THE SHELDON
CONCERT HALL & GALLERIES

SHELDON SOUND STUDIO

SHELDON SOUND STUDIO TEACHER MATERIALS

Dear Teachers,

Thank you for participating in *Sheldon Sound Studio*. *Sheldon Sound Studio* is a hands-on STEAM program that challenges students to design and create their own meaningful sound art. The program places an emphasis on technology by challenging students to incorporate a contact microphone into their sound art projects. *Sheldon Sound Studio* is inspired by the work of St. Louis sound artist, Brett Williams, who experiments with the expression of sound through combining technology with acoustic sound.

This hands-on STEAM project is preceded by six short videos that teach students about 1) the concept of sound art, 2) the mechanics of sound, 3) communication through sound, 4) sound design and acoustics, 5) the use of technology in sound art, 6) and the application of engineering to the Sound Studio Challenge. Coordinating lesson plans and student materials will enhance understanding of the videos and culminate in student groups building their own sound art project. Schools local to St. Louis may submit projects to be displayed at The Sheldon in a spring showcase. More information can be found HERE. Use the password "solid" to login.

This curriculum provides classroom materials to support you in implementing Sheldon Sound Studio in your classroom. In this packet you will find background and introductory materials to help in your preparation for the project followed by each of the six lessons. Within each lesson, you will find activities to explore the content further in your classroom.

We hope your students have a meaningful and fun learning experience through the *Sheldon Sound Studio Challenge*.

STEAM Program Manager
Kgalenski@thesheldon.org
314-533-9900 ext. 33

RECOMMENDATIONS FOR IMPLEMENTATION

Process of implementation

Sheldon Sound Studio is intended to be completed over 10-12 forty-five minute class periods but can be modified to fit your class's needs and timeline. Below is a recommended process of implementation.

- Participate in *Sheldon Sound Studio* professional development offered virtually at the beginning of each semester
- Using provided lesson materials, pace the lessons for the abilities of your students and the allowable time. Consider collaborating with another teacher on this cross-curricular project.
- **See suggested timeline below.**

Lesson or Stage	**Suggested Time** (based on 45 minute period)	**Notes**
Video 1, Lesson 1	1 class	
Video 2, Lesson 2	1 class	
Video 3, Lesson 3	1 class	
Video 4, Lesson 4	1 class	Present activity from lesson 3 before starting lesson 4
Video 5, Lesson 5	1 class	
Video 6, Stage 1 (Ask), Stage 2 (Imagine)	1 class	
Stage 3 (Plan)	1 class	If time is limited, can combine with stages 1 & 2
Stage 4 (Create)	1-3 classes	
Stage 5 (Test)	.5-1 class	Complete stage 5 at the tail end of last stage 4 (Create) class
Stage 6 (Improve	1 class	If improvements require more than 1 class period, teachers may extend the project for an additional class or have students work at home.

- In groups of two or three, students use the engineering cycle to complete the Sound Studio Challenge.
- Submit videos and pictures of completed sound art projects to The Sheldon for display in an online gallery.
- Participate in survey to provide feedback for Sheldon Sound Studio.

Collaboration
The focus of Sheldon Sound Studio is on art, science, engineering, and technology, but additional connections can easily be made to math, music, and language arts. Because of the cross-curricular aspect of the program, collaboration between teachers of different subject areas is encouraged.

The Lessons & Activities
There are six lessons which accompany each video. Within each lesson, you will find learning objectives, an overview of the video content, definitions, and directions for lesson implementation. Also included in the lessons are a core activity and optional extension activities. Each core activity is integral in preparing students for the Sound Studio Challenge. Additional activities may be selected based on each teacher's timeline and area of focus.

Student Worksheets
Student worksheets are provided for each of the six lessons and are found in the student packet. During lessons 1-5 students will collect data, make observations, and draw conclusions from the activities and record in the worksheets. The worksheet for video six will guide students through the Sound Studio Challenge with prompts that follow each stage of the engineering cycle. Students are encouraged to reference their worksheets from previous lessons to guide their sound art design process.

