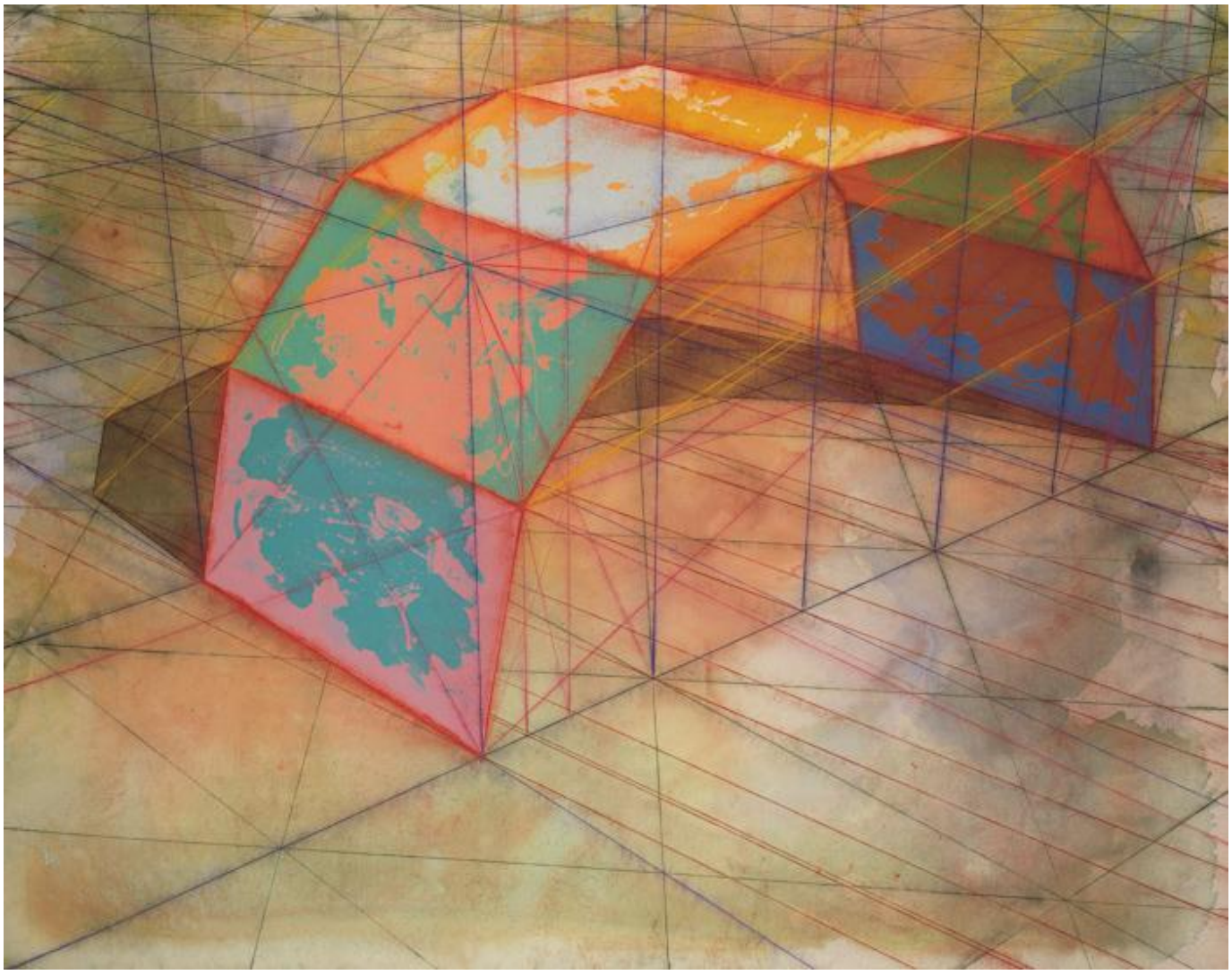
SAN JOSE MUSEUM OF ART



SOWING CREATIVITY S.T.E.A.M. PROGRAM

Math and Art Curriculum

SHOW YOUR WORK

Teacher Packet

SAN JOSE MUSEUM OF ART

The San Jose Museum of Art celebrates new ideas, stimulates creativity, and inspires connection with every visit. Welcoming and thought-provoking, the Museum rejects stuffiness and delights visitors with its surprising and playful perspective on art and the artists of our time. The San Jose Museum of Art is the largest provider of arts education in Santa Clara County. The quality of its exhibitions, the extent of its educational programs, the expertise of its staff, and the depth of its ties in the local arts community uniquely qualify the museum to deliver the ambitious Sowing Creativity program.

