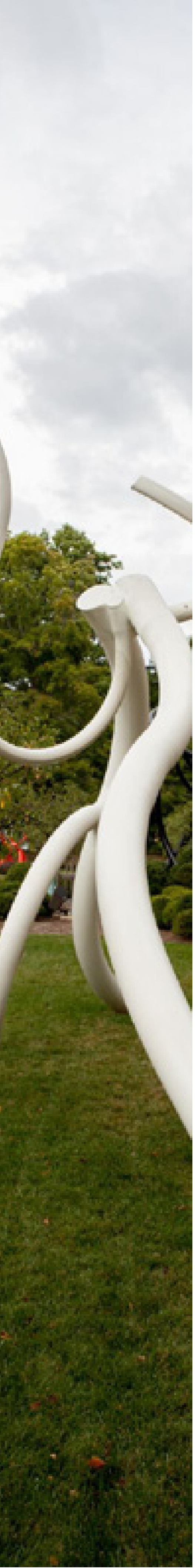


STEAM

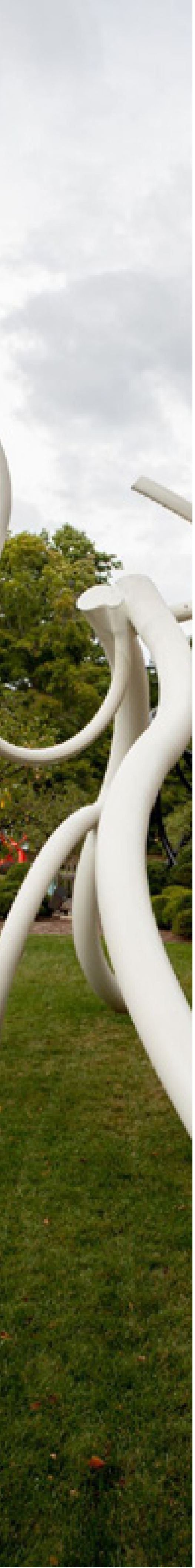
Science, Technology, Engineering, Art, Math

STEVE TOBIN

Steve Tobin working in his studio. Photographs by Kenneth Ek

About the Artist

Quakertown, PA artist Steve Tobin studied mathematics and physics in college. He is internationally known for his sculpture *Trinity Root*, which memorializes the 80-year old sycamore tree that partially protected the St. Paul's Chapel during the September 11th terrorist attacks in NYC. Tobin created many other tree root sculptures which are cast in bronze to look like large **abstract forms**. He also bronze casts giant African termite hills, animal bones, and debris from the earth. His 'Steelroots' series feature more stylistic versions of tree roots engineered from steel. Tobin also uses his knowledge of math and science to create large glass sculptures and ceramic work that are exploded by detonating controlled explosives. Tobin describes his sculptures as "**monuments** to the meeting of science and art." He says the objective of his art is to redirect the viewers attention back to the life of nature.



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STEVE TOBIN
ROMEO AND JULIET

Looking Questions

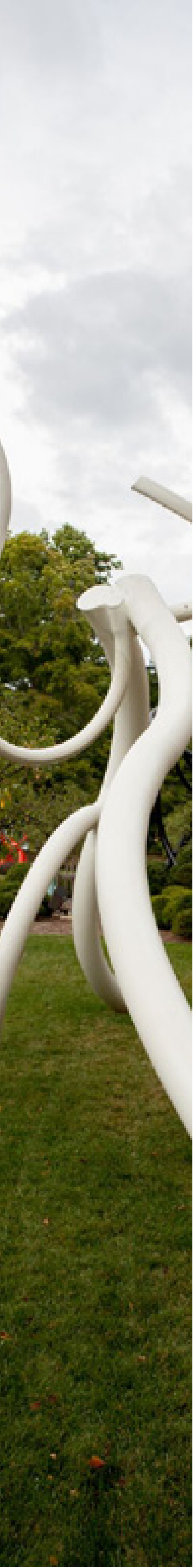
- What do you see?
- Describe this sculpture in terms of **form** and color.
- Have you ever seen anything like this before? Where?
- What material do you think it is made of. Why?
- Why do you think Tobin installed these two sculptures next to each other?
- How does environment effect a sculpture?

