Assessment of Noise Pollution in Two Types of Rooms in Rockbox Building, Smallville, Mandurriao, Iloilo City

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ASSESMENT OF NOISE POLLUTION IN TWO TYPES OF ROOMS IN ROCKBOX, SMALLVILLE, MANDURRIAO, ILOILO CITY

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Researchers

March 2012

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ABSTRACT

Indoor noise is very common in many places, because sound waves are kept inside the confined spaces of a room, where a higher sound level is present and will absolutely have the presence of noise. For the average person, noise is considered as the level of sound that is intolerable to the ears. On the other hand, sound is considered as noise if the sound level or loudness reaches 80 decibels or higher, in reference to the standards of science.

This study described the sound level of two different dimensions of rooms in the Rockbox establishment located in Smallville, Iloilo City. Rockbox is a new establishment to the Smallville complex is the chosen candidate for the purpose of this study because of the popular game Rock Band which is available in their Play Station 2 game console. This game is very similar to karaoke machines, only that there can be a maximum of four participants can play the game, where each can hold a game controller in the likes of the essential musical instruments in a music band (drums, guitar, bass, and microphone). The game consoles are placed inside private rooms that can be can be rented by customers with a consumable time limit.

In this study, the main aim is to compare the sound level produced by customers in two different dimensions of the private rooms in Rockbox, one big and one small. The situation of the sampling of data is the normal activites of the customers who rented the room. The number of individuals inside, as well as the volume and random sounds they make are independent variables of the study.

An Explorer GLX Data logger with an available digital decibel meter was used to record data for each of the two rooms. Three samples of data were recorded for each room where one sample is equal to one hour of recording. After sampling the data, raw data

was processed in a laptop with Data Studios software. A table of raw data along with a graph for each sample was produced for comparing the average sound level produced in the two rooms. In the results, the average sound level for the small room is 95 decibels while in the big room there is an average of 89 decibels. Through careful study of results, there were many reasons why the sound level of the smaller room was higher, but the main reason is that the dimension of the room kept more sound in, whereas the other room has a wider dimension, giving a longer time for sound to disperse.

Key words: noise, indoor noise pollution, sound, sound level, decibel

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CHAPTER 1
INTRODUCTION

Background of the Study

Noise pollution does not seem to have any effects on the daily activities of the people in the public indoor areas because they are unaware of the noise that surrounds them. They are also unaware of what can it do to their health especially indoors where sound can be louder than outdoor noises. Most noise indoors is created by machines, gadgets, stereos, electric appliances, loud conversations among groups of individuals and the like. Noise from various sources interrupts conversations, creates stress and annoyance (Nagi and others 2009).

Excessive noise seriously harms human health and interferes with people's daily activities at school, at work, at home and during leisure time. It can disturb sleep, because cardiovascular and psychological effects reduce performance and provoke annoyance responses and changes social behavior (World Health Organization 2011). People nowadays would now be entertained by popular tech gadgets of the new age.

Today, there are certain establishments such as arcades, game bars and recreational facilities where people of the age group of 13 to mid 20's can go and enjoy the entertainment within these establishments. Now, individuals enjoy the use of personal computers, handheld gadgets and game consoles with gadgets with physical interaction that these establishments have to offer. Some of these gadgets can be played while mounted on television sets with installed loudspeakers for the individuals to experience the game.

In this study, we will be conducting research on the new recreational center called The Rockbox in Smallville, Mandurriao, Iloilo City. The Rockbox's services for entertainment and recreation consist of Xbox 360 game consoles and Rock Band PlayStation 2 game consoles. This establishment is the first recreational center to introduce public access to playing these game consoles. This study will focus gathering data on the sound produced while playing Rock Band. Rock Band is a game with the simulation of a band in concert where players can really hold wireless guitar gadgets,

drum set and microphone designed for the game while watching the TV screen where game play is similar to karaoke machines. Since this game feature simulations of a live concert, it is considered to be a source of sound and therefore can be possible of producing noise This study will determine the sound level in two private rooms where gamers play Rock Band.

Statement of the Problem

This study aims to determine the noise pollution individuals are exposed to while playing Rock Band in Rockbox, Smallville, Mandurriao, Iloilo City.

Objectives

This study aims:

1. To measure the sound level (decibel) customers normally experience in the small and big game rooms of Rockbox
2. To calculate and compare the acceptable time exposure (seconds) to noise in small and big rooms in Rockbox.
3. To compare the average sound level (dB) of the small and big rooms in Rockbox.

Significance of the Study

The study aims to determine if the sound level in Rockbox does reach 80 decibels or beyond the acceptable noise level indoors. This study will also determine which of the two rooms will affect the individuals inside the most if there is a difference in the average sound level of the two rooms.

If so that the sound level has reached the noise threshold (80 dB), this study would benefit the workers as well as the customers in the building and rooms who are exposed to the threshold of noise and who are experiencing mild side effects while being expose to noise in a long period of time. This study would also be of use to notify the customers

that they are being exposed to noise that would reach beyond 80 decibels because the noise in the building and rooms would affect customers who easily gets stressed and annoyed because this would affect their performance during the day if further being exposed to higher levels of noise.

Scope and Delimitation

This study was conducted in Rockbox at the Annex Building, San Pedro Street, Smallville, Diversion Road, Mandurriao, Iloilo City. There are two different dimensions of rooms in which the sound level produce in the room while customers inside are playing Rock Band has been recorded for data sampling. A device called the Xplorer GLX Data Logger that has a sound level recording device and an air temperature recording device programmed in the GLX was the recording devices used throughout the course of the data sampling part of the study.

In this study, only the duration of exposure to sound and distance of the device from the speakers (source of sound) and distance from the customers and volume the speakers create are the variables that were kept constant. Air temperature is the only independent variable in this study. Other variables such as number of individuals present in the room, level of sound the individuals create, number of tracks played, doors of the rooms being opened are considered independent as well because of the objectives of this study was to record sound level on a normal situation because the sound level of produced in the room is what the customers normally experience.

