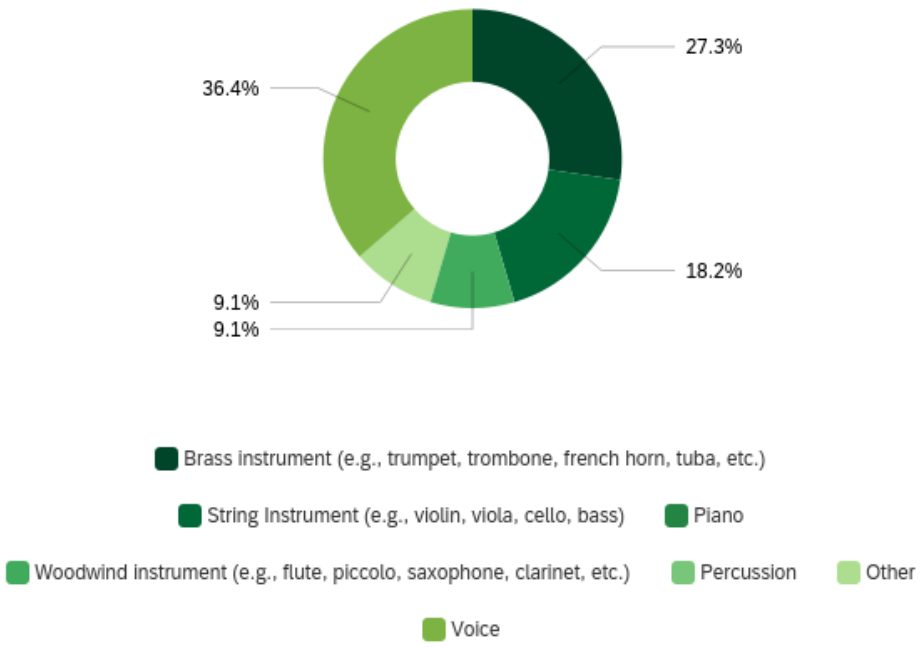

Figure 1. Online Survey Primary Instrument Demographics

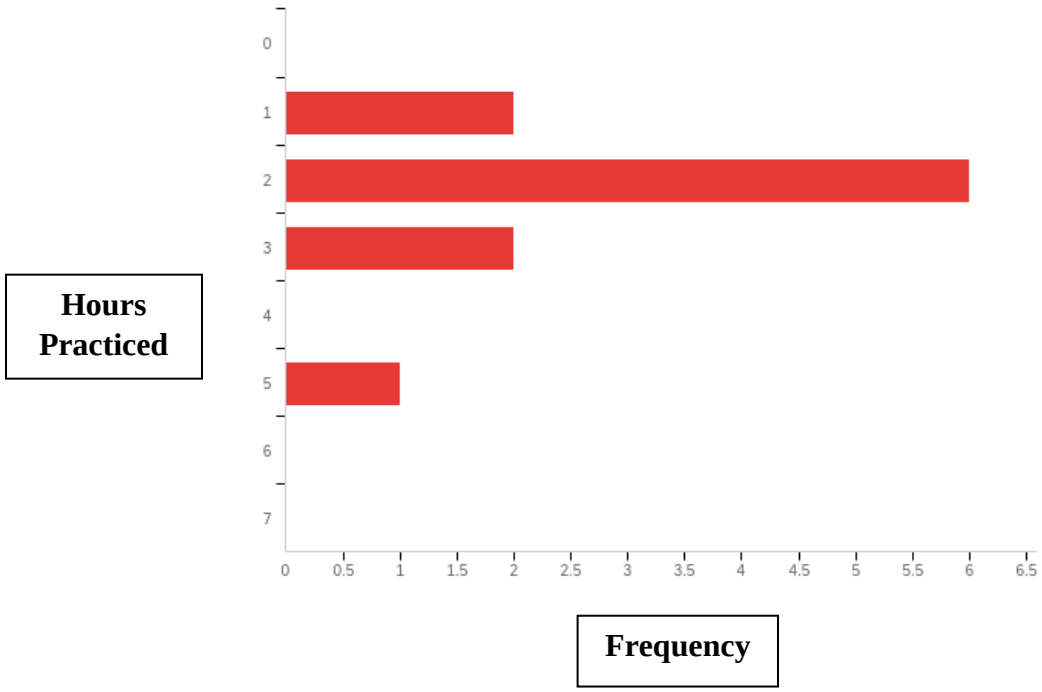

Figure 2. Practice Duration for Online Survey Participants

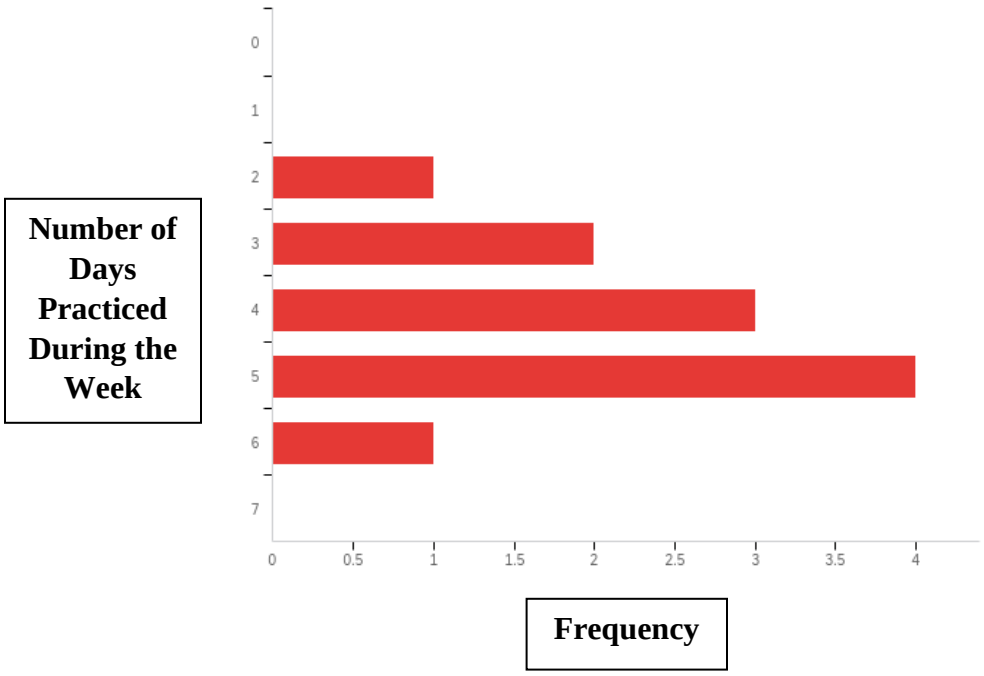

Figure 3. Weekly Practice Frequency for Online Survey Participants

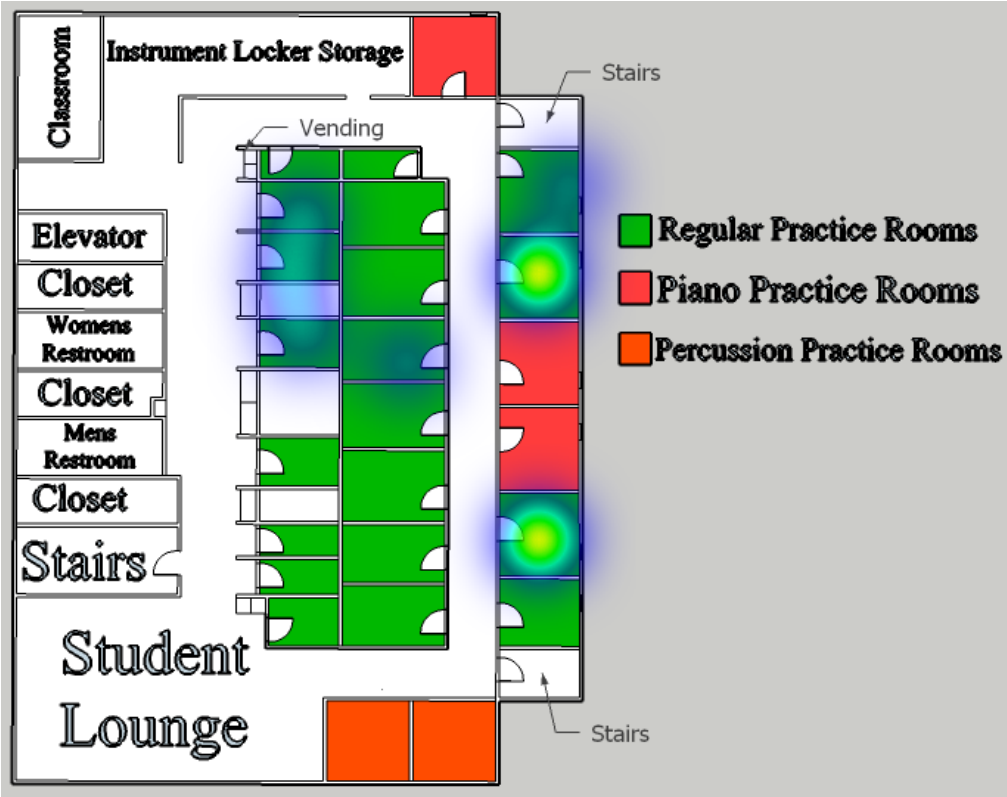

Figure 4. Heat Map of Practice Rooms Used in the Foy Building

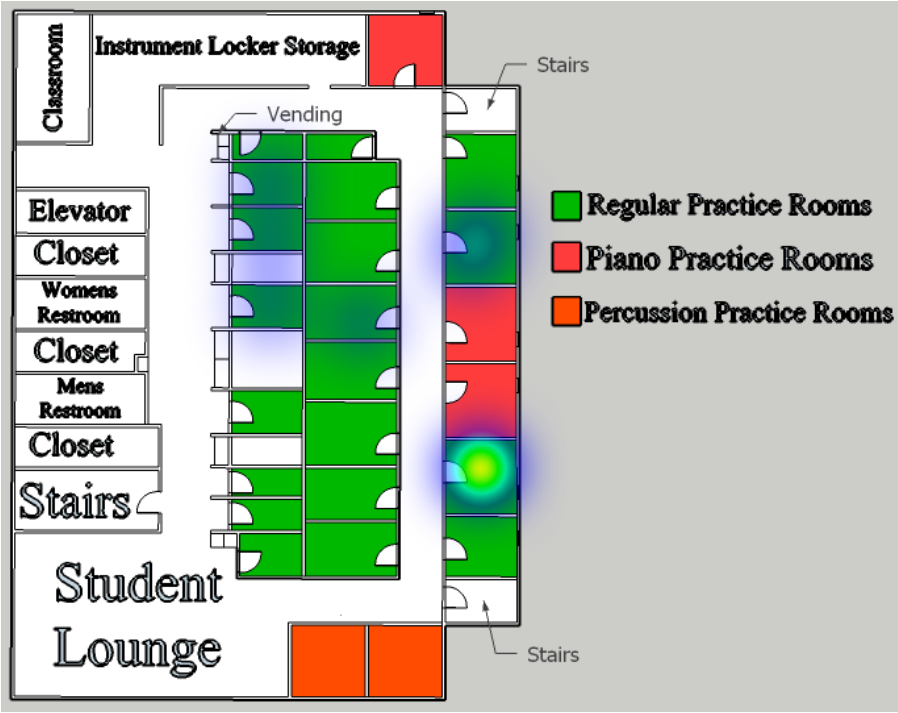

Figure 5. Heat Map of Preferred Practice Rooms in the Foy Building

Participants were asked about the design features that influenced their choice for their preferred practice rooms, and the top four features mentioned were the type of piano in the room, the size of the room, the location of the room, and the presence of windows (See Figure 6). Participants were then asked to consider how these same design features affected their practice duration, frequency, and quality. Based on the answer choice statistics for questions eleven, thirteen, and fifteen, the design features in the practice rooms did affect practice duration, frequency, and quality. Comfort and the size of the room were factors that were stressed in terms of how the practice room design features affected participants. Participants stressed the fact that if they were comfortable in a room, they were more likely to stay in the same room to practice for a longer period of time as well as frequent the same practice room. For example, participant #7 said:

> I feel like because the room is set up in a way I like, I feel more comfortable in the room. Because I am more comfortable, I am more likely to practice for a longer period of time in the room. I really like routine, and I function best under routine. Therefore, I feel like I am most efficient and effective with my practice when I am in the same room consistently.

Another student stated "If I'm in a smaller room without an accompaniment piano I typically won't practice for long. I feel like I need to get out after an hour because it's so cramped" (participant #4). Further a student noted "If I am comfortable in the room, I am less inclined to cut my practice time short" (participant #5).

As for the size of the room, participants stated that they preferred a bigger room, whether it was for better sound quality based on their instrument type or for comfort

since most of the practice rooms in the Foy Building tend to be small and make people feel cramped (See Figures 7-11).

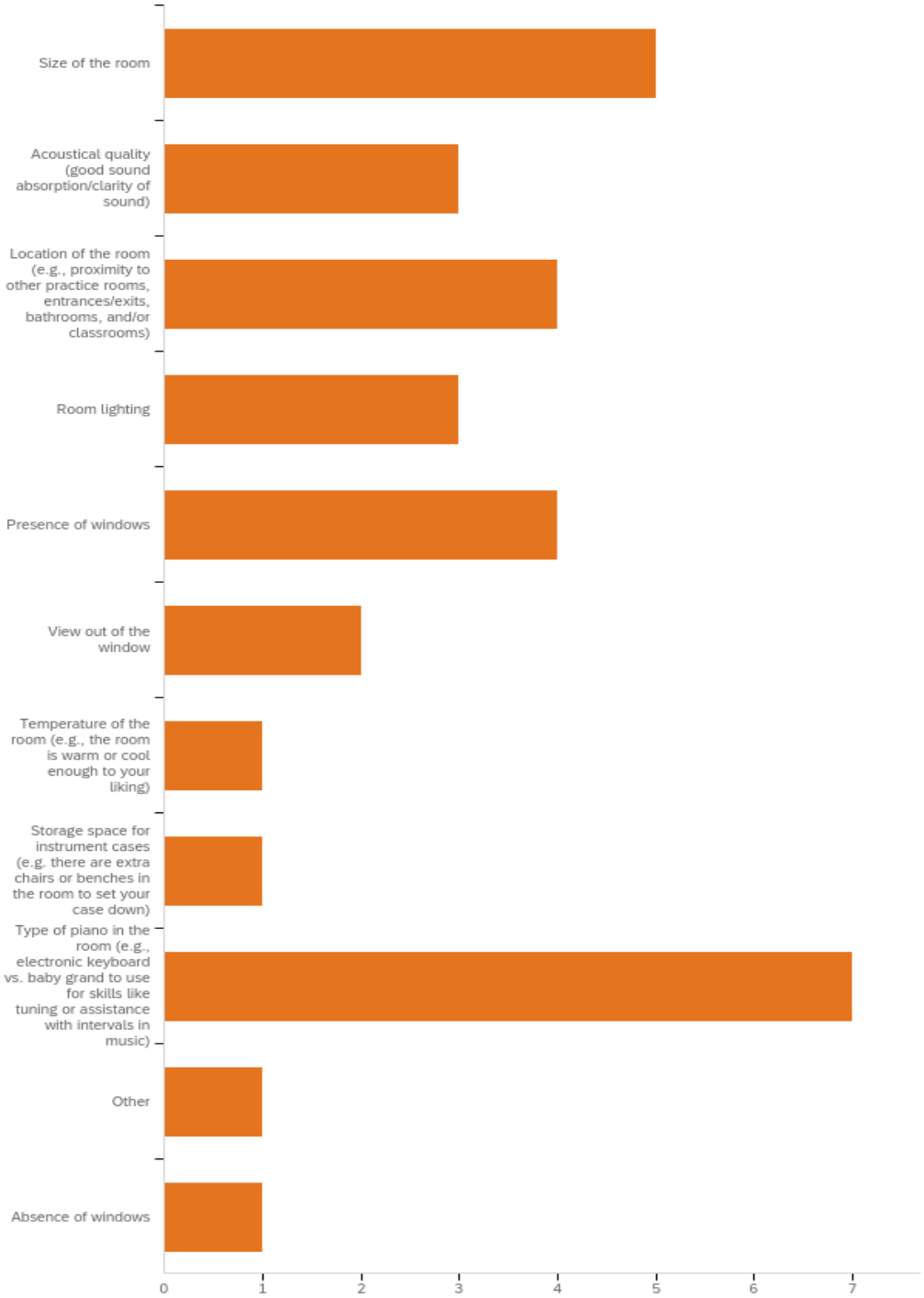

Figure 6. Design Features Affecting Practice Room Preferences

How these design features impact the duration of your practice time.	Frequency
Comfortable = more time	3
Small room = less practice time	2
Same room supports routine = more time	1
Temperature not comfortable = less time	1
Window and daylight = more time	1