Steve Tobin (1957-Present), *Romeo and Juliet*, 2002. Photograph by Kenneth Ek.

- Would you consider this sculpture **realistic** or **abstract**? Explain.
- Why do you think he titled it *Romeo and Juliet*? Can you think of another title for this sculpture? What would you call it and why?

About the Sculpture

This pair of large sculptures are made by casting tree roots in bronze. Tobin excavates the entire root structures and then makes several flexible rubber **molds** that capture the intricate shapes and detail of the roots. He uses the rubber **mold** to make a wax shell that he covers in a heat-resistant ceramic material and fills it with melted bronze. Tobin uses a bright-red **patina** to finish these sculptures. The two sculptures are installed together so that they are almost touching limbs and named after the star-crossed lovers in William Shakespeare's *Romeo and Juliet*.



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STEVE TOBIN
DANCING STEELROOTS

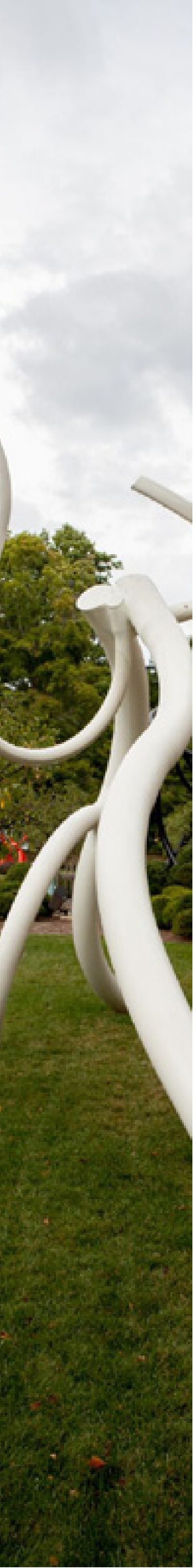
Looking Questions

Steve Tobin (1957-Present), *Dancing Steelroot*, 2002. Photograph by Kenneth Ek.

- What do you see? Describe all of the sculpture's details.
- Does this sculpture remind you of anything?
- How does the artist create movement in his sculpture?
- If you could move like this sculpture, what shape could you create with your body?
- How is this sculpture both similar to and different from *Romeo and Juliet*? Explain your answer.
- This sculpture doesn't have any colors. If you were the artist, would you paint this a different color? If so, how would that change the meaning or feeling of the sculpture?

About the Sculpture

Trinity Root was one of Tobin's last times working in bronze. He now primarily uses steel to create sculptures for his 'Steelroots' series. The Steelroots sculptures like *Dancing Steelroots* are a more **abstracted** linear interpretation of a root system. The limbs of the roots resemble the arms and the legs of a figure outstretched to show movement and fluidity. *Dancing Steelroots* suggests two figures intertwined gracefully as if they were dancing.



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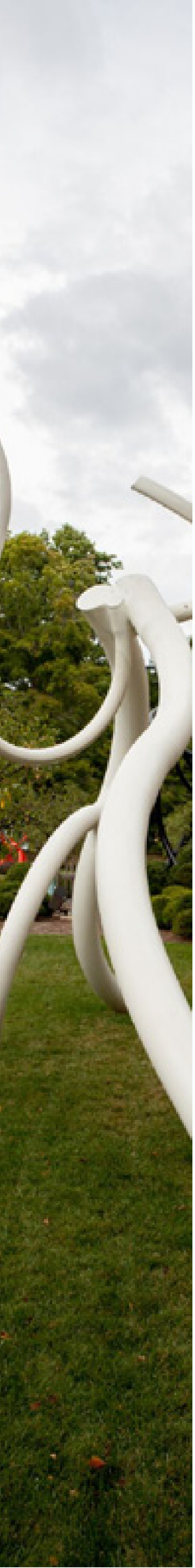
STEVE TOBIN
STEAM ACTIVITIES