www.sanjosemuseumofart.org

See what you think

This project was made possible in part by the Institute of Museum and Library Services (IMLS grant# MA-10-15-0497-15).

Sowing Creativity is supported by generous funding from the Leo M. Shortino Family Foundation, Koret Foundation, Daphne and Stuart Wells, KPMG LLP, The Audrey and Sydney Irmas Charitable Foundation, the Boydston Foundation, Wells Fargo, Farrington Historical Society, Ian Reinhard, Avi Stachenfeld, Technology Credit Union, and Xilinx.

This activity is supported in part by the California Arts Council (CAC), a state agency.

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Teachers,

This packet is intended to familiarize you with Sowing Creativity so you can make the most out of the program for you and your students. In addition to basic information, the packet includes a letter to parents that can be printed and distributed directly, or adapted to fit into your own parent newsletter. It also includes a detailed curriculum outline so you can plan ahead and connect the sessions to your classroom content. Lastly, it offers a number of resources for related activities before, during, and after the program.

We look forward to working with you!

Education Department, San Jose Museum of Art

To get your students ready:

Prior to the first Sowing Creativity session, students will benefit from the review of a few general guidelines:

- **Follow the instructions of the teaching artist carefully.**
- **Be respectful to others.**
  SJMA's Teaching Artists strive to create a safe learning environment where discussions promote the practice of respectful, democratic, and collaborative problem solving among students.
- **Be respectful of art materials.**

SJMA Teaching Artists will be bringing in a variety of art materials. Although they are all AP certified non-toxic, some materials might stain clothes or other surfaces. We will make sure to bring in table coverings for particularly messy lessons.

- **Participate in all discussions and art making projects.**

  The Museum's approach to teaching draws on museum and education-based research, which shows that children learn best when they are encouraged to develop their own ideas, experience art through multiple senses, and actively participate in group settings.

To get your classrooms ready:

Thank you for inviting us into your classroom**!** SJMA's Teaching Artists will make every effort to maintain a neat and orderly classroom environment while delivering the Sowing Creativity program. We are sensitive to and respectful of the patterns and practices you have already set up, so please do not hesitate to share your classroom management strategies. There are a few things that you and your students can do prior to each session that will help us deliver a more successful program:

- **Students should be seated at clear desks, ready to begin at start time of session.**
- **Space should be cleared for wet artwork to dry.**
- **Stored projects should be available when class begins.**

SOWING CREATIVITY

Sowing Creativity is an integrated visual arts residency program developed by the San Jose Museum of Art to address the new California Common Core State Standards and to meet the urgent need to promote creativity across disciplines. The premise behind the program is that well-honed visual thinking abilities contribute powerfully to the teaching and learning of specific cross-disciplinary concepts. Sowing Creativity brings elementary school classroom teachers together with teaching artists from SJMA and science instructors from the Youth Science Institute (YSI) to promote student creativity and success.

MATH + ART CURRICULUM

"Making student thinking visible"

Timed to precede the formal introduction of fractions in the fourth-grade curriculum "Show Your Work" will similarly use hands-on visual art exercises to build student understanding of key mathematical concepts like scale, proportion, and symmetry, in the service of preparing them to master the critical concept of fractions. This "turning point" concept—often dreaded by students--is considered essential for eventual success in algebra and general college readiness. [1] To promote student success in this area, Sowing Creativity lessons use the natural enthusiasm students show for art class to introduce key mathematical concepts and to help build what Stanford professor Jo Boaler calls "a positive math mindset."