Figure 7. Themes for How Design Features Affected Participants' Practice Duration

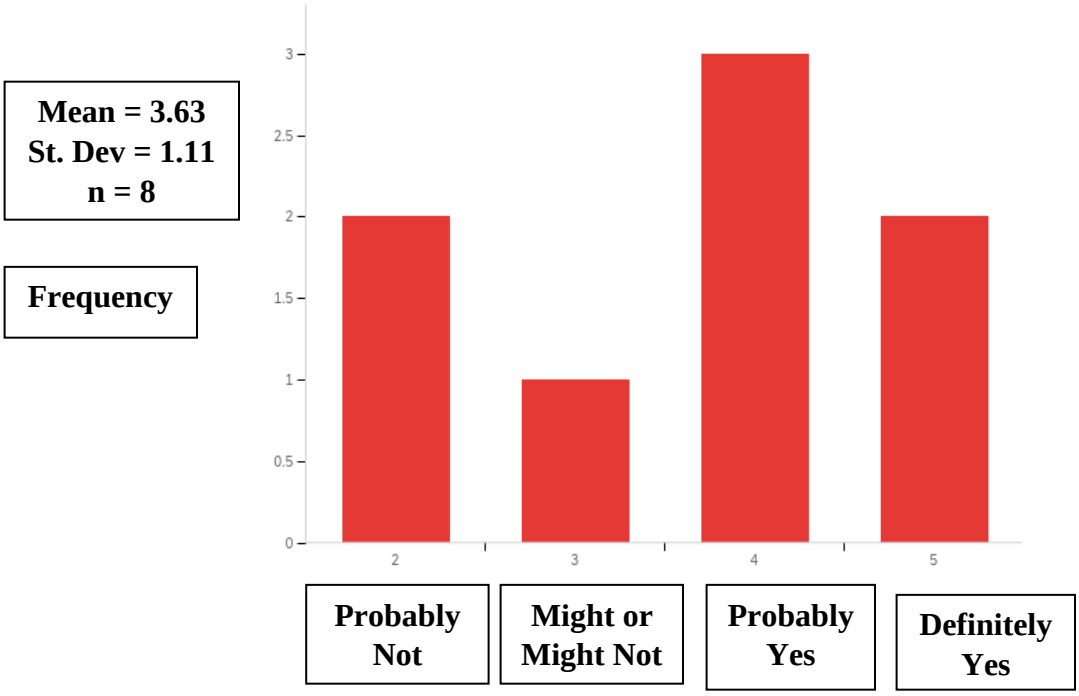

Figure 8. Statistics for Design Features' Effect on Participants' Practice Frequency

Please describe how these same design features impact the frequency of your practice time.
If the room I like the most is taken, I'm more likely to not want to practice which potentially effects the frequency of my practice
If I get a room with these features I typically practice for longer, it feels more comfortable and enjoyable to practice.
If you're physically uncomfortable in a room, you're not likely to want to return to that room.
In all honesty they really don't
I often don't use the practice rooms that often because I don't like the atmostphere.
I don't think the impact the frequency at all because I practice for specific time slots each day no matter where I am as I believe it to be the best practice philosophy.

Figure 9. Open Ended Responses for How Design Features Affected Participants' Practice Frequency

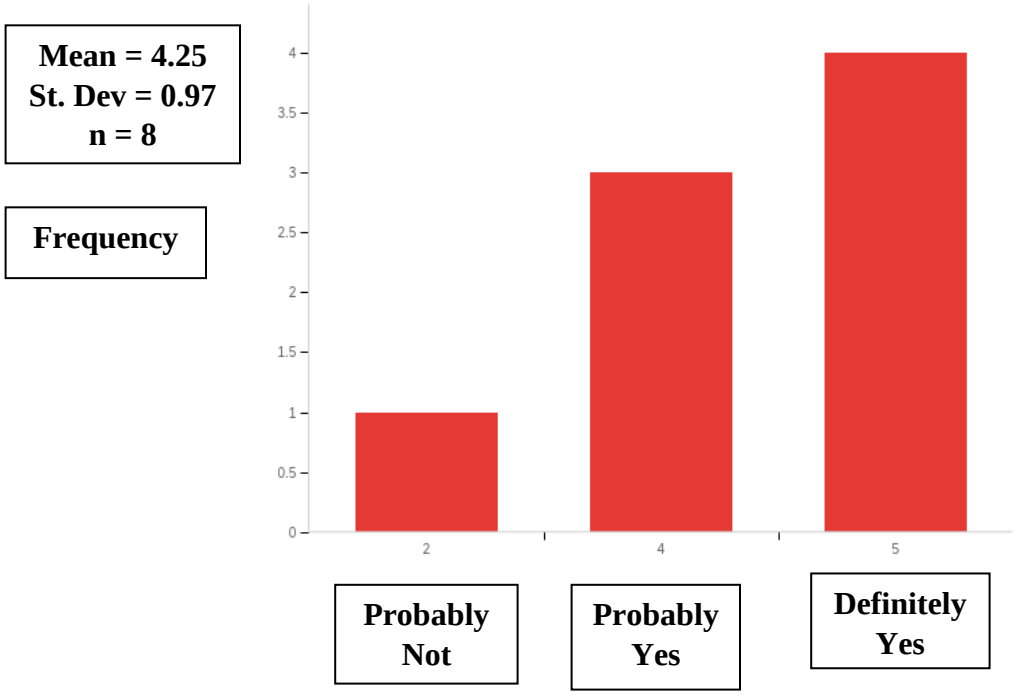

Figure 10. Statistics for Design Features' Effect on Participants' Practice Quality

Please describe why these design features impact the quality of your practice time.
With the other practice rooms I use if the one I like is taken, there are things that I find distracting (bad lighting, buzzing lights, etc). Due to these distractions, I usually do not practicing as effectively as I could if the distractions were not present
I feel like my sound is better in a bigger room. And I'm able to focus better in a room with natural lighting.
Staying along the back hallway decreases the chance of distractions from friends walking by.
Being more comfortable makes me more locked in and focused.
Sunlight helps me focus more. I focus more when the room is farther from the student lounge.
When I feel more at ease and have no interruptions I can focus better and get more done.

Figure 11. Open Ended Responses for How Design Features Affected Participants' Practice Quality

In terms of the overall satisfaction with participants' preferred practice room spaces, satisfaction tended to be neutral (See Figure 12). Key suggestions that participants provided to improve their experience in the Foy Building practice rooms included maximizing comfort levels and making the spaces more lively, providing better temperature regulation, removing excess pianos and adding more accompaniment pianos to the spaces, improving lighting in the rooms without windows, and improving acoustics (See Figure 13).

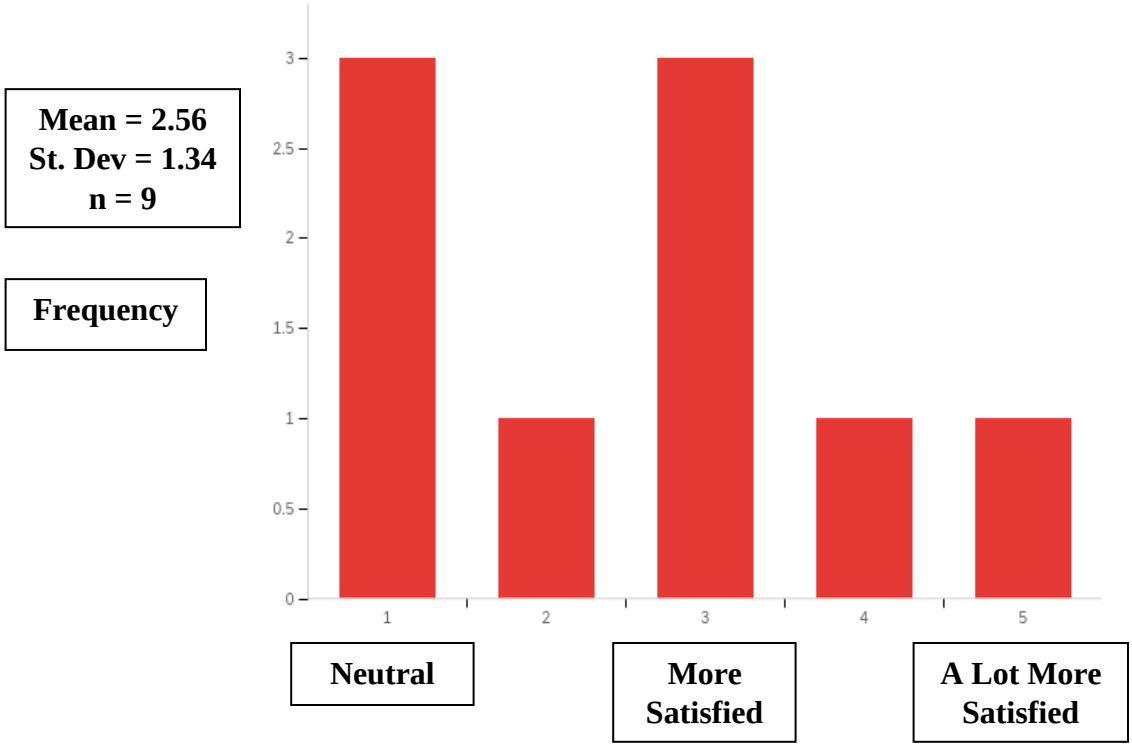

Figure 12. Statistics for Participants' Satisfaction Level for their Preferred Practice Room