Definition of Terms

Noise refers to any undesired sound measured in decibels. It can cause hearing impairments at higher levels of exposure (Oxford Dictionary of Physics 1996). In this study, noise refers to the sound level customers are exposed to in small and big rooms of Rockbox by various sources of indoor sounds in the big and small rooms of Rockbox. Noise is the variable being measured in this study.

Decibel meter is a device that measures sound level in terms of decibels to determine noise (Oxford Dictionary of Physics 1996). In this study, the decibel meter refers to the Xplorer GLX Data Logger device that was used to measure sound level in Rockbox during the course of this study.

Pollution is the undesirable change in physical, chemical, or biological characteristics of the natural environment, brought by man's activities (Oxford Dictionary of Biology 1996). In this study, the pollution that is being described is noise pollution, which is the physical change of sound in the environment where sound is unpleasant to the human ear as the sound level reaches 80 dB and higher.

Ambient describes the condition and factors present in the environment (Oxford Dictionary of Biology 1996). In this study, ambience refers to the factors such as air temperature, volume level of speakers, noise created by individuals and humidity in the big and small rooms which could affect the sound level in these rooms in Rockbox.

CHAPTER 2

REVIEW OF RELATED LITERATURE

A. Sound

Sound is vibrations in a medium at a frequency and intensity that is capable of being heard by the human ear. The frequency range of the ability of the human ear to hear is 20 Hz-20,000 Hz. Sound at lower frequencies are called infrasound while at high frequencies, they are called ultrasounds (Oxford Dictionary of Physics 1996). Sound can also have different properties.

A.1 Properties of sound

The properties of sound are harmonics, pitch and intensity.

A.1.1 Intensity

Intensity is the level of sound is usually expressed in terms of the Sound Pressure Level (SPL) in decibels, which is defined as SPL = 20 log 10 P/PO dB where P is the pressure variation measured in N/ m^2 and PO is the standard reference pressure taken as 2 x 10^{-5} N/m^2 (Vijayalakshmi 2003).

A.2 Factors that affect sound propagation

Factors that affect sound propagation are Geometrical diverging, air absorption, meteorological effects, and ground effects.

A.2.1 Geometric spreading

Geometric spreading is independent of frequency and has a major effect in almost all sound propagation situations.

A.2.2 Air absorption

As a sound wave travels through the air a small proportion of energy is absorbed (converted to heat) by the air itself. The main mechanism is the setting up of vibrations in the molecules of oxygen and nitrogen in the air. Energy is also extracted due to the viscosity of the air. The energy loss depends upon the temperature, but primarily on the humidity of the air and is different for different frequencies of sound. The effect is small and usually ignored except in long distance propagation.

A.2.3 Meteorological effects

In meteorological effects there are 3 parts, wind, temperature and turbulence. These factors can affect the speed and dispersion of sound.

A.2.3.1 Temperature

Temperature is another characteristic upon which the velocity of sound depends. Velocity increases with temperature. The speed of sound in air at 20 degrees Celsius is 343 m/s. The speed increases with each increasing temperature because when temperature increases, the random speeds of air molecules makes passages of pressure fluctuations more rapid (Modern Technical Physics 6th Edition, Beiser 1991). In this study, air temperature can affect the speed and dispersion of sound.

A.2.3.1a Measuring Air Temperature

Air temperature is a factor that can affect how sound propagates in a room (Modern Technical Physics 6th Edition, Beiser 1991). If air temperature is high, the speed of sound travels faster because of the fast motion of air molecules.

A.2.3.2 Turbulence

Turbulence can be caused by gusting of or obstructions to the wind flow. It introduces fluctuations of noise levels. The sound is scattered in the turbulent region and could result in an increase or decrease in the levels received at a given position. In this study, turbulence is caused by any object that could be hit by sound waves and reflect or scatter the sound waves that come in contact. In Rock Box, turbulence is influenced by tables, chairs, small furniture, dish shelves and other objects.

A.2.4 Ground effects

When source and receiver are close to the ground the nature of the ground becomes important. If the ground is capable of absorbing the sound then a further attenuation with distance may be appropriate over those described in previous sections. In many noise prediction schemes an extra attenuation is specified for propagation over grassland. This is usually expressed as a function of propagation distance and the average height of the propagation path above the ground.

B. Noise

Noise is unwanted sound. It is an acoustic wave which travels in a given medium at a constant velocity. When the level of the sound becomes unpleasant to the human ear, it is called noise (Vijayalakshmi 2003).

B.1 Noise level

The typical noise level chart classifies various sounds based on five different categories.

Faint noise levels - usually carries arrange of no more than 30 decibels. These are considered to be completely safe and pose no threat at all to the ears. This sound level is approximate to whispering.

Moderate noise levels - This level of noise is usually between 40 and 50 decibels is often pleasant and ideal for helping someone relax. Moderate noises also pose no threat to the human ear and are common. This sound level is equivalent to a quiet room.

Very loud noise levels - This class usually involves a range between 60 and 80 decibels. Noises of this type are still considered acceptable and do not pose any real threat to hearing capability. This level of sound is equivalent to loud conversations.

Extremely loud noise levels - This class usually involves a range of 90 to 110 decibels. They do have some potential for causing damage to the ear.

Painful noise levels - This category is for noises that register over 120 decibels. Sounds in this category are capable of causing temporary or even permanent loss of hearing in one or both ears. At this level, plane engines can achieve this level of sound.