- EXPERIMENTING WITH OXIDATION. Look at Tobin's root sculptures and then view Google Art Project's gigapixel photographs to look even closer at the surfaces and **patinas** of other metal sculptures in the Michener's collection. The **patina** is the color and **texture** of metal caused by a chemical reaction. **Patinas** are usually coated with a layer of wax or other sealant to protect from **oxidation**. **Oxidation** is when an **element** looses an electron from exposure to water and oxygen. Choose items made of different types of metals and **alloys** (paper clips, coins, hardware etc.) and put them in little paper cups of water for a week to see what metal rusts (iron oxide) the most. Make predictions. Experiment with different coatings (vaseline, rubber cement, white crayon, paint etc.) and repeat the experiment with the object that rusted the most to see which coating protects from **oxidation** the best.
- ALL ABOUT ALLOYS. Bronze is an **alloy** which is a combination of two metals (copper and tin). Copper and tin are pretty soft by themselves but when they are melted together, they create hard bronze. Distribute samples of metals and alloys for students to observe and describe. Demonstrate the concept of **alloys** by mixing play dough (plasticide) with various amounts of sand. Use a different color play dough for each **mixture**. How does the strength, **ductility**, **malleability** and **brittleness** of the dough change as you add more sand. Make a sculpture using the dough you think is the strongest. Optional: Discuss the **alloys** mathematically in terms of addition, **ratios** and **percentages**.



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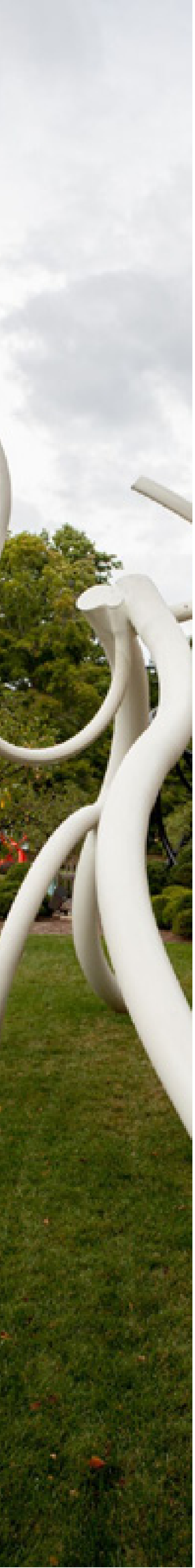
STEVE TOBIN
STEAM ACTIVITIES CONTINUED...

- FORM. What is a **form**? Learn about different **three-dimensional** shapes. How is creating a **three-dimensional** sculpture different than creating something **two-dimensional**? Use CAD technology such as Sketch-Up or Leopoly. Construct a model of the sculpture with clay or play dough so that it is visually interesting from all angles. If the technology is available use 3-D printing to print the models. Discuss the calculations involved with enlarging a model to a full-size sculpture.
- SHADOWS. Look at the **shadows** cast by *Romeo and Juliet* and shadows in different paintings and photographs from the Charles Sheeler exhibit or from the Michener Online Collection Catalogue www.collection.michenerartmuseum.org/mweb/ What are some ways an artists depict **shadows** in their art? Discuss the science behind **shadows** and light. Choose an interesting **three-dimensional form** such as a tree branch. Place the object on a large sheet of paper and trace the **shadow** at several times throughout the day and label with the time. Discuss the position of the sun in the sky. Optional: Visit the Michener and sketch the **shadow** made by *Romeo and Juliet or Dancing Steelroots*. Note the time of day. Compare sketches.
- BOTANICAL ILLUSTRATION. Bronze casting is a great way to replicate and document the details of an organism like a plant or animal so that others can learn about and study that organism. Photography and drawing are other ways to document. Create a very detailed illustration of a plant using colored pencils. Include the scientific name of the plant and label the parts of the plant in a visually interesting way. Optional: Draw an imaginary tree or plant, give it a scientific name, and label its parts.