Are there any suggestions that you have for the overall design of the Foy Building practice rooms that would improve your practice experience within the spaces?
I don't know how this would be possible, but I wish there was a way to make them cancel out some of the noise; when Foy is at its busiest, the practice rooms get really noisy which can be distracting
Improve lighting in rooms without windows, get more accompaniment pianos. Fix, remove, replace broken items in the rooms. It could help to improve acoustics within rooms but also try to keep the sound contained in the room. You can hear everyone practicing from almost every room and it can be quite distracting.
Removing excess pianos to de-clutter the spaces (why do we need three pianos in a room???) Ensuring 2-4 stands are kept in each room would also make small ensemble rehearsals feasible without leaving multiple rooms free of stands.
I think closer temperature regulation can help , but I don't see any other major issues with the rooms.
Allow students to bring rugs, wall art, etc into practice room so that they are more comfortable and feel less mental institution-ish.
Quality in design in rooms (music stands, mirrors, in tune pianos, quality lighting)
Add more noise cancelling material and get rid of the hallway windows.

Figure 13. Participants' Suggestions for Improving the Foy Building Practice Rooms

Average foot candle readings for practice 2011 on a sunny day were 18.23 foot candles with the window blinds open and 11.64 foot candles with the window blinds closed. On an overcast day in practice room 2011, the average foot candle readings were 10.48 foot candles with the window blinds open and 10.18 foot candles with the window blinds closed. As for practice room 2032, the average foot candle reading was 20.51 foot candles. The recommended foot candle readings for music spaces as noted by the IESNA is 15 foot candles. Both of the practice rooms met this recommendation. However, this 15 foot candle recommendation was not met in practice room 2011 unless it was a sunny day with the window blinds open.

When it came to the acoustics of the practice room spaces, the average decibel reading when Piano I was played in practice room 2009 was 78.8 dbA, and the average decibel reading in practice room 2011 when Piano I was played was 44.4 bA. When Piano II was played in practice room 2009, the average decibel reading was 82.3 dbA, and the average decibel reading in practice room 2011 when Piano II was played was 46.3 dbA. In practice room 2031, the average decibel reading was 80.3 dbA when the piano was played, and the average decibel reading for practice room 2032 when the piano was played in practice room 2031 was 42.6 dbA. On average, there was a 35.2 decibel drop between the wall separating practice rooms 2009 and 2011 and a 37.7 decibel drop between the wall separating practice rooms 2031 an 2032 (See Figures 14 and 15). When it came to the types of frequencies recorded in practice rooms 2011 and 2032, it seemed that no matter what dynamic level was played or what distance the pianos were from the wall separating the adjacent rooms, the lower frequencies were the loudest when compared to the higher frequencies (See Figures 16-19).

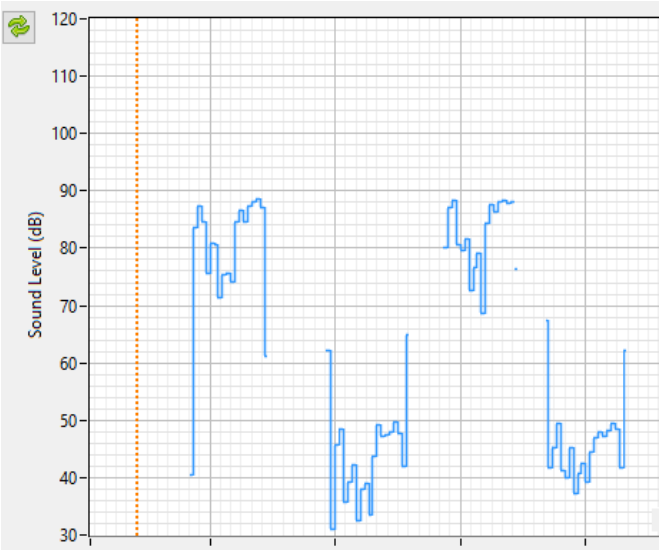

Figure 14. Acoustic Readings for Practice Rooms 2009 and 2011

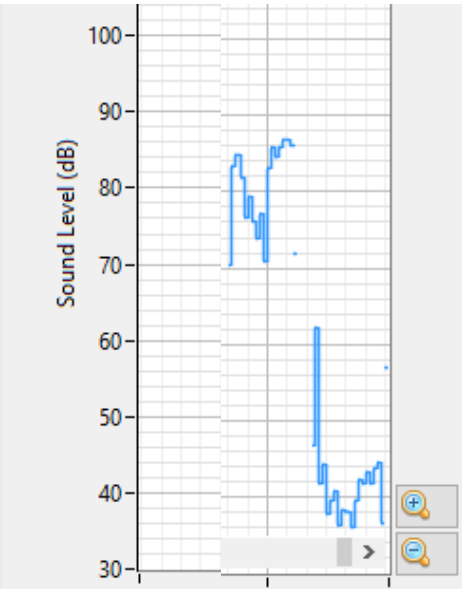

Figure 15. Acoustic Readings for Practice Rooms 2031 and 2032

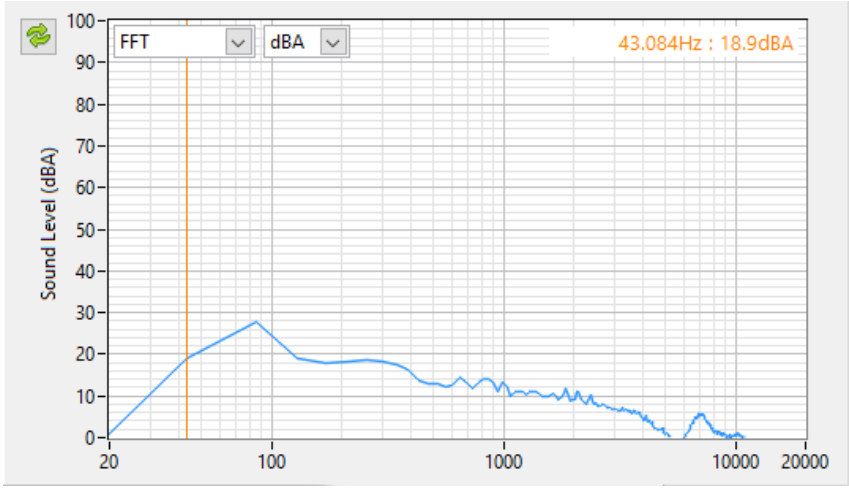

Figure 16. Frequency Readings for Lowest Decibel Recordings in Practice Room 2011

Figure 17. Frequency Readings for Highest Decibel Recordings in Practice Room 2011

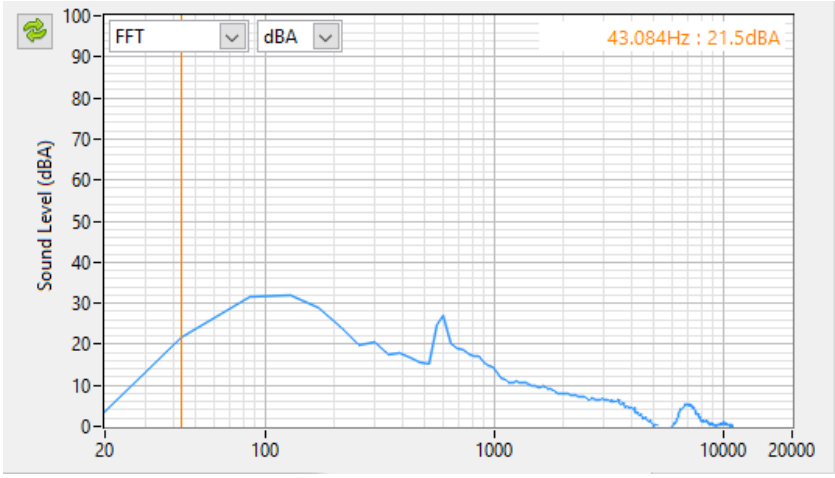

Figure 18. Frequency Readings for Lowest Decibel Recordings in Practice Room 2032