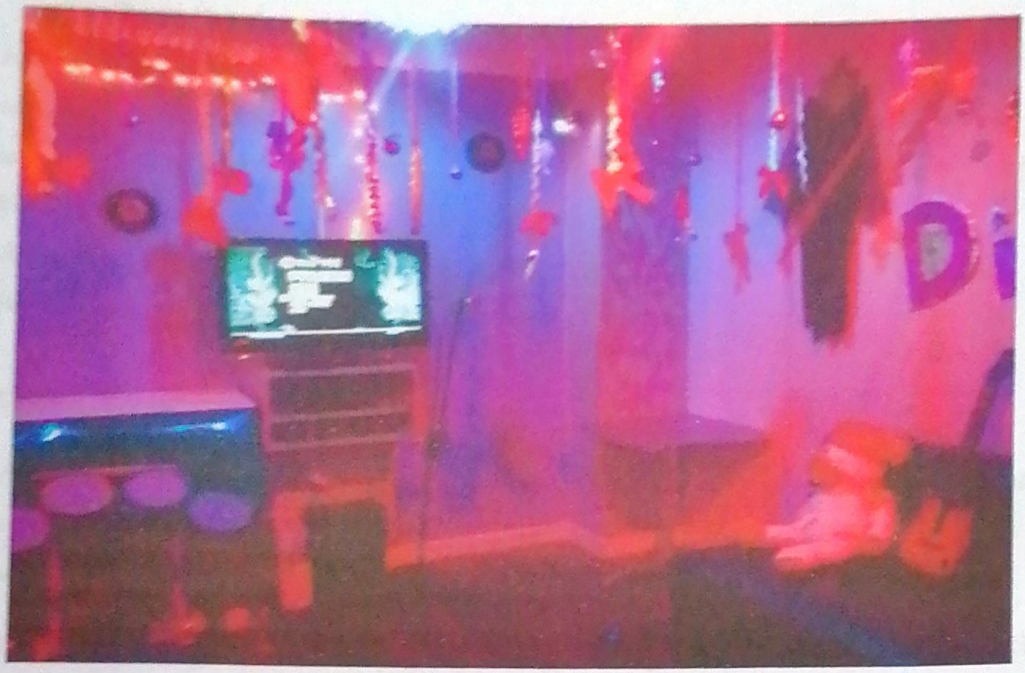
B.2 Noise standard

The threshold at the normal hearing is 20-25 decibels and of normal conversation is 60 decibels. It has also been noticed that speech interference occurs at 75 decibels and definite annoyance begins at 80 decibels. The motor- activities disturbed at 90 decibels and physiological disturbance occurs beyond 120 decibels. Definite pain occurs at 140 decibels (Vijayalakshmi 2003).

To calculate the maximum time of exposure the following equation is used:

$$t = 28{,}800 / 2^{(L - 85)/3}$$

where t = maximum exposure duration (seconds), L = exposure level (dBA), and 3 = exchange rate (dB)



Rockbox (inside) - Room

C.1a Dimension and Present Obstruction of Small Room

Room dimensions is 3x4m with 2 small steel tables and 2 steel chairs ,sofa chair,2 sofas, flat screen TV, Playstation 2 console and four Rock Band instruments. The room is surrounded by five small speakers (ceiling level) and a medium speaker (floor level) with egg trays on the ceiling for sound proofing.

C.1b Dimension and Present Obstruction of Big Room

Room dimensions is 7x4m with 2 small steel tables and 2 steel chairs ,1 big table, sofa chair,2 sofas, 2 flat screen TVs ,shelf (2x1m),2 Playstation 2 console and 4-8 Rock Band instruments. The room is surrounded by ten small speakers (ceiling level) and 2 medium speakers (floor level) with egg tray and insulation foam for sound proofing.

C.2 Rock Band

A Play Station 2 game which is similar to karaoke, only that the game is a cooperative game where you can access the use of guitars and drums along with the microphone where it can be played with a maximum of four players. The game procedures are simply striking the right color on the screen with the same color indicated on an instrument and reaching the right note and lyrics for the vocals on the screen while the players are scoring points.

D. Decibel meter

A decibel meter is a device which measures sound pressure to determine how intense sounds are, measuring in decibels. Decibels are a logarithmic scale based on the sensitivity of the human ear.

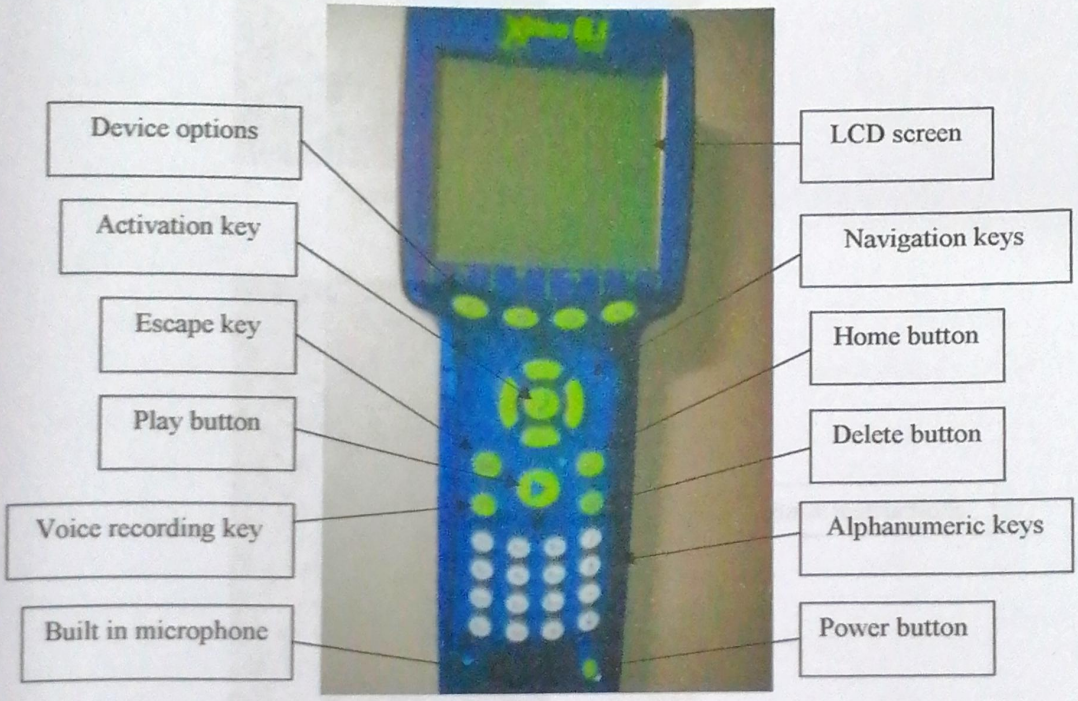
The decibel meter measures the sound pressure and provides a reading in decibels for the convenience of the user. Some may also provide readings in other units of measurement, depending on the uses they are intended for. Decibel meters are often designed to be portable so that people can move them around as needed, and are often hand held, although sometimes they can be part of a permanent instrument array which is designed to take continuous measurements in a given area.