EDUCATIONAL FRAMEWORKS & STANDARDS

Sowing Creativity is rooted in a number of educational frameworks. Following the national shift to **Common Core** standards, the program promotes an integrated approach to big-picture questions at the intersection of science and art. The curriculum aligns itself with the **California Visual Arts Standards** and the newly implemented **Next Generation Science Standards**. It is informed by the research-based initiative to add the arts into the nationally dominant science, technology, engineering, and math (STEM) curriculum. The shift from STEM to **STEAM** fosters true innovation founded in the belief that, by developing students' abilities to use knowledge across contexts, the arts can play a vital role in promoting the four C's of the **Partnership for 21st Century Learning** skills**:** creativity, critical thinking, collaboration, and communication. The program has also adopted the **Studio Habits of Mind** framework for teaching and learning in the visual arts as developed by the Harvard Graduate School of Education's Project Zero.

[1] Sue Shellenbarger, "New Approaches to Teaching Fractions," *The Wall Street Journal*, 24 September 2013.<< https://www.wsj.com/articles/new-approaches-to-teaching-fractions-1380064772?tesla=y>>

PROGRAM DELIVERABLES

- **Pre-program meeting**

A required meeting with participating classroom teachers, the principal, and SJMA educators is held at each school before beginning the Sowing Creativity program. These meetings are a platform to collaborate, communicate, and work out any necessary logistics.

- **Nine hands-on artmaking sessions in the classroom**

SJMA teaching artists lead a weekly, hour-long artmaking session in each participating classroom. Over the course of eight weeks, students will complete up to four projects and participate in a range of processes that may include drawing, painting, printmaking, photography, and sculpture. All art materials, including a sketchbook/scientific journal for every student, are provided with the program.

- **A field trip to the San Jose Museum of Art**

The Two-Part Art field trip to the museum encourages students to experience art as both viewers and makers. Each student participates in a one-hour, inquiry-based tour of selected artworks that relate to their classroom art and science lessons, followed or preceded by a corresponding one-hour hands-on art workshop.

- **Teachers' packet**

An informational packet is offered to all participating teachers in an effort to help develop classroom connections to the Sowing Creativity program. The teacher resource guides offer optional pre- and post- program activities as well as grade-appropriate suggestions for related books, videos, websites, and other local resources.

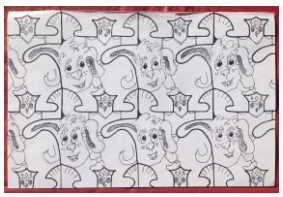
- **Teacher membership to museum**

Each participating classroom teacher and school principal receives a one-year Individual Membership to the San Jose Museum of Art. Benefits of the membership include free admission card for yourself and one guest, invitations to exhibition receptions and members-only events, discounted tickets for programs and lectures, SJMA e-News subscription and e-updates, and 10% discount in the SJMA Store and Café Too!

- **Post-program assessment**

In addition to formative and summative student assessments throughout the program, participating teachers will be directed to an online survey to provide feedback at the end of the Sowing Creativity. Each school also has the option to schedule a post-program meeting to discuss the successes of the program along with potential areas of improvement for the following year.