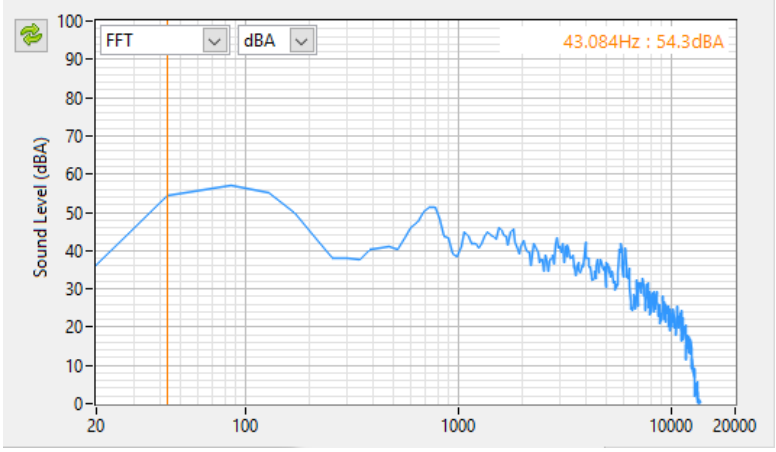

Figure 19. Frequency Readings for Highest Decibel Recordings in Practice Room 2032

Discussion

The first research question that this research project asks pertains to finding design features for the Foy Building practice rooms that increase practice duration and frequency. Based on the online survey responses, comfort and size of the rooms are the main factors that participants noted that affect these aspects of their practice experience. For suggestions pertaining to how to improve the Foy Building practice rooms, acoustics and lighting conditions in rooms without windows were some aspects that participants pointed out. Therefore, better acoustical comfort and proper lighting conditions in the

practice rooms without windows are important design considerations. Some suggestions that Osman (2010) makes for improving acoustics in small practice rooms include having an option in the rooms that allows users to control and alter reverberation times, as well as to include elements that distribute sound equally throughout the room. As for lighting conditions within the Foy Building practice rooms spaces, the lighting met the recommended foot candles set by the IESNA, which was 15 foot candles. However, at the moment, practice room 2032, a room without windows, only has two light fixtures. While it's understandable that the lighting fixtures would be few in quantity for this space due to its elongated and the generally small size, the low quantity of the light fixtures as well as their spacing doesn't work for this space, especially considering how poorly lit the back of the rooms are. In order to accommodate for the uneven lighting distribution within the practice rooms without windows, more lighting fixtures or even just lighting with a higher light output could be specified. Adequate spacing criteria should also be considered for the light fixtures. Livingston (2014) describes this as a ratio that determines the distance between the work plane and the luminaire as well as the maximum distance between the light fixtures in order to maintain an even amount of illumination throughout the space.

When it comes to the size of the rooms, for smaller practice rooms in the Foy Building, color theory could be used to make the rooms feel bigger since most of the practice room spaces tend to be small. For instance, Paula Interiors (2020), states that lighter colors can make an interior environment feel larger and more spacious.

When it came to my second research question pertaining to the acoustic performance levels of both the interior and exterior facing practice rooms in the Foy

Building, the acoustic performance level was relatively poor. The acoustic measurements for the practice rooms spaces showed that the interior walls are not effective at reducing sufficient amounts of noise coming from adjacent rooms. The sound transmission between the adjacent rooms was more than the maximum amount of background noise recommended in individual practice rooms as noted by ANSI. 2002. Standards, which was 35 dBA. There were comments by participants requesting limitations to external noises in the practice room spaces. Additional acoustical controls that may be helpful include adding carpet and acoustical padding in the hallways and practice rooms.

When it came to satisfaction levels among participants based on instrument type, there wasn't a big difference between the responses of any instrument type, as the satisfaction was generally neutral when it came to their preferred practice rooms. As for satisfaction levels based on whether rooms had a window or didn't have a window, there wasn't a big satisfaction level jump when it came to participants who noted the inclusion of windows in their open answer responses. Based on the frequency of this theme in the responses, however, it was clear that this was a major design factor that affected student's practice experience in the Foy Building practice rooms.

When it came to my hypotheses, they were not proven to be true. It was unclear whether the acoustics of the room or the room location greatly affected users' overall satisfaction levels with the practice room spaces. Only one participant mentioned acoustics as a design factor that could be improved within the space, and several few mentioned that they preferred a room with a window while practicing. However, these responses didn't equate with the overall satisfaction with the design features of their preferred practice rooms, as the overall satisfaction level was pretty neutral.

Limitations and Future Directions

One major limitation for this project was the sample size. Only twelve people participated in this research, which is a really low sample size considering there are about one hundred or more music students here on the Statesboro campus of Georgia Southern University. Because of the low sample size, it was hard to get the most accurate generalizations about how students felt about the existing practice room space in the Foy Building and what they hoped they could change to make their practice environment more beneficial to them. Another factor that made it hard to get the most accurate generalizations about the Foy Building practice room spaces was the demographics based on primary instruments. The participants in this survey were mostly vocalists, so most of the responses especially for the most preferred practice room and the open ended response were from their perspective. It would have been nice to have gotten a more equal amount of perspectives from each instrument type just to get more different perspectives from the sample population. In terms of participants for my virtual focus group, there were several participants who stated that they would be interested in doing the virtual focus group for my project. Yet even though there were fliers posted around the Foy Building and the link and flyer were shared virtually with possible participants advertising the virtual focus group, there were no participants that signed up which ultimately led to the virtual focus group being cancelled. This result could have also been due to unclear advertising on my part.

Limitations in terms of the quantitative data included elements that affected both the lighting and acoustic measurements. While the lighting measurements were being taken, the sun was constantly shifting in the sky which therefore provided some room for

large outliers to appear in the foot candle readings. On the sunny day in particular, some clouds may have formed in the sky while taking the lighting measurements, which could have made some of the foot candle readings slightly lower than they really were. When it came to the acoustic measurements, background noise was an issue in terms of getting accurate readings throughout the duration of the acoustic test. For instance, while getting acoustic recordings in rooms 2009 and 2011 while I was playing the Piano II in practice room 2009, there were two other students playing the piano on either end of the hall where I was located. These frequencies were recorded in the acoustic readings during those times along with the frequencies that I was producing for the acoustic test. Background noise also came from me as well since I conducted the readings alone. These came from me moving the piano benches, my heel hitting the floor while I was pedaling on the piano, and from me running, walking, and shutting the practice room doors behind me while getting acoustic recordings from the adjacent rooms. Another thing that affected the accuracy of my acoustic readings was the fact that I played on three different pianos for each test, and they didn't all have the same timbre. Also on Piano II in practice room 2009, which was the piano furthest from the separating wall between that room and practice room 2011, the three keys at the top of the piano were partially broken, so it didn't matter whether or I was playing a loud or soft dynamic; those keys sounded very quietly.

In terms of future directions for this research topic, this project shows the need to conduct more research on music practice room design for higher education settings based on user feedback. Some of the open-ended responses were quite interesting in terms of how design features affected students' practice experience or even in terms of what their

suggestions for improving the practice room spaces. Often times, acoustics is the only factor that is considered in the design of music spaces, but as this research shows there are plenty of other design considerations that should be kept in mind in order to make the spaces more comfortable and enjoyable for the users.

Reflective Critique

I think that while conducting this research, several of my skills have improved, including critical thinking, data collection, literature review, and synthesizing information from different texts. I think that having these skills has really prepared me for tasks that will be needed in both of my majors, whether it is conducting research for an interior design project, or conducting a study related to the music field.

In regards to the topic of this research, I think it has made me more knowledgeable about music practice room design guidelines and how it affects students in higher education. It's a very interesting topic, and it's something I never really got the chance to explore until I started conducting this research project.

When it comes to my research design, I really got a chance to develop my knowledge and gain experience conducting both qualitative and quantitative assessments, as well as additional skills accompanied with it such as advertising. While some of these skills might have been more challenging than others, such as advertising my project, I think that this experience has prepared me when it comes to conducting projects that utilize the same skills and research design in the future.

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Appendices

Appendix A: Honors Research Survey- Practice Room User Feedback

Q1 Please indicate whether you are a music major or minor.