Contact Microphone Component
Sheldon Sound Studio challenges students to incorporate a contact microphone into their sound art. Each class will be provided with fifteen contact microphones – once for each student group. The contact microphone will come fully assembled and will only need to be connected to a guitar cable (provided in Sound Studio kit) and plugged into an amplifier (provided in Sound Studio kit). If additional contact microphones are needed for your class, your school will be responsible for purchasing them. You will find a link to the contact microphone supplies in the *Internet Resources* (page 10).

Teachers who would like to give their students an extra challenge may elect to have their classroom construct the contact microphone from scratch using the video tutorial and written guidelines (See Support Materials for Lesson 7). This process will entail soldering wires together and will give the opportunity for students to learn more about electronics and circuitry. Teachers who choose this option will be responsible for purchasing the needed materials, found on the *Internet Resources* page.

Terms of Use
The Sheldon Sound Studio videos and lesson packet are intended to be used only by schools that are registered participants. Teachers may make copies as needed for their own classroom instruction.

You may not
… claim it as your own.
… share it with others outside of your school.
… sell this packet, any of its contents, or anything that is based on this lesson.
… post any part of this lesson online.

SOUND ART MATERIALS

Sound Studio Kit

- 15 contact microphones (components consist of piezo disc (transducer), speaker wire cable, and cable jack)
- One guitar cable
- One amplifier

Construction Materials

Recycled and repurposed materials for student sound art will need to be collected by each classroom. These items will serve as vibrating and resonating materials to produce sound. Recycled materials may be gathered throughout the project by teachers and students. Once the challenge statement has been introduced after videos 1-5, students may start thinking about the kind of sound art they would like to produce and bring to class specific items to use. Teachers should give instructions about how and when materials should be gathered after considering how much flexibility is appropriate for their students.

Recycled/repurposed materials list:

Cardboard	**paper towel/toilet paper tubes, pringle cans, shoe boxes, containers for different sizes, etc.**
Plastic	**PVC pipe, bowls, cups, bottles, straws, tubes, hoses, food and condiment containers, funnels, etc.**
Metal	**cans, short sections of pipe, pie tins, pans, utensils, screws etc.**
Wood	**blocks, broom sticks, wooden dowel rods, cigar boxes, etc.**
Other	**rubber bands, string, fishing line, wire, beads, beans, corn, rice, etc.**
Decorative	**yarn, feathers, glitter, stickers, markers, paint, tape of different colors, etc.**

The list of possible materials is much more extensive than what is seen above. Students are encouraged to think creatively about what they could use as a vibrating or resonating material from home.

Note on safety: Be conscious that materials are clean and have no sharp edges. Avoid materials and containers which may have been used for medications or products which can cause allergic reactions in some students (nuts/peanuts, latex, gluten, milk, and the like). This is especially important if you allow students to provide their own materials from home or other sources.

TOOLS

Classrooms will need tools for measuring, cutting, and securing the components of students' sound art. As you review the Sound Studio Challenge and make decisions about how you will implement it, plan what tools might be needed for students to build and assemble their creations.

They might include:

ruler	**masking tape**	**scissors**	**box cutter**
markers/pencils/pens	**duct tape**	**drill**	**hand saw**
graph paper	**glue gun**	**hole punch**	

Note on safety: Consider students' ages and skill levels and allow them to only use appropriate tools.Some tools and construction activities may require close supervision

SAFETY GUIDANCE

The *Sound Studio Challenge* activities should take place in an appropriate space to ensure safe conditions for students to design and build their sound art projects. This may or may not be your regular classroom.

Before beginning the *Sound Studio Challenge*, review your school/district safety procedures and inform students about classroom safety and expectations. Employ active supervision while students build their sound art.

Additional precautions should be taken for classrooms who participate in the contact microphone build. See Support Materials for Lesson 7 for more information.

SHELDON SOUND STUDIO CLASSROOM CHALLENGE

The content of the *Sheldon Sound Studio* video series and instructional materials is guided by a single purpose – the *Sound Studio Challenge*. This challenge will engage students in creative thinking and experimentation for the purpose of creating their own sound art. It will also provide you and your students with an assessment tool throughout the design process.