D.1 Decibel

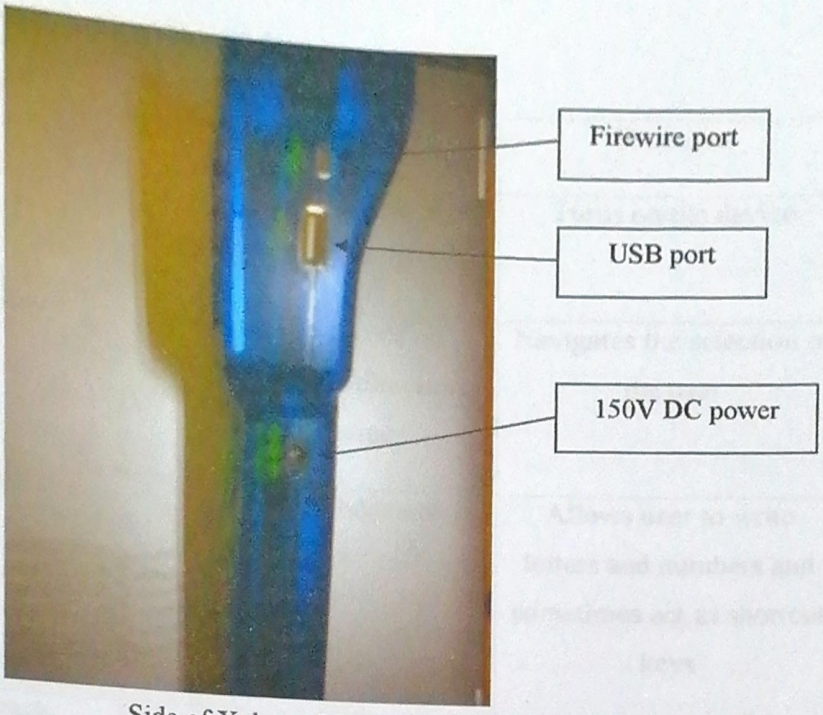
Decibel (dB) is the unit of measure of sound intensity (Oxford Dictionary of Physics 1996). Decibels can be measured using a decibel meter or sound level meter that has a microphone attached to this device or has a built-in microphone.

D.2 GLX Meter

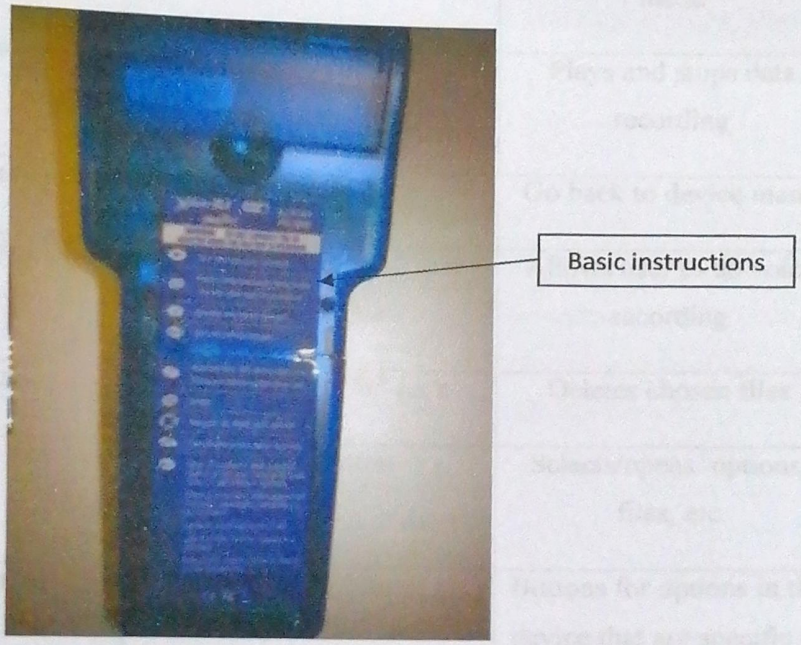
The Xplorer GLX is a data collection, graphing, and analysis tool designed for science students and educators. The Xplorer GLX supports up to four PASPORT sensors simultaneously, in addition to two temperature probes and a voltage probe connected directly to specialized ports. In this study, we will be using the sound level meter in Xplorer GLX.