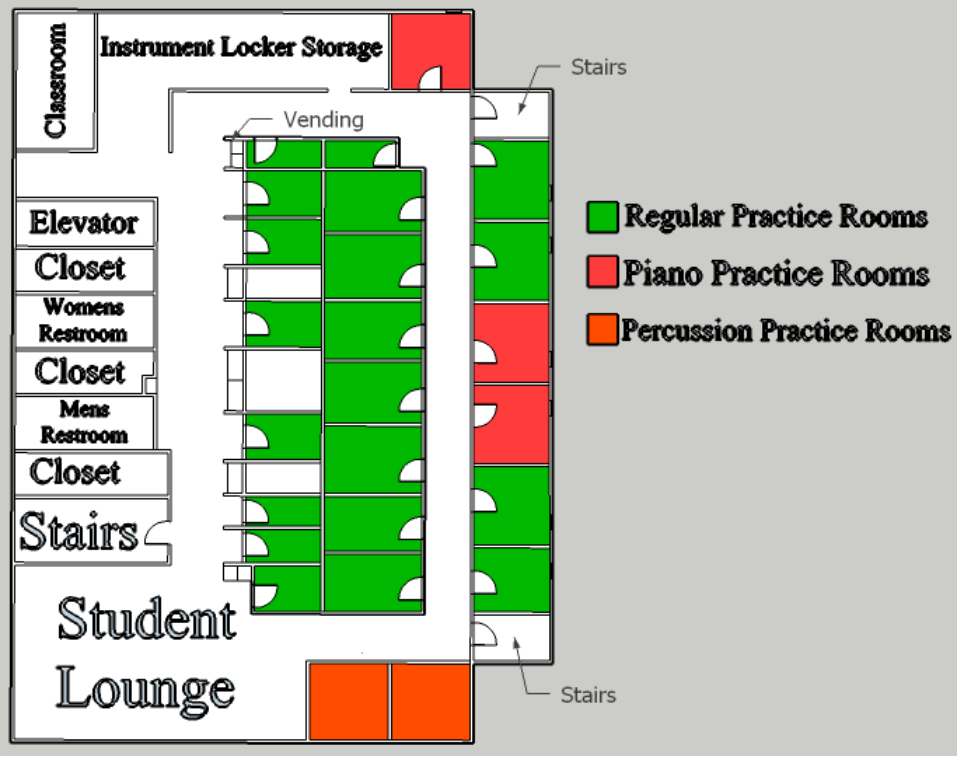
Q2 What is your primary instrument?

Q3 Excluding music lessons, how many days (out of a typical week during the semester) do you use the Foy building practice rooms to practice your instrument?

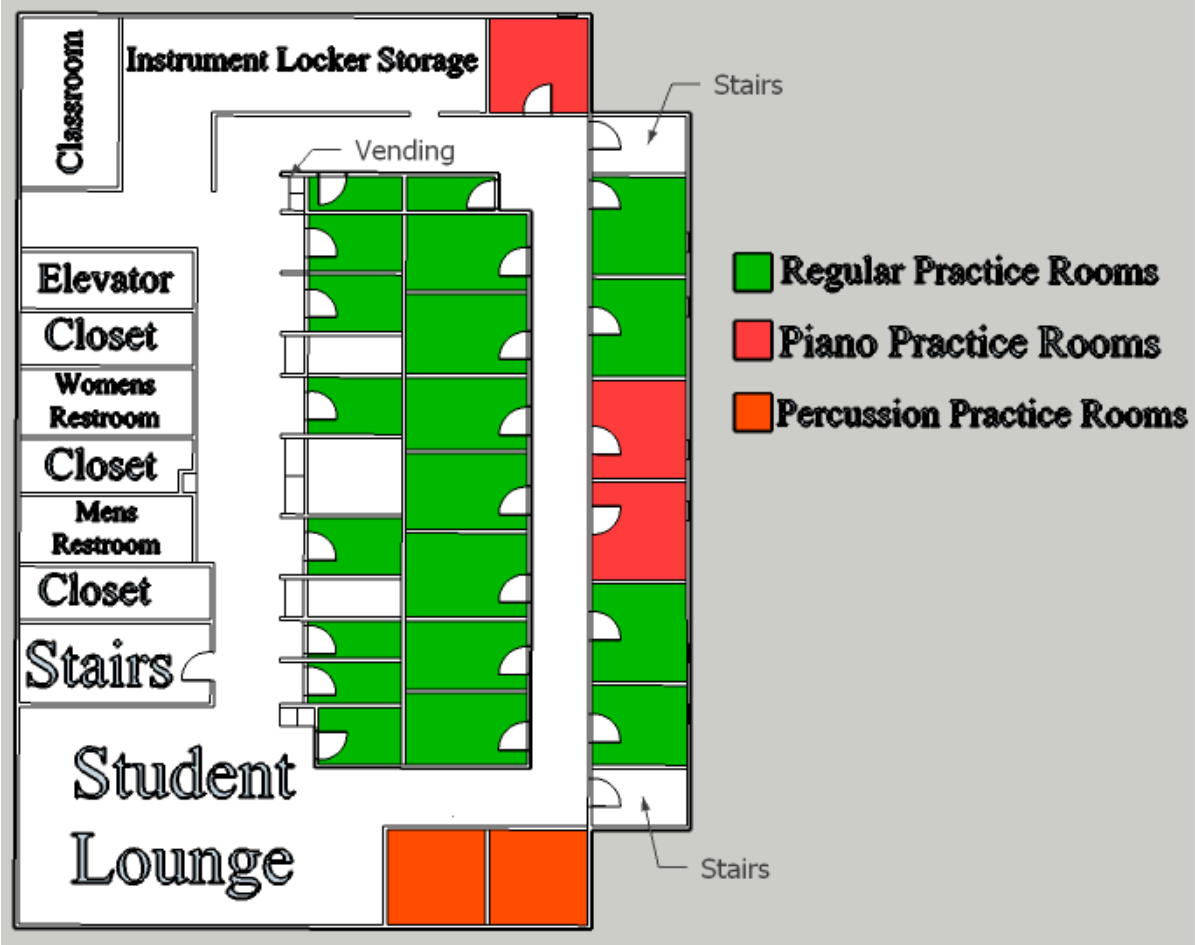
Q4 Excluding music lessons, how many hours a day (out of a typical week during the semester) do you practice in the Foy building practice rooms?

Q5 Do you tend to use the same practice room every time you practice your instrument in the Foy Building?

Q6 What is the general location of the practice room that you use the most? (See the image below for reference and click on the practice room location.)



Q7 What is the general location of the practice room that you like or favor the most? (See the image below for reference and click on the practice room location.)



Q8 What are the design features that influence your room selection for your favorite practice room? Select all that apply.

Q9 Please describe why these design features influence your room selection.

Q10 Rate your satisfaction with the design features of your favorite Foy building practice room on a scale of 1-5, with 1 being neutral, and 5 being a lot more satisfied.

Q11 Do these same design features have any impact on the duration of your practice time (i.e., increase your practice time throughout the semester or keep it consistent) when you are in your favorite room? Use the slider below to provide your answer.

Q12 Please describe how these same design features impact the duration of your practice time.

Q13 Do these same design features have any impact on the frequency of your practice time (i.e., increase the number of practice times throughout the semester or keep it consistent) when you are in your favorite room? Use the slider below to provide your answer.

Q14 Please describe how these same design features impact the frequency of your practice time.

Q15 Do these same design features have any impact on the quality of your practice time (i.e., ability to focus, hear clearly) when you are in your favorite room? Use the slider below to provide your answer.

Q16 Please describe why these design features impact the quality of your practice time.

Q17 Are there any suggestions that you have for the overall design of the Foy Building practice rooms that would improve your practice experience within the spaces?

Q18 There will be a virtual focus group in a later phase of this research project that will gather user feedback about a proposed design solution for the Foy Building practice rooms. Would you be interested in participating in this?