PROJECT	 *JOURNALS - CLASS QUILT*	 *DATA CITY SCAPE*	 ***SCALE UP***
SESSION, TIME	***Session 1, 1 hour***	***Session 2 & 3, 2 hours***	***Session 4 and 5, 2 hours***
PROBLEM/ ACTIVITY STATEMENT	*Students will learn about one another and how to represent their friends symbolically. They will also learn about fractions and how fractions can help them to work collaboratively with one another.*	*Students will learn about bar graphs and various ways to create visual representations of data. Students will practice gathering data, learning different ways to represent that data, and create ways to interpret that data.*	*Students Create a clay animal using the grid method to enlarge and transfer a small image or outline of a shape. In these projects, students will learn to use mathematical concepts, such as scale, in their artistic practice.*
GOALS	*Students will:* *Learn about shapes and geometry. Make observations of their classmates and experiment with symbolic representation. Use tools, such as sketchbooks and oil pastels.*	*Students will:* *Learn about data collection and representation. Make observations of their classmates and use unexpected mediums to create art. Use art and math tools, such as sketchbooks, graph paper, and paint chips.*	*Students will:* *Observe and learn the grid method. Envision and scale up small drawings into a different medium. Develop craft using tools and techniques that artists use in their professional practice.*
CROSS-DISCIPLINARY CONNECTIONS	*Language Arts, Communication, Mathematics*	*Communication, Mathematics, Psychology*	*Language Arts, Communication, Mathematics*
PROCESSES	*Sketching, drawing, 2D art*	*Collaborating, Sketching, Drawing, 2D art*	*Sketching, Drawing, Sculpting, Scaling*
SKILLS	*Understanding and using symbolic representations. Students will also collaborate to create new art work.*	*This lesson demonstrates the representation of data through recognizable symbols. In this lesson students will learn to translate data gathered as a class into an aesthetic final work.*	*Developing an understanding of scale. Translating 2D images into a 2D final project.*
CONCEPTS	*Sketchbook, journaling.*	*Patterns, Data, Perspective, Gradient. Graphing*	*Scale, Ratio, Sculpture, Grid*
STUDIO HABITS OF MIND	*Develop Craft, Observe, Stretch and Explore*	*Develop Craft, Envision, Express, Reflect, Stretch & Explore*	*Stretch and Explore, Observe, Reflect*
NGSS SCIENCE & ENGINEERING PRACTICES	*Asking questions, Carrying out investigations, Obtaining, Evaluating, and Communicating Information*	*Analyzing and Interpreting Data; Obtaining, Evaluating, and Communicating Information*	*Asking questions, Carrying out investigations, Obtaining, evaluating, and communicating information*

			
SJMA FIELD TRIP	***PRINT MAKING MANDALAS***	***TESSELATIONS***	***REFLECTION TIME***
Session 6, 2 hour	***Session 7, 1 hour***	***Sessions 8 & 9, 2 hours***	*Session 10,1 hour*
The Sowing Creativity Two-Part Art field trip includes a one-hour tour of the galleries with a member of the museum's gallery teaching staff. Students share their ideas about the artwork that they see in inquiry-based, open ended group discussions. The second hour consists of a hands-on artmaking activity in which students will explore one point perspective by drawing a self-portrait as a giant.	*Students will learn about how Islamic tiles demonstrate mathematics and art. This activity is focused on creating radial symmetry through printing, using Styrofoam plates and ink. At the end of the lesson student will be able to define radial symmetry.*	*Students create a tessellation using chip board and then trace the tessellating shapes onto drawing paper, repeating their pattern until their shape goes off the edge of all sides of the paper. Next, each student will decide what their shape looks like and will add the necessary details to bring their pattern of shapes to life first using pencil and eraser before later adding ink and color.*	***PROBLEM/ ACTIVITY STATEMENT***
Students will: *Experience art as makers, viewers, and active community members, engage with contemporary art through close looking, critical thinking, and collaborative discussion*	*Students will:* *Use geometric shapes to create a design. Define and understand radial symmetry. Use a plate to properly print a design which demonstrates radial symmetry. Be able to identify ways in which math and art are similar.*	*Students will:* *Create a tessellation by making careful cuts to chip board and taping the cut parts according to instructions; understand the mathematical connections to tessellations and pattern making; explore the process of pattern making and illustration*	***GOALS***
Variable based on current exhibitions and art work visited	*Language Arts, Communication, Social Studies, History, Anthropology, Mathematics*	*Pattern making, illustration, line, color, animation, evolution artwork.*	***CROSS-DISCIPLINARY CONNECTIONS***
Scale, Proportion, Perspective	*Sketching, printmaking, writing*	*Sketching, drawing, tracing, repetition*	***PROCESSES***
Looking closely, critical thinking, collaborative discussion	*Brainstorming, sketching, print making*	*Pattern making, repetition, design thinking*	***SKILLS***
Museum, gallery, translucent, perspective, scale, symmetry, and other terms based on current exhibitions and art work visited	*Symmetry, Radial Symmetry, Print making, Geometric shapes*	*Sketching, drawing, Tracing, Repetition*	***CONCEPTS***
Understand Arts Community, Express, Reflect	*Develop Craft, Engage and persist, Reflect*	*Observe, Understand, Envision, Explore, Develop Craft*	***STUDIO HABITS OF MIND***
Asking questions, Carrying out investigations, Engaging in arguments from evidence	*Carrying out investigations, Asking questions, Constructing explanations*	*Asking questions, Carrying out investigations, Obtaining, evaluating, and communicating information*	***NGSS SCIENCE & ENGINEERING PRACTICES***