Front of Xplorer GLX



Side of Xplorer GLX



Back of Xplorer GLX

D.2a Buttons and Functions of the GLX

Buttons Of GLX	Description	Functions
Power Button	Located at the bottom right on the front of the device	Turns on the device
Navigation Keys	Arrows that shows up, down, left, right directions on the device	Navigates the selection of the user
Alphanumeric Keys	Keys in numbers and letters	Allows user to write letters and numbers and sometimes act as shortcut keys
Escape Button	Esc button	Go back to previous menu
Play Button	Bold arrow	Plays and stops data recording
Home Button	Button with the house icon	Go back to device menu
Voice Recording Key	Button with the flag icon	Allows user to do voice recording
Delete Button	Button with a "x" icon	Deletes chosen files
Activation Key	Check button	Selects/opens options, files, etc
Device options	F1-F4 buttons	Buttons for options in the device that are specific to other applications

CHAPTER 3
METHODOLOGY

Overview

This study assessed the sound level in the two rooms in Rock Box. The sound level meter (decibel meter) in the explorer GLX Data Logger by PASCO was used to measure the sound level in the two chosen rooms in the building during the opening time until late night for three hours for each of the two rooms in the weekends. The players are any individuals who purchased the use of the room with the standard consumable time of 1 hour for 400 pesos. They were asked for permission if they can allow recording of their play time for 1 hour and are free to choose the soundtrack/s of their choice. This study only accepted data with four players playing Rock Band and lasts for a minimum of one hour of game play.

Materials and Equipment

- Explorer GLX Data Logger version 1.4x
- GLX Temperature sensor node

Temperature Measurements

The room temperature was set at a standard of 16 degrees Celsius as set by the manger of Rock Band. No further changes in the air conditioner settings are allowed.

If there is a need to measure the temperature, plug in the sensor node in the data logger and configure variable in the Sensors settings menu. Set to record in Celsius per second. Press the home button and open the graph. Sound level and temperature was recorded at the same time. Place the node on shoulder level to finish setting up the temperature set up.

Positioning Explorer GLX

Make sure that the device is fully charged before you start positioning. Place the device on the table in the room with equal level with the speakers and position it on the center of the table to avoid knocking the device off the table. The device was placed and secured equidistant from the speakers and the players in the room to be able to record the noise coming these sources.

Volume Adjustments

The volume was set to the max for recording if allowed by the players. Otherwise, the players are free to set the volume to their preferred level.

Game Factors

The choice of music or audio track was of the one with the highest number of plays by recent players of the game. All four instrumental positions (guitar, bass, vocals and drums) was included in measuring the data.

Accessing the Sound Level Meter in the Explorer GLX

To turn on device press and hold the power button of the device until a green light appears. Wait until the device menu appears. Now, on the menu, open Data Files. To access Data Files, press the activation key. After opening Data Files, select a file or an "untitled ()" file. Press F2 to save and F1 to open and access file. Pressing F4 will allow you to rename and/or create a new file if desired. Go back to the device menu to find the decibel meter. To go back, press the home button. Open the Sensors application. To select application, use navigation keys to find application and press activation key or press F4 to open the application. To selecting Decibel meter, press F4 to add a sensor. Use navigation keys to find the sensor GLX Sound Level Meter then press F1 to open sensor. An options menu for the GLX Sound Level Meter will appear. Set the Sample Rate to Seconds for the data recording.

Recording Data on Device

Press home button to go back to device menu again. To start recording data, press F1 and home buttons together and a dB vs. Time graph will appear. To start recording data, press play button. The device will create a graph of the sound level taken as well as recording the sound level every second. The data recording will go on from opening time until 11pm for 3 sampling times. One sampling time is equal to 1 hour. To stop your recording, press play button again.

Saving Data

Press home button to go back to device menu. After that press activation key to open Data Files. Press F2 to save to device or External flash drives attached to the device.

Installation of Data Studios

Open your laptop. Open the CD drive and input Data Studios installer CD. An installation menu will appear that will allow you to accept the terms of agreement of the software and find a location to install the software. The files will be installed to your laptop and the software is now ready for use

Processing Data

Using a flash drive or universal serial bus data connector from device, plug in to laptop. The laptop must have the program Data Studio to process the recorded data. The program will present a menu. Click on Create Experiment icon and the program will show your files from the GLX. Click on your file and press "download to computer" option. Select a destination to save file and save the data in the desired location. Now you can collect your data. To access press the Files option on the top left of the screen and press "open activity". Open the file with the name of the data you have used to record. A graph of the data will appear.

To save graph as a picture, open the Display menu on the top left of the screen and select export graph. A menu will appear to where you want to save the picture. Select a location and save graph as a picture.

To export data, again open the Display menu. Press export data and a menu will appear to where you want to save data. Select a location and save. The data will be saved as a .txt document where only the Notepad application may access it. The data will appear with two columns. The first column will be the time in seconds and the second column will be the sound level in decibels

CHAPTER 4
RESULTS AND DISCUSSION

Overview

This study determined the noise pollution experienced by customers in the small and big rooms of Rockbox. Six samples were taken all throughout the study with three samples for the small room and three samples for the big room. There is no change in the number of obstructions as well as their position in the rooms during the data sampling in each room. The study has taken to account that all four instruments are used and each sample was taken exactly as one hour. In the study, the results show that each room has a minimum range of 70 dB/s and a maximum of 100-115 dB/s during the recording of the raw data. In comparing the sound level to the two types of rooms, the big room has less of the mean in sound level in the small room by about 5-9 dB for each sample taken.

Results

The sound level was recorded with a calibration of 60 to120 dB. The sound level taken to account is the level of 80 dB and higher to achieve the true mean for the results. The data has many variations of the sound level in the observations due to:

- The opening and closing of doors (either the room being sampled or other rooms in use) during the sampling, which has affected the sound level of the room with the device.
- The number of individuals present and the current noises they have caused besides that fromthe game.
- The time between gameplay and break time for choosing songs during the process of sampling.
- Ambient noise level the may have been present outside the rooms during sampling.

Air temperature in the rooms affected the speed of sound therefore may be able to affect sound level as well. In each room, level of temperature is standard by the establishment to a level of 30 out of a 100, which would keep the room a steady temperature of 21 to 25 degrees Celsius depending on the factors that could affect the air temperature, so air temperature tended changed with the number of individuals present. During the time of data sampling, air temperature ranges from 24 to 31 degrees Celsius for each room.