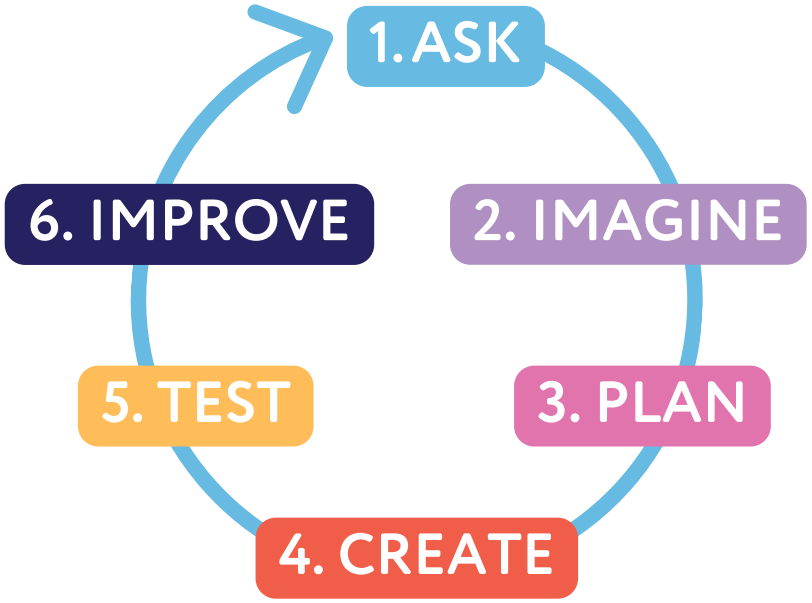
Sound Studio Challenge Statement

Design and create a sound art project. It must:

- include a vibration source and a resonator
- incorporate the use a contact microphone
- be made from recycled or repurposed materials
- be able to make at least two different timbres
- convey an emotion or idea

STEAM ENGINEERING CYCLE

The *engineering cycle* is a design process made up of a series of steps or stages that engineers follow to develop a solution to a problem. In Sheldon Sound Studio students use a 6-stage process.



What Takes Place in Each Stage?

ASK	What is the problem? What have others done to solve this problem? What are the requirements and constraints for the problem?
IMAGINE	Brainstorm possible ideas. Consider several solutions. Choose the best ideas.
PLAN	Develop a plan. Draw a design. List the materials needed. Describe how it will work.
CREATE	Build a model or a prototype based on the design and using the available materials.
TEST	Test the model. Evaluate the results based on the challenge statement. Determine how well it functions.
IMPROVE	Redesign the model to improve how it functions, feels, and looks.

VOCABULARY & DEFINITIONS

This section includes vocabulary and definitions of important terms that appear in Videos 1 -6. They are listed in the same order as they appear in each of the videos.

VIDEO 1 - WHAT IS SOUND?

sound – vibrations that travel through the air or another medium and can be heard when they reach a person's ear
Haptic suit – a wearable device with many receiver points that transfer sound into sensations you can feel, like a cell phone on "vibrate" allows a person to feel the phone is "ringing"
vibration – a rapid back and forth motion of material or an object that can be felt when touched and also produces a sound wave that be heard
noise – unorganized sound (irregular or nonmelodic), especially one that is loud or unpleasant or causes disturbance
music - organized sounds (rhythmic and melodic) combined in such a way as to produce beauty of form, harmony, and expression of emotion
art - the expression or application of human creative skill and imagination
sound art – a form of contemporary art that uses sound as a channel for creative expression

VIDEO 2 - MECHANICS OF SOUND

compression wave – the vibration of high and low pressure moving through air, water, or a solid material and traveling in the same direction as the wave
sound wave – the transfer of energy vibrations or pressure that travel through air or other material that can be heard by the ear with unique frequency and amplitude
compression – a high pressure area in a compression wave
rarefaction – a low pressure area in a compression wave
ear – a compression wave detector made up of the outer ear that collects sound, the middle ear that amplifies and clarifies it, and inner ear that sends sound information to the brain
tympanic membrane – also called the "eardrum", it separates the outer ear and middle ear and tympanic membrane – also called the "eardrum", it separates the outer ear and middle ear and vibrates when sound waves reach it before passing the vibrations to the ossicles
ossicles – the small, connected bones inside the middle ear that transmit sound signals from the tympanic membrane to the cochlea
auditory nerve – the part of the inner ear that sends an electrical message to the brain
frequency – the number of times a vibration occurs every second and the frequency of vibration determines the pitch of a sound
amplitude – the strength or intensity of a vibration which determines the volume of a sound
timbre – the unique characteristic or quality of a sound
oscilloscope – an electronic machine that graphically displays on a screen varying electrical voltages in the form of waves