SOWING CREATIVITY-- SHOW YOUR WORK: MATH + ART
STEAM Curriculum Alignment Chart

Overview:

Sowing Creativity not only introduces young students to the tools and practices of the visual arts, it provides them with a much-needed vehicle for self-discovery and self-expression. Our goal this year was to connect these life-changing art experiences to the rest of the subjects taught in school. We want our students to think creatively and be expressive all day long!

As the attached analysis clearly shows, we were able to find solid alignments between our seven art experiences and virtually every educational standard the students will encounter: from STEM to English Language Arts. In fact, every project we offer has **six** or more ties to art standards, and **ten** or more ties to science, technology, engineering, math, and language standards. Here are just a few examples:

- ✓ **Science (NGSS):** Ask questions about the world, plan investigations.
- ✓ **Technology (ISTE):** Explore a variety of media and formats.
- ✓ **Engineering (NGSS):** Design solutions, build models.
- ✓ **Common Core Math (CCSS-Math):** Persevere in problem-solving, make use of structure, use repeated reasoning and patterns
- ✓ **Common Core English Language Arts (CCSS-ELA):** Describe ideas, decode academic words, engage in discussions.

The teachers and children who engage in the Sowing Creativity program with us will not only be inspired artistically, they will develop new skills and new insights that will help them across subjects.

SOWING CREATIVITY STEAM CONNECTIONS (rev 6)

SAMPLE: FOAM PRINT MANDALAS

- ✓ Science: Plan and Carry out an investigation, See patterns, Explore cause and effect
- ✓ Technology: Plan strategies, explore alternative solutions
- ✓ Engineering: Draw models, Define problems
- ✓ Math: Model with mathematics, make use of structure, attend to precision
- ✓ Visual Art: Explore ideas in a sketchbook, Compare works of art, create art emphasizing Pattern and repetition
- ✓ Studio Habits: Focus and persevere, observe more closely, learn from mistakes
- ✓ English: Explain ideas, use knowledge of language, define ideas and procedural steps
- ✓ 4C's: Creativity, Communication, Critical Thinking, and Collaboration

COMMON CORE - MATH PRACTICES

The **Common Core State Standards** (CCSS) in Mathematics are built on the best of 1-quality math standards from states across the country. The math standards provide clarity and specificity.

	Class Quilt	Data City	Scale Up	1-pt Giant	Mandala	Tessellations
MATHEMATICAL PRACTICES						
1. Make sense of problems and persevere in solving them.	1	1	1	2	2	1
2. Reason abstractly and quantitatively.		2	2			
3. Construct and critique arguments.		1	1	1		
4. Model with mathematics.	1	1	1	1	1	1
5. Use appropriate tools strategically.	1	1	1	2	2	2
6. Attend to precision.	2	1	1	2	1	1
7. Look for and make use of structure.	1	1	1	1	2	1
8. Use repeated reasoning.	1	1	2	2	2	1

NGSS: SCIENCE AND ENGINEERING

The **Next Generation Science Standards** (NGSS) give educators the flexibility to design learning experiences that stimulate students' interests in science and prepare them for college, careers, and citizenship. Science standards that align well with each Sowing Creativity activity are highlighted below:

Sowing Creativity Alignment to Standard: 2 (strong) 1 (strongest)

