



THE
SHELDON
Arts Without Borders

The Sheldon SOLID Project **(SCIENCE OF LEARNING** **INSTRUMENT DESIGN)**

Introduction Packet

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PROJECT OVERVIEW

The Sheldon *SOLID (Science of Learning Instrument Design)* Project challenges students to design and construct a musical instrument from recycled materials. This project uses the STEAM approach, which connects science, technology, engineering, arts, and math. Students will work individually or in groups to follow the Engineering Cycle to create their own unique instrument. The program culminates with a public instrument display at The Sheldon each spring. All schools are invited to submit instruments to participate in this event.

This packet is intended to support teachers in planning, scheduling, and executing The Sheldon SOLID project successfully.

SOLID is aligned to Missouri State Standards in science, music, and art. See page 15 in the Instructional Plan.

THE SOLID CHALLENGE

Design and construct a unique musical instrument.

It must...

Create sound through vibration

*Be a membranophone, idiophone, chordophone, or aerophone

*Be able to change pitch (frequency)

*Be able to change dynamic (amplitude)

Be made from recycled or repurposed materials

Be well-constructed and functional

Demonstrate artistry and creativity

Be an invention OR an innovation, but NOT a copy

*Omit or simplify for prek-2nd grade

PROCESS AND TIMELINE

The Sheldon SOLID Project is intended to be completed over 8-12 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 professional development offered in person at the beginning of each semester.
- Register for SOLID to receive curriculum and have presenters scheduled for your classroom.
- Saint Louis Science Center visits classroom to teach the science of sound.
- Sheldon teaching artist visits classroom to teach on instrument classification & design and introduce the SOLID Challenge Statement.
- Students use the engineering cycle to complete the SOLID Challenge. Determine if students will work in groups or individually. If using the group model, assign roles for each member of a group to keep students focused, productive, and on-task.
- Submit videos and pictures of instruments to be featured in spring Sheldon display.
- Complete survey to provide feedback.

Activity	Suggested Time based on a 45-minute class period	Notes
St. Louis Science Center presentation	45 minutes (30 minutes for pre-K-2nd grade)	Schedule through The Sheldon. Led by Saint Louis Science Center educator.
Sheldon presentation	45 minutes (30 minutes for pre-k-2nd grade)	Schedule through The Sheldon. Led by Sheldon educator.
World Music Lesson (optional)	.5-1 class period	This lesson and all future lessons led by teacher with Sheldon provided resources.

Activity	Suggested Time based on a 45-minute class period	Notes
Stage 1 – Ask & Stage 2 – Imagine	.5-1 class period	These two stages can occur in the same or separate class periods.
Stage 3 – Plan	.5-1 class period	Scheduling this stage as a separate class period is recommended.
Stage 4 – Create	2-5 class periods	Begin this stage after students have had time to complete and review their plans
Stage 5 – Test	.5-1 class period	Students may test their instruments during the create stage, but a separate time to test, evaluate, and plan for future changes is recommended.
Stage 6 – Improve	1 class period	If improvements require more time to complete, consider adding another class or having students finish at home.
Present	1 class period or more as needed	Students will present their instruments to the class. Take video/pictures to submit to The Sheldon for display.

ENGINEERING CYCLE

SOLID uses the engineering cycle as the structure of the project. It consists of six stages that students will follow to develop a solution to a problem.

ASK

What is the challenge?
What have others done to solve the challenge?
What are the requirements and constraints of the challenge?

IMAGINE

Brainstorm possible ideas to solve the challenge.
Consider several solutions.
Choose one idea.

PLAN

Develop a plan.
Draw a design.
List the materials needed.
Describe how it will work.

CREATE

Construct the object detailed in the plan .

TEST

Test the object.
Evaluate the results based on the challenge statement.
Determine what improvements need to be made.

IMPROVE

Edit the plan to include the necessary improvements.
Make changes one at a time to improve how the object functions, feels, or looks.
Repeat steps 3-5 until all changes have been made.

EDUCATIONAL COMPONENTS

SOLID touches many subject areas, but is built on three main components: science, music, and art. Each one of these subject areas is integral to the project and will be reinforced through the curriculum and student packet.



Science

The science of sound lays the foundation for the project. “Sound is vibration” is the primary teaching point that must be understood in order to complete The SOLID Challenge successfully. Additionally, students learn how sound travels as a compression wave, the properties of a sound wave (frequency and amplitude), and how a sound’s frequency and amplitude can be changed. In addition to the classroom visit from the Saint Louis Science Center, the student packet contains a reference sheet with a summary of the science of sound.



World Music

The Challenge Statement asks students to create a musical instrument that can be categorized in one of four main World Music categories: membranophone, chordophone, idiophone, or aerophone. This method of classification is used in SOLID due to its direct tie to the science of sound. Each category produces sound through a different means of vibration.

This study of the science of musical instruments and their World Music classifications is organology. It includes the historical cultural study of musical instruments, how they were used in different cultures, and the technical aspects of how instruments produce sound.

The Sheldon teaching artist will teach the World Music classification system, emphasizing the different methods of vibration in each category. For further study, classrooms may utilize Dr. Aurelia Hartenberger’s website to view instruments from each category.



Art

Ultimately, SOLID is an art project. Students are challenged to design and create something with the potential to be on public display at The Sheldon. They are encouraged to use their creativity throughout the project.

The Engineering Cycle, employed through SOLID, is a design process not exclusive to engineers. Artists use a similar process to plan, create, test, and improve their work. This cycle teaches students how to think in a creative yet systematic way.

Several artistic elements may be implemented in SOLID, including decoration, construction, and use of materials.

Decoration may include paint, tissue paper, construction paper, or beads and other accessories.

Some instruments are simple decoratively but are constructed with interesting and unusual materials. Past examples include a garden hose, a hubcap, cow jawbone, bicycle wheel, license plate, etc. These materials, whether functional or only visual, display creative design and artistry.

Construction is also very important. If the instrument does not hold together as intended, the artist's expression will be lost.

Instruments that are intentionally designed, colorful, creative in use of material, and well-constructed are most likely to be selected for display at The Sheldon.