VIDEO 3 - LANGUAGE OF SOUND

foley – the reproduction and recording of everyday sound effects that are added to films, radio broadcast, and other media
foley artist – a person who creates sound effects using a variety of objects and materials, usually for movies or radio broadcasts

VIDEO 4 - ACOUSTICS & DESIGN

acoustics – the properties or qualities of a room, building or instrument that determine how sound is transmitted in it
reflection – when energy, like a sound wave, hits and bounces off a material without any energy being lost
transmission – when energy, like a sound wave, moves through a material without any energy being lost
absorption – when energy, like a sound wave, hits a material and is transferred to that material, instead of passing through it
instrument - a container for sound that includes a vibration source and a resonator
Newton's cradle – a device used to demonstrate Newton's 3rd Law of Motion which state that for every action there is an equal and opposite reaction
vibration source – the part of an instruments that generates the sound
resonance – when a vibration is amplified by another part, system, or device
resonator – the body of an instrument that aids the application of sound
voltage – the electrical potential between two points – the greater the voltage the greater the current flow will be through that point

VIDEO 5 - TALKING WITH A NOISE ARTIST

microphone – an instrument for converting sound waves into electrical energy variations which may then be amplified, transmitted, or recorded
diaphragm – a thin flexible surface or disc that vibrates when wave pressure is applied to it
transducer – an electronic device that converts energy from one form to another and in a microphone, a transducer converts physical sound waves to electrical signals
contact mic – a type of microphone that senses sound vibrations through contact with solid objects and consists of a crystal (piezo) disc that converts vibration to an electric charge, wire that transfers the electric charge, and a jack or plug that is inserted into an amplifier

VIDEO 6 - SOUND ART PROJECT

STEAM engineering cycle – a series of steps that engineers and designer follow to plan, build, test, and improve an object, process, or system
STEAM – a creative and problem-solving approach that involves Science, Technology, Engineering, the Arts, and Mathematics
engineering – a system or method for designing objects, processes, and systems to meet human needs and wants

INTERNET RESOURCES

MATERIALS PROVIDED IN KIT:

Fully-assembled contact microphone
10-foot guitar cable
Miniature amplifier

PARTS FOR CONTACT MIC BUILD

Piezo disks (15 pc)
Audio plugs (10 pc)
16-guage speaker wire (100 ft)
Soldering iron kit
Helping hands & magnifying glass
Soldering flux
Wire stripper
Wire cutter
Small desk fan

SOUND ART EXAMPLES

Cymbalum DIY - Youtube
Field of Flowers - sound sculpture - YouTube
J.S. Bach "Air" on crystal harp by Pavel Chizhik - YouTube
“The Singing Ringing Tree” by Mike Tonkin & Anna Liu
Wooden String Instrument "Le Koto" - YouTube
"The Magic of Sound" by Zimoun - YouTube

Noise Box Example 1
Noise Box Example 2
Noise Box Example 3
Noise Box Example 4
Noise Box Example 5
Noise Box Example 6

ON-LINE OSCILLOSCOPE

Option 1
Use with Google Chrome or Microsoft Edge. Click on "toggle mic input" and allow mic access to activate live input.

Option 2
Best used with Google Chrome. Allow mic access to activate live input.