	Class Quilt	Data City	Scale Up	1-pt Giant	Mandala	Tessellations
SEP: SCIENCE AND ENGINEERING PRACTICES						
1. Ask questions and define problems	1	1		2	2	1
2. Use drawings and models	1	1	1	1	1	1
3. Plan and carry out investigations	1	1	1	1	1	1
4. Analyze data		1	1			1
5. Use math and computational thinking	1	1	1	2	1	1
6. Construct explanations/design solutions	1	1	2	2	2	2
7. Argue from evidence	1	1	2			
8. Obtain, evaluate, and communicate info.	1	1	1	2		2
DCI: DISCIPLINARY CORE IDEAS						
ETS: Develop and test possible solutions		2	2		2	2
CCC: CROSS-CUTTING CONCEPTS						
1. See patterns	2	1	1	1	1	1
2. Explore cause and effect			1		1	
3. Notices scale, proportion and quantity	2	2	1	1	1	
4. Define systems and system models		1	1		1	1
5. Explore energy and matter						
6. Consider structure and function		1	1		1	1
7. Notice stability and change			1		1	

COMMON CORE - ENGLISH LANGUAGE ARTS

The **Common Core ELA** standards challenge students to read stories and literature, as well as more complex texts that provide facts and background knowledge in areas such as science and social studies. Students will be asked questions that push them to refer back to what they've read. This stresses critical-thinking, problem-solving, and analytical skills.

	Class Quilt	Data City	Scale Up	1-pt Giant	Mandala	Tessellations
RL: Reading: Literature						
Describe characters in a story	1	1		1		
Explain how illustrations contribute to text	1	1		1	1	
RI: Reading: Informational Text						
Ask and answer questions.	1	1	1	1	2	1
Describe science ideas and procedures.	1	2	2	2	1	1
Determine the meaning of academic words.	2	2	1	2	1	2
Use information gained from illustrations.	2	2		2		2
W: Writing						
Provide reasons that support opinions.	2	1	2	1	2	2
Recall information from experiences.	2	2	2	2	2	2
SL: Speaking & Listening						
Engage in collaborative discussions.	2	2	1	1	2	2
Explain ideas.	1	2	2	1	2	2
Tell a story or recount an experience.	2	1	2	2	2	2
L: Language						
Use knowledge of language when writing, speaking, reading, or listening.	1	2	2	2	1	2

VISUAL ARTS

The Visual and Performing Arts (VAPA) standards cultivate essential skills, such as problem solving, creative thinking, effective planning, time management, teamwork, effective communication, and an understanding of technology.

	Class Quilt	Data City	Scale Up	1-pt Giant	Mandala	Tessellations
1.0 ARTISTIC EXPRESSION						
1.2 Use tints and shades.	1	1		1	1	
1.3 Create the illusion of space.		1		1	1	1
1.4 Compare works of art	1	2	2	1	1	2
1.5 Describe works of art.	2	2		1	2	2
2.0 CREATIVE EXPRESSION						
2.1 Explore ideas in a sketchbook.	1	2	1	2	1	1
2.4 Create art based daily life	2	1			1	2
2.6 Create art emphasizing movement	2	1		2		2
3.0 HISTORY AND CULTURE						
3.4 Observe art in a museum				1		
3.5 Research and write about a work of art from your culture	1	2		1	2	2
4.0 CULTURE AND VALUING						
4.1 Use the vocabulary of art	1	2		2		2
5.0 LIFE CONNECTIONS						
5.3 Look at art and predict what might happen next.	2	2		2		1
5.4 Describe how artists (e.g., architects, book illustrators, muralists, industrial designers) have affected people's lives.	2	2		2	1	

STUDIO HABITS OF MIND

Studio Habits of Mind (SHoM) were developed by Project Zero at Harvard's School of Education. Developing these habits will help students be creative, learn, and express themselves in any subject area.