Appendix B: Picture #1 of Foy Building Practice Room 2032

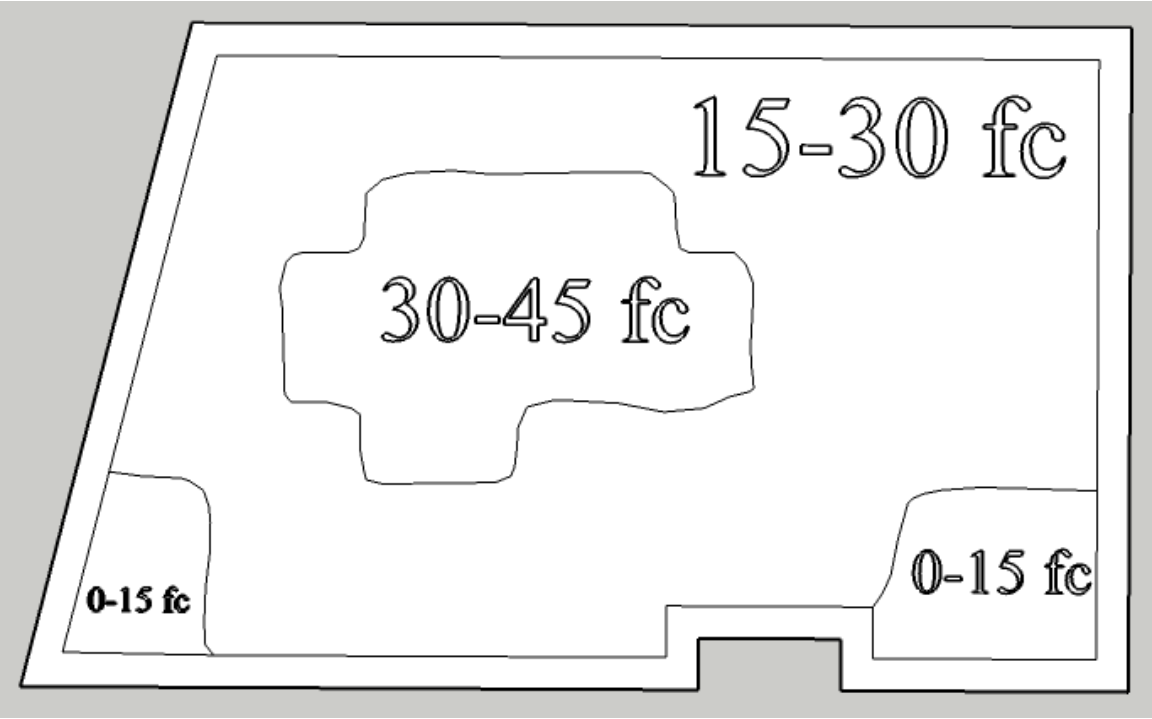
Appendix C: Picture #2 of Foy Building Practice Room 2032

Appendix D: Lighting Fixtures in Foy Building Practice Room 2032

Appendix E: Light Meter Readings for Foy Building Practice Room 2032 in Foot Candles

11.4	0	0	0	0	0	0
13.2	14.8	16.7	18.3	0	0	0
13.4	15.9	20.0	21.2	22.9	21.3	20.6
15.9	19.9	25.8	30.5	31.5	28.7	24.8
17.9	22.6	30.2	32.8	34.1	31.9	26.9
17.8	22.8	30.3	34.5	35.8	32.9	28.4
19.1	25.6	29.0	34.0	35.9	33.4	27.7
18.5	23.9	29.2	33.4	34.5	31.8	27.4
0	24.8	29.2	33.4	33.5	29.1	25.3
0	22.7	25.6	29.5	29.2	26.7	20.1
0	18.6	23.0	23.8	24.1	22.2	19.0
11.5	14.1	17.5	18.5	19.7	17.8	15.4
10.5	12.5	15.5	15.8	16.2	16.4	15.7

Appendix F: Isolux Diagram for Foy Building Practice Room 2032



Appendix G: Sunny Day in Foy Building Practice Room 2011

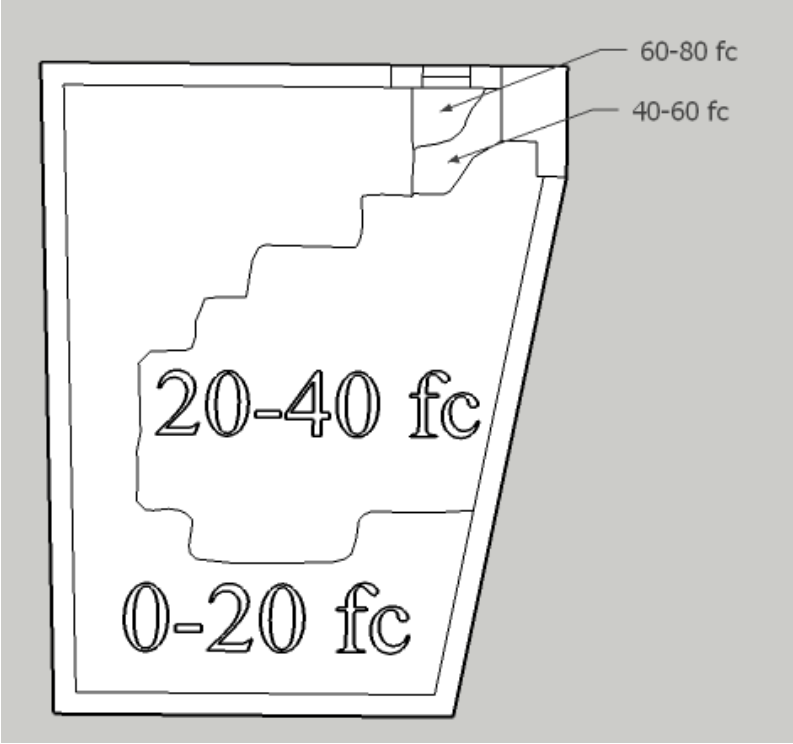
Appendix H: Lighting Fixtures in Foy Building Practice Room 2011

Appendix I: Sunny Day Light Meter Reading for Foy Building Practice Room 2011

in Foot Candles (Open Window Blinds)

0	0	0	0	0	0	0	0	70.5	55.9
9.7	10.6	11.2	12.3	13.4	15.2	19.4	31.7	45.7	31.8
11.1	12.0	14.4	15.9	18.3	19.8	23.2	28.6	33.0	32.2
12.0	14.4	16.3	19.3	23.3	24.8	25.6	27.7	29.2	26.7
13.7	17.3	20.0	23.6	26.6	26.7	27.0	26.6	25.9	24.1
0	18.6	22.7	27.0	30.3	30.8	29.6	27.7	26.1	22.6
0	18.2	23.0	27.7	30.1	30.3	28.1	26.0	25.9	0
0	17.6	20.7	24.1	26.9	27.7	25.6	23.3	21.2	0
0	16.8	18.1	21.2	22.7	23.3	21.5	19.9	19.6	0
0	15.1	15.8	16.4	18.0	18.1	17.5	17.2	16.4	0
0	0	14.0	14.6	17.1	14.2	14.4	13.4	14.1	0

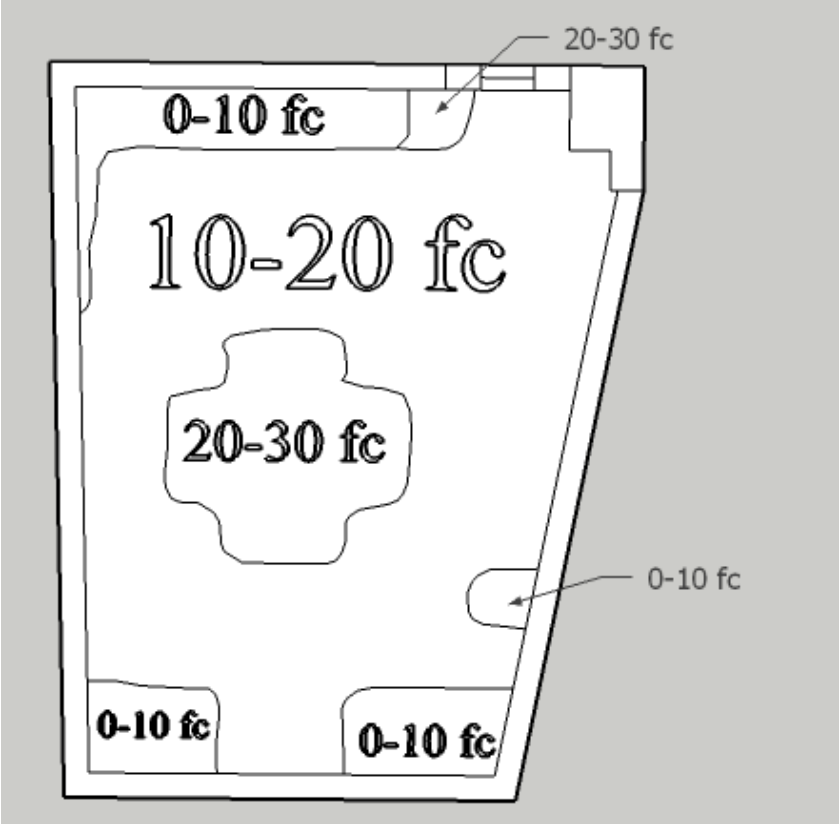
Appendix J: Isolux Diagram for Foy Building Practice Room 2011 (Sunny Day-Open Window Blinds)