FURTHER CLASSROOM LEARNING

Recycled materials used in music video

- OK Go - Needing/Getting - Official Video - YouTube

Sound Foley

- The Magic of Making Sound - Bing video
- FOLEY: How Hollywood Sounds Effects Are ACTUALLY Made! I Filmora Workshop Series Ep. 1 - Bing video
- Foley artist shows how sounds effects are made - Bing video
- How To Make Your Own Foley Sound Effects with Peter Burgis (Interactive On Web Browser Only) - Bing video

Science of Sound

- Sound: Crash Course Physics #18 - YouTube

Synthesizer Basics

- Synthesizer Basics: Amplitude, Oscillators, Timbre I Music Production I Berklee Online -YouTube

Acoustics Series

- Architectural Acoustics 1 of 4: Sound and Building Materials - YouTube
- Architectural Acoustics 2 of 4: Sound Absorption Coefficient and Noise Reduction Coefficient - YouTube
- Architectural Acoustics 3 of 4: Ray Tracing and Sound Reflections - YouTube
- Architectural Acoustics 4 of 4: Sound Moving In a Room - YouTube

SOUND ALPHABET

A – clap

B – stomp with one foot

C – snap with one hand

D – crow like a rooster

E – slap knee

F – tap pencil on desk

G – drop pencil on floor

H – tap one finger on window

I – rub finger on desk

J – make a "bzzz" sound

K – pop air filled cheeks

L – rub hands together

M – grunt like you've been punched in the stomach

N – say "good morning" in a high pitch

O – say "good morning" in a low pitch

P – knock on wood (door or desk)

Q – knock on glass (window)

R – squeak chair on floor

S – close a book

T – crunch a plastic water bottle

U – unzip a hoodie or backpack

V – close a door

W – Flip pages of a notebook

X – shake a container of paper clips (or choose alternative shaker)

Y – run a pencil on the binding of a spiral notebook

Z – open and close scissors

The Sheldon Sound Studio Project
Missouri Learning Standards Correlation

Below are the Math, Science, and Art Missouri Learning Standards for grades 6-8. In addition to these, elements of the Sheldon Sound Studio project also relate to components of standards in Fine Arts (media arts and music technology), Computer Science (devices and hardware), and English Language Arts (vocabulary, writing, speaking, and listening).

COMPONENT	MATH & SCIENCE	ART
Part 1: Setting the Stage Overview: Provide students with background knowledge relating to sound art, production of sound, and communication through sound.	6-8.PS4.A.1 Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. 6-8.PS4.A.2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. 9-12.PS4.A.1 Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. 6-8.PS3A.3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. 6-8.PS3.B.1 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.	

COMPONENT	MATH & SCIENCE	ART
Part 2: The Engineering Cycle Overview: Students will be challenged to follow the engineering cycle as they design, construct, and test their sound art.	6-8.ETS1.A.1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. 6-8.ETS1.B1 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. 6-8.ETS1.B.3 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	VA:Cr2A.3 Create personally satisfying artwork using a variety of artistic processes and materials. VA:Cr1A.6 Combine concepts collaboratively to generate innovative ideas for creating art. VA:Cr1A.7 Apply methods to overcome creative blocks. VA:Cr1A.I Use multiple approaches to begin creative endeavors. VA:Cr2A.6 Demonstrate openness in trying new ideas, materials, methods, and approaches in making works of art and design. VA:Cr2A.8 Demonstrate willingness to experiment, innovate, and take risks to pursue ideas, forms, and meanings that emerge in the process or art-making or designing. VA:Cr2A.I Engage in making a work of art or design without having preconceived plan. VA:Cr2A.III Experiment, plan, and make multiple works of art and design that explore a personally meaningful theme, idea, or concept. VA:Cr3A.6 Reflect on whether personal artwork conveys the intended meaning and revise accordingly. VA:Cr3A.7 Reflect on and explain important information about personal artwork in an artist statement or another format. VA:Cr3A.8 Apply relevant criteria to examine, reflect on, and plan revisions for a work of art or design in progress.
Part 3: Present Overview: Students should prepare to present their sound art to their peers.		VA:Pr4A.7 Compare and contrast how technologies have changed the way artwork is preserved, presented and experienced. VA:Pr4A.8 Develop and apply criteria for evaluating a collection of artwork for presentation. VA:Pr4A.I Analyze, select, and curate artifacts and/or artworks for presentation and preservation. VA:Pr4A.II Analyze, select, and critique personal artwork for a collection or portfolio presentation.