	Class Quilt	Data City	Scale Up	1-pt Giant	Mandala	Tessellations
1. Develop Craft						
Learn to use art tools and conventions.	2	1	1	1	1	1
2. Engage & Persist						
Embrace relevant problems. Focus on problems of personal importance.	1	1	1	1	2	1
3. Envision						
Learn to picture things in your mind. Imagine next steps in making a piece.	1	2	1	1	2	1
4. Express						
Create works that express feelings and ideas	1			1	2	2
5. Observe						
Observe more closely. See things that otherwise might not be seen.	1	1	1	1	2	1
6. Reflect						
Learn to think and talk with others about one's work or process, and learn to judge one's own work and process and the work of others.	1	1	1	1	1	1
7. Stretch & Explore						
Learn from mistakes. Explore playfully.	1	2	1	1	1	1
8. Understand (Arts) Community						
Interact with other artists in the community	2	2		1	2	

21st CENTURY SKILLS (The 4C's)

The "4C's" are were developed by the **Partnership for 21st Century Skills** (P21) and are widely accepted as the skills which all young people need to master to be successful in the future.

	Class Quilt	Data City	Scale Up	1-pt Giant	Mandala	Tessellations
21st CENTURY SKILLS						
CREATVITY	1	2	1	1	1	1
CRITICAL THINKING	2	1	1	1	1	2
COLLABORATION	1	1			1	
COMMUNICATION	1	1	2	1	2	1

BACKGROUND: NGSS SCIENCE AND ENGINEERING PRACTICES

In third grade, students are discovering the "science and engineering practices." Just like artists, scientists notice patterns and use Models to convey their ideas. Approaching the practices from both angles (art and science) will give the students a robust introduction to the vital skills listed below:

1. **Asking questions and defining problems**
   - Predict reasonable outcomes based on patterns.
   - Define a simple design problem.

2. **Modeling**
   - Build and revise simple Models.
   - Use Models to represent events and design solutions.
   - Develop a model using an analogy, example, or abstract representation.
   - Develop a diagram or physical prototype to convey a proposed object, tool, or process.

3. **Planning and carrying out investigations**
   - Make observations and measurements to explain a phenomenon or test a design.
   - Test two different Models of the same proposed object, tool, or process.

4. **Analyzing data**
   - Collect data and conduct multiple trials of qualitative observations.
   - Represent data in tables and graphs to reveal patterns that indicate relationships.
   - Use data to evaluate and refine design solutions.

5. **Mathematical and computational thinking**
   - Organize simple data sets to reveal patterns that suggest relationships.
   - Describe, measure, estimate, and/or graph quantities (e.g., area, volume, weight, time).
   - Use graphs and charts to compare alternative solutions to an engineering problem.

6. **Constructing explanations and designing solutions**
   - Construct an explanation of observed relationships.

7. **Engaging in argument from evidence**
   - Construct and/or support an argument with evidence, data, and/or a model.
   - Use data to evaluate claims about cause and effect.

8. **Obtaining, evaluating, and communicating**
   - Combine information in written text with that contained in tables, diagrams, and charts.
   - Communicate scientific and/or technical information.

BACKGROUND: NGSS DISCIPLINARY CORE IDEAS

The best fit with the NGSS DCI's is in the design area:

ETS.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical Models.
- Testing a solution involves investigating how well it performs under a range of likely conditions.
- Communicate with peers about proposed solutions is an important part of the design process.
- Shared ideas can lead to improved design.
- Tests are often designed to identify failure points or difficulties.
- Different solutions need to be tested to determine which one best solves the problem.

BACKGROUND: NGSS "Nature of Science"

The NGSS focus on helping children understand "the nature of science." This focus is clearly documented in Appendix H:

- Scientists use tools and technologies to make accurate measurements and observations.
- Scientists use drawings, sketches, and Models as a way to communicate ideas.
- Science theories are based on a body of evidence and many tests.

The Sowing Creativity projects provide students with a simple and effective 2ium to:

- Document questions
- Share interests, ideas and feelings
- Collect drawings, designs and sketches
- Plan projects
- Make measurements and record observations
- Communicate insights

As students become more expressive and perceptive artists, they also become more creative and observant scientists.