Room dimension had a great effect on the sound level. The results of the data showed that the sample from the small room is 5 to 9 dB more than the data samples of the big room. This is most likely due to the effects of the closer space in the small room. Sound has less travel time in the smaller room, so sound is dispersed fast, unlike the big room, were sound has a longer distance to travel through space. Because of this, the build-up of sound is less than the build –up in a smaller space.

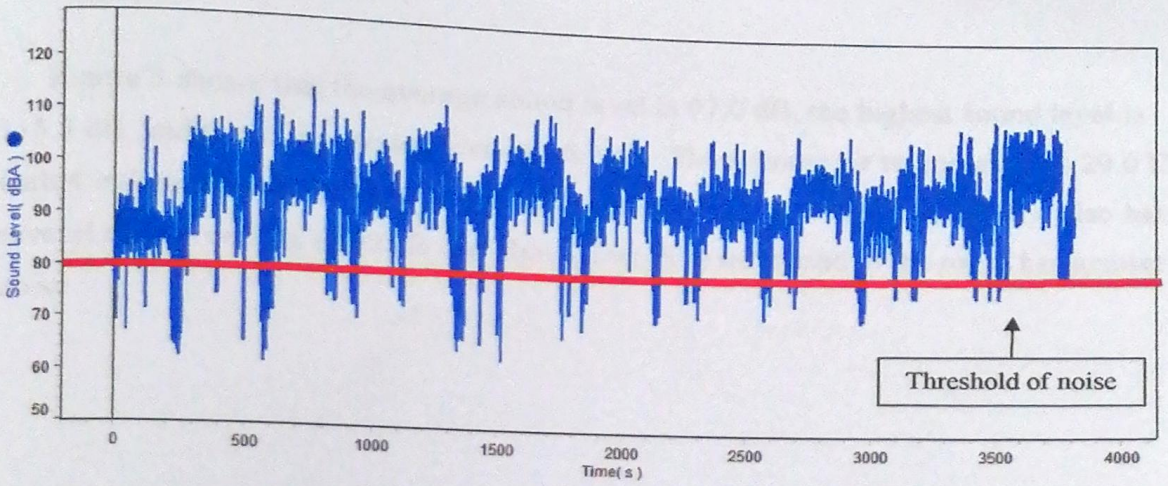
The number of individuals varied for every sampling because this is not a controlled variable, so the number of individuals came at random. Although at other sampling times there are more individuals present than the other, the sound level are greater for the samples with less number of individuals. These can be said that the other group had other activities done in the room other than playing Rock Band that has higher sound level than other groups.

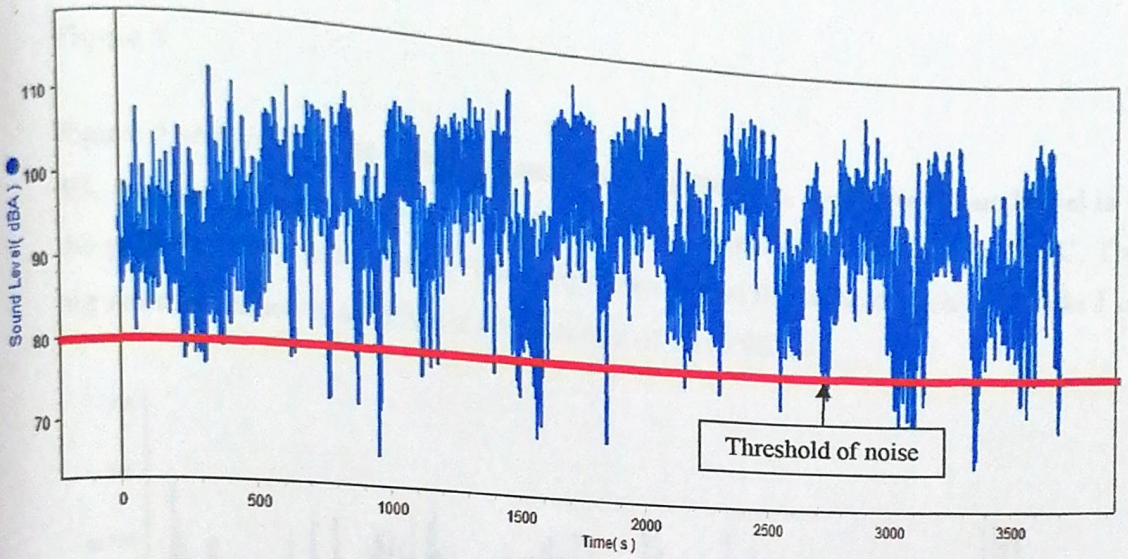
A. Graphs and Metadata of the Samples

a. Small Room

Figure 1

Figure 1 shows that the average sound level is 95.9 dB, the highest sound level is 115 dB, and the lowest sound level is 61.8 dB. The average air temperature is 27.7℃. It can be observed in the graph that sound level is 80 dB or higher several times more than below 80 dB.





b. Big Room

Figure 4

Figure 4 shows that the average sound level is 88.5 dB, the highest sound level is 106.1 dB, and the lowest sound level is 62 dB. The average air temperature is 27.0℃ with 9 individuals present. The graph looks like it has a bold pattern all throughout the recording where it is nearly consistent between 80 to 90 dB.