Appendix K: Sunny Day Light Meter Readings for Foy Building Practice Room 2011 in Foot Candles (Closed Window Blinds)

0	0	0	0	0	0	0	0	24.1	18.5
6.6	7.2	7.4	7.9	8.2	8.5	9.8	12.3	13.2	11.0
7.8	8.4	10.2	17.2	12.0	12.1	11.9	11.9	11.4	10.1
9.0	10.8	12.4	14.8	16.5	17.0	15.8	14.1	12.0	10.6
9.9	12.8	15.7	18.6	20.5	20.4	17.7	15.1	13.0	11.5
0	14.1	17.5	21.6	24.4	24.0	21.4	17.8	15.2	12.0
0	13.6	17.8	22.2	24.6	23.9	21.2	18.4	17.5	0
0	12.9	15.9	19.7	21.0	21.3	19.9	15.9	12.5	0
0	12.5	14.2	17.0	18.8	17.5	16.1	11.0	10.0	0
0	10.1	11.3	12.0	12.9	13.0	11.9	11.5	10.1	0
0	0	9.5	9.7	11.8	10.5	8.9	9.2	8.4	0

Appendix L. Isolux Diagram for Foy Building Practice Room 2011 (Sunny Day-Closed Window)

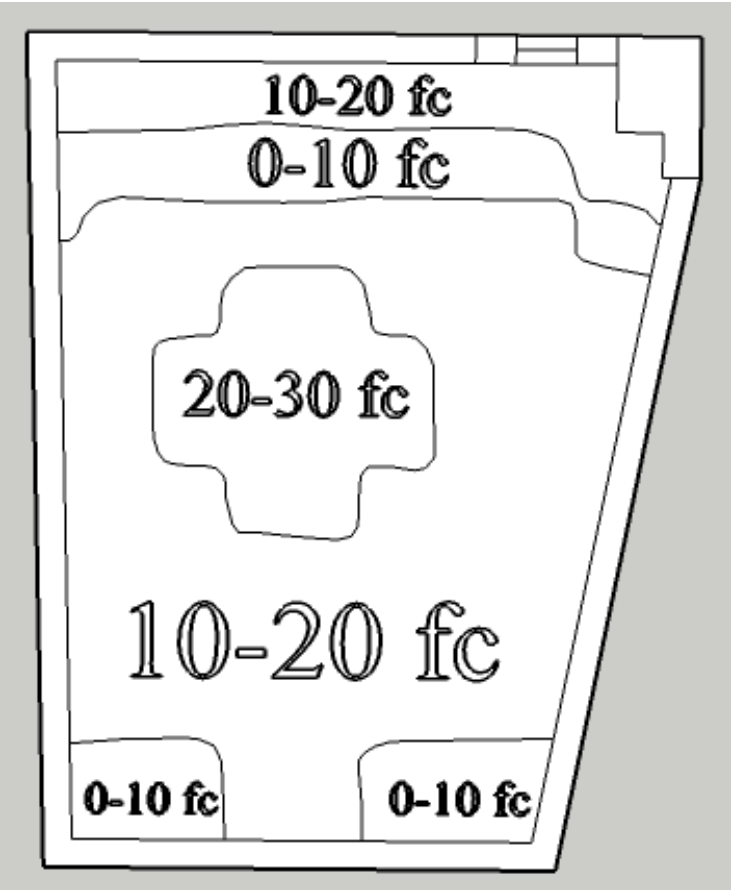


Appendix M: Overcast Day in Foy Building Practice Room 2011

Appendix N: Overcast Day Light Meter Readings for Foy Building Practice Room 2011 in Foot Candles (Open Window Blinds)

0	0	0	0	0	0	0	0	12.0	10.5
7.1	7.6	7.7	8.0	8.8	8.3	8.8	9.4	9.4	10.3
8.3	9.4	11.7	12.3	13.1	12.4	11.9	12.1	12.3	10.0
8.7	9.0	13.1	15.5	17.0	17.4	17.0	16.4	14.8	13.2
12.0	14.0	16.8	19.3	21.3	20.8	18.1	16.4	14.8	12.0
0	15.6	18.6	21.2	23.2	23.5	22.1	18.7	17.7	13.4
0	15.3	18.6	23.3	24.4	23.0	21.0	19.3	18.5	0
0	13.4	17.0	18.1	21.0	20.4	18.7	16.6	14.2	0
0	13.0	14.2	16.7	17.6	16.0	15.5	13.9	13.2	0
0	10.3	11.2	12.1	13.2	13.6	12.3	12.0	10.6	0
0	0	9.4	9.4	12.4	9.7	9.4	9.3	9.0	0

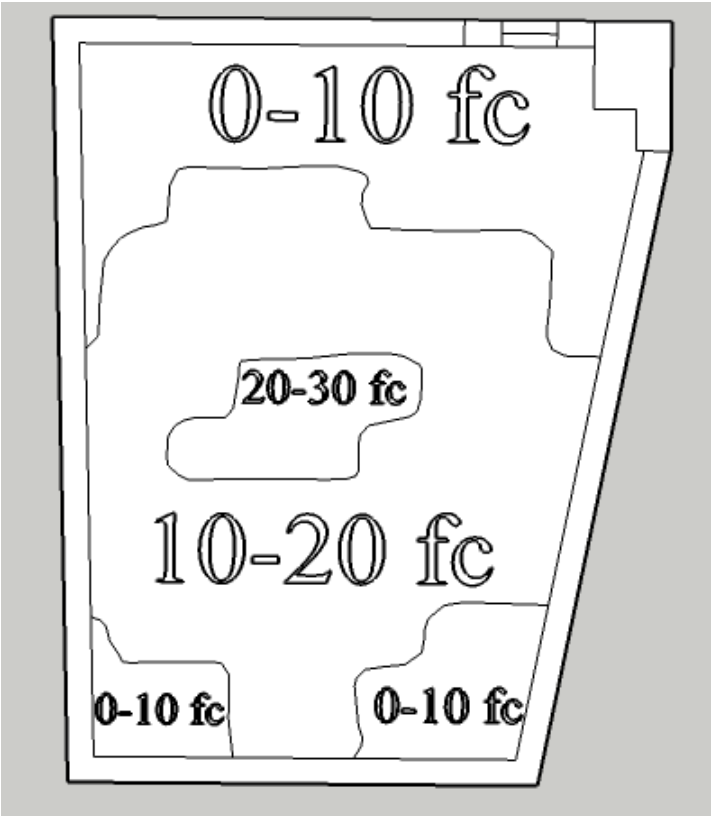
Appendix O. Isolux Diagram for Foy Building Practice Room 2011 (Overcast Day-Open Window Blinds)



Appendix P. Overcast Day Light Meter Readings for Foy Building Practice Room 2011 in Foot Candles (Closed Window Blinds)

0	0	0	0	0	0	0	0	6.4	5.9
6.4	6.8	7.1	7.5	7.8	8.4	8.0	7.1	7.2	6.7
7.4	8.0	9.6	10.4	10.9	10.7	9.9	8.6	8.1	7.8
7.4	8.5	11.9	14.1	15.8	14.8	14.0	12.2	10.5	8.9
9.2	11.6	14.6	17.0	18.3	18.1	15.1	13.0	12.1	9.9
0	14.3	16.5	19.4	22.4	22.6	20.5	17.0	14.9	10.7
0	14.2	16.9	20.9	22.5	21.5	18.6	17.2	15.3	0
0	12.3	15.4	18.0	19.3	20.0	17.0	14.4	12.5	0
0	11.4	12.9	15.7	16.6	15.5	13.7	12.1	10.9	0
0	9.3	10.3	10.7	11.6	11.8	10.6	9.9	8.8	0
0	0	8.6	8.9	10.6	9.1	8.1	7.8	7.1	0

Appendix Q: Isolux Diagram for Foy Building Practice Room 2011 (Overcast Day-Closed Window Blinds)



Appendix R: Picture of Practice Room 2009 (for Acoustic Measurements)

Appendix S: Picture of Piano I in Practice Room 2009

Appendix T: Picture of Piano II in Practice Room 2009

Appendix U: Picture of Piano in Practice Room 2031 (for Acoustic Measurements)