BACKROUND: NGSS CROSS-CUTTING CONCEPTS

Crosscutting concepts (CCCs) provide students with intellectual bridges that help connect different content areas of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas and develop a coherent and scientifically based view of the world. Sowing Creativity connects to all seven CCC's:

1. **Patterns** exist everywhere. For example, in the symmetry of flowers and snowflakes. In grades 3-5, students identify similarities and differences in order to sort and classify natural objects and designed products. They identify patterns related to time, including simple rates of change and cycles, and to use these patterns to make predictions.

2. **Cause and effect** is often the next step in science, after a discovery of patterns or events that occur together with regularity. Indeed, the process of design is a good place to help students begin to think in terms of cause and effect, because they must understand the underlying causal relationships in order to devise and explain a design that can achieve a specified objective. In grades 3-5, students identify and test causal relationships to explain change.

3. **Scale, proportion and quantity** are important in both science and engineering. An understanding of scale involves not only understanding systems and processes vary in size, time span, and energy, but also different mechanisms operate at different scales. In grades 3-5, students recognize natural objects and observable phenomena exist from the very small to the immensely large. They use standard units to measure and describe physical quantities such as weight, time, temperature, and volume.

4. **Systems and system Models** are useful in science and engineering because the world is complex, so it is helpful to construct a simplified model of it. Models can be valuable in predicting a system's behaviors or in diagnosing problems or failures in its functioning. In grades 3-5, students understand that a system is a group of parts that can carry out functions its individual parts cannot. In Sowing Creativity, students investigate Models of the eye system.

5. **Energy and matter** are essential concepts in all disciplines of science and engineering, often in connection with systems. In grades 3-5, students learn matter is made of particles and energy can be transferred in various ways and between objects. Students observe the conservation of matter by tracking matter flows and cycles before and after processes and recognizing the total weight of substances does not change.

6. **Structure and function** are complementary properties. The functioning of natural and built systems alike depends on the shapes and relationships of certain key parts as well as on the properties of the materials from which they are made. In grades 3-5, students learn different materials have different substructures, which can sometimes be observed; and substructures have shapes and parts that serve functions.

7. **Stability and change** - When looking at a living organism over the course of an hour or a day, it may maintain stability; over longer periods, the organism grows, ages, and eventually dies. In grades 3-5, students measure change in terms of differences over time, and observe that change may occur at different rates. Students learn some systems appear stable, but over long periods of time they will eventually change.

BACKGROUND: NGSS PERFORMANCE EXPECTATIONS

The **Next Generation Science Standards** (NGSS) performance expectations detail what students should learn in their science classes throughout elementary, middle, and high school. They outline the science skills and knowledge students should be able to demonstrate at each grade level, from kindergarten through high school. Expectations increase in complexity at each grade level.

Here are the PE's that most closely align with Sowing Creativity. Note that this list shows Grades 4 and 5 in addition to the target audience (Grade 3).

LIFE SCIENCE

- 3-LS1-1: Develop Models to represent living organisms.
- 3-LS3-1: Plants and animals share similar traits with their parents.
- 4-LS1-2: Observe that energy can be transferred from place to place by light.

EARTH AND SPACE SCIENCE

- 3-ESS2-1: Use data to describe weather conditions and seasons.
- 3-ESS2-1: Describe climates in different regions of the world.
- 5-ESS1-2: Represent patterns showing the changing length and direction of shadows.
- 5-ESS3-1: Describe ways communities use science information to protect the environment.

PHYSICAL SCIENCE

- 3-PS2-1: Show the effect of balanced and unbalanced forces on the motion of an object.
- 3-PS1-2: Show how the current motion of an object can be used to predict future motion.
- 4-PS3-2: Show the effect of balanced and unbalanced forces on the motion of an object.
- 4-PS3-4: Design and test a device that converts energy from one form to another.
- 4-PS4-1: Develop a model of waves to describe patterns.
- 4-PS4-2: Develop a model to describe that light reflecting off an object and entering the eye allows the object to be seen.
- 5-PS1-3: Make observations to identify materials based on their properties.

ENGINEERING DESIGN (All Grades)

- ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- ETS1-2: Generate and compare multiple possible design solutions.
- ETS1-3: Plan and carry out fair tests to improve a model or prototype.
- ETS1-4: Develop a model to generate data