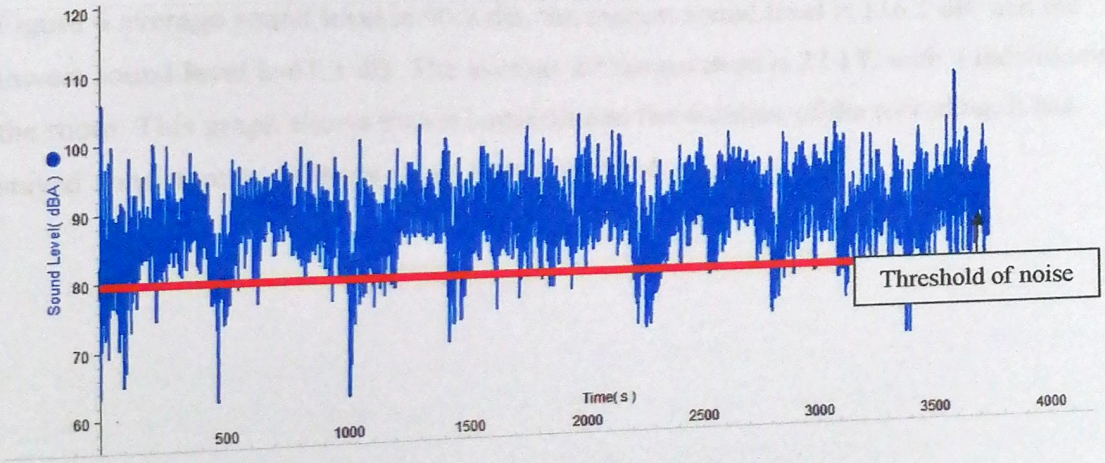


Figure 5

Figure 5 shows that the average sound level of 89.1 dB, the highest sound level is 109.2 dB, and the lowest sound level is 65 dB. The average air temperature is 27.9℃. There is the presence of 8 individuals. The graph also shows the same pattern as sample 1 of the big room because it also has a consistency of 80 to 90 dB.

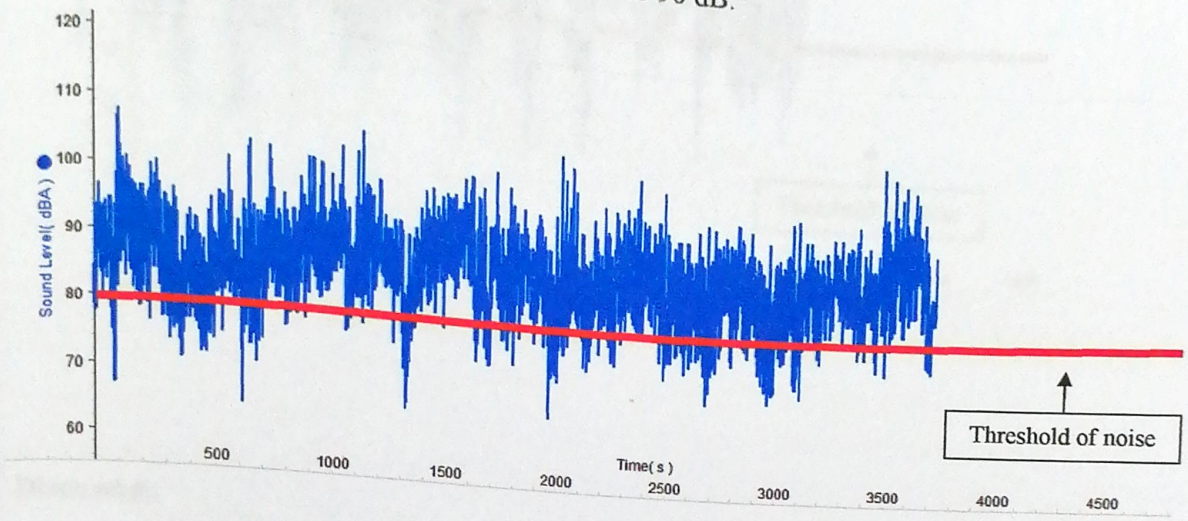
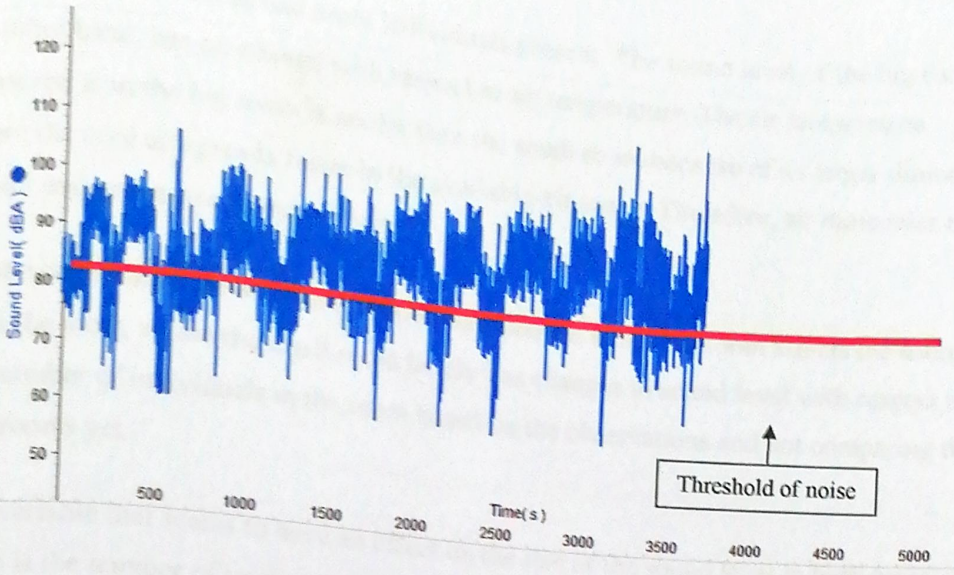


Figure 6

Figure 6 average sound level is 90.2 dB, the highest sound level is 116.1 dB, and the lowest sound level is 61.3 dB. The average air temperature is 27.1℃ with 7 individuals in the room. This graph shows that at some time in the duration of the recording, it has stayed consistent at different range levels of sound.



Discussion

Regardless of the size of the room, both rooms exhibit sound levels that reached 80 dB and higher where the small room has the higher average sound level of 95.0 dB while the big room has an average sound level of 89.0 dB. Each sample taken from the small room has an average sound level above 90, indicating greater levels of noise that could not be tolerated by some individuals. The sample taken from the big room on the other hand ranges an average of 88 to 90 dB which is a slight difference in sound level that is due to variation of presence of individuals, number of tracks played and temperature. Factors like the opening and closing of the doors and random sounds created by the customers may have contributed to a change in sound level during the data sampling.

For samples in the small room, temperature may have affected most to the level of sound in the room. As shown in the table, temperature increases from samples 1 to 3 and sound level increases as well, showing the effects of air temperature in the level of sound, since the body temperature also has a contribution to the change of temperature and has greater

increase when the room had more individuals present. The sound level of the big room on the other hand, has no change with respect to air temperature. The air temperature measured is in the big room is cooler than the small room because of its larger dimension where the cool air spreads faster in the available air space. Therefore, air molecules move slower and propagate sounds slower.

On the other hand, the number of individuals present in the big room affects the sound level the most, where the small room barely has changes in sound level with respect to the number of individuals in the room based on the observations and not comparing the two rooms yet.

The variable that seems to have an effect on the rise of the sound level in both types of room is the number of tracks played. More tracks played results to higher sound level when the samples are compared. This is because the game has a break time in between songs where players choose the next song to play, during this time, there is not much sound while being on the song menu, which affects the sound level as well as how long they want to choose the next track to play.

Based on the observations, it can be said that the small room has proved to produce higher levels of sound, therefore, has most of the noise created in comparison the big room.

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSIONS, & RECOMMENDATIONS

A. Overview

This study aims to determine the noise pollution individuals are exposed to while playing Rock Band in Rockbox, Smallville, Mandurriao, Iloilo City.

This study aims:

1. To measure the sound level (decibel) customers normally experience in the small and big game rooms of Rockbox
2. To calculate and compare the acceptable time exposure (seconds) to noise in small and big rooms in Rockbox.
3. To compare the average sound level (dB) of the small and big rooms in Rockbox.

B. Summary of Findings

1. The small room has an average of 95 dB with a range of 64.6 dB to 113.8 dB while the big room has an average of 89 dB with a range of 62.9 dB to 111.3 dB.

2. In the small room, the average time exposure to noise is 3478.33 seconds. In the big room, the average time exposure is 3244.33 seconds.
3. The small room had an average of 95 dB while the big room had an average of 89 dB.

C. Conclusion

The results of the study showed that there is the presence of noise pollution in each of the two rooms that is experienced normally by the customers inside the rooms. Playing Rock Band in Rock Box exposed individuals to sound level that reached even more than the threshold of noise, being 116dB as the highest possible sound level that can be reached, therefore, the study concludes that the staff and individuals who are costumers of Rock Box should limit their exposure to the noises present around them while spending their leisure time playing Rock Band. Also, rooms that have smaller dimensions will tend to have higher levels of sound due to the small distribution area for sound to travel.

D. Recommendations

To future researchers who will use this study you should consider:

- Have the number of tracks played and number of individuals kept constant for more precise results.
- Control the air temperature to close to the room temperature of 25 degrees Celsius.

C. Conclusion

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D. Recommendations

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- Control the air temperature to close to the room temperature of 25 degrees Celsius.

APPENDIX A

Raw Data

BIG ROOM

Table 1

	0	1	2	3	4	5	6	7	8	9
6	0	0	0	0	4	1	2	4	3	0
7	1	7	8	16	28	21	41	59	57	86
8	84	109	141	174	188	112	231	270	261	274
9	251	216	200	203	147	64	122	68	43	33
10	287	15	9	6	6	2	1	2	5	1

	0	1	2	3	4	5	6	7	8	9
6	0	0	2	2	0	1	1	2	0	5
7	3	6	9	9	19	6	21	38	40	73
8	86	103	122	180	207	118	262	284	319	320
9	342	280	213	171	129	54	110	40	24	17
10	13	4	4	1	0	0	1	0	0	1

Table 2

Table 3

	0	1	2	3	4	5	6	7	8	9
6	0	14	9	2	9	1	7	5	12	1
7	12	19	18	16	29	27	59	58	92	102
8	108	127	115	140	145	72	163	172	180	189
9	209	222	209	201	175	84	148	146	79	62
10	50	36	34	17	8	2	4	1	2	1
11	0	0	0	0	0	0	1	0	0	0

SMALL ROOM

Table 1

	0	1	2	3	4	5	6	7	8	9
6	0	0	2	2	2	2	3	7	4	5
7	6	5	9	18	12	4	22	18	31	23
8	29	42	58	44	55	30	86	79	79	106
9	110	133	142	187	214	146	232	260	247	260
10	212	175	138	113	103	30	46	35	32	21
11	12	9	4	2	0	1	0	0	0	0

Table 2

	0	1	2	3	4	5	6	7	8	9
6	0	0	0	0	0	0	3	3	3	5
7	5	8	5	14	7	1	18	27	26	28
8	50	71	91	122	120	84	146	147	142	165
9	159	162	168	183	172	100	191	198	198	183
10	189	141	113	70	38	12	16	8	5	2
11	1	1	0	0	0	0	0	0	0	0

Table 3

	0	1	2	3	4	5	6	7	8	9
6	0	0	0	0	0	0	0	1	0	1
7	4	0	4	5	6	3	8	15	24	26
8	29	29	35	62	65	22	72	76	89	106
9	136	175	152	171	161	72	174	158	170	168
10	146	176	174	173	134	74	114	89	86	81
11	66	39	19	6	4	0	1	0	0	0

Metadata Table

Sample No.	Ave. Temperature(℃)	Ave. Sound Level(dB)	No. of Individuals	No. of Tracks Played
Small Room				
1	27.1	95.9	7	11
2	25.4	92.9	7	8
3	29.0	97.0	4	11
Big Room				
1	27.0	88.5	9	9
2	27.5	89.1	8	10
3	27.0	90.2	7	11