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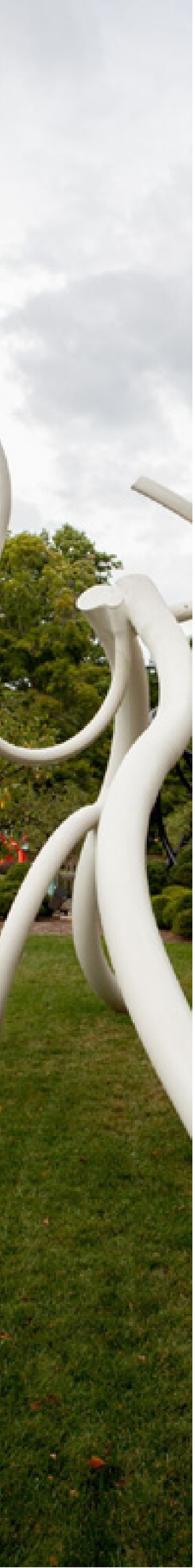
STEVE TOBIN
STEAM ACTIVITIES CONTINUED...

- COLLABORATIVE OUTDOOR SCULPTURE. Tobin works with a team of people to create his large sculptures. Work with a team to design and build a big **three-dimensional** structure using only tree branches and sticks. How will you assign roles and divide the work? Use creative problem solving to build your structure without using any glue or tape. Install sculptures somewhere outside. Observe how the environment and weather effect the sculpture over time.
- SCALE. The grand size of the root sculptures is very important to Tobin. Discuss **scale** and the difference size makes in an artwork or structure. Work in small teams to create a tree structure using leaves and wikki sticks or pipecleaners that is at least one foot high. Use a ruler to measure the sculptures. What challenges did you face as you built it higher? Try making the tallest structure possible. What methods did you use to make it sturdy?
- YARN BOMBING. In 2015 for the Michener's exhibit *Blanket Statements,* Philadelphia artist IshKnits wrapped Tobin's sculpture *Steelroots* in yarn. Learn about **street art** and **yarn bombing**. Work in teams to create a method to figure out a way to approximate the **surface area** of *Steelroots* and estimate how much yarn you would need to wrap the entire sculpture. Try using the **surface area** of a **cylinder** $A=2\pi rh+2\pi r2$ or **cone** $A=\pi r(r+h2+r2)$. Work in small groups to **yarn bomb** an object in or outside of your school. Optional: focus on color schemes (**primary**, **secondary**, **complimentary**, warm/cool, **monochromatic**) or try **weaving**/finger **knitting** some of the pieces. Optional: Post a photo your yarn bombing on Instagram and tag @Ishknits and @michenerart to share.



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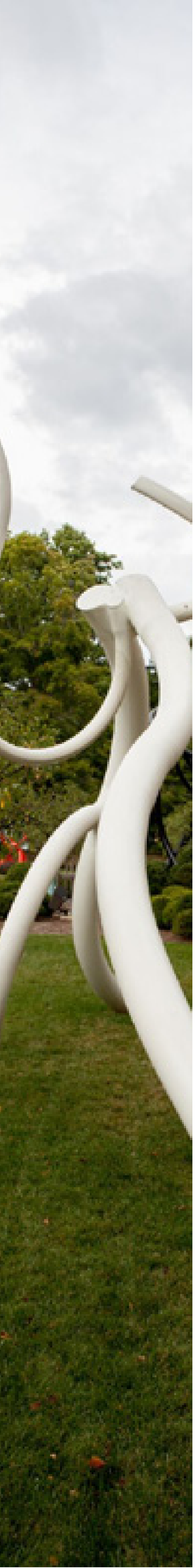
STEVE TOBIN
STEAM ACTIVITIES CONTINUED...

- PROTECTION CHALLENGE: When Tobin exhibited his sculptures at the Michener in 2014, his pieces were transported very carefully. Some were even taken apart and assembled on the Museum's grounds. Tobin's *Trinity Root* sculpture was moved from its site near Ground Zero in NYC to Connecticut without his permission and it was damaged in transit. How would someone move a large sculpture like *Trinity Root* or *Romeo and Juliet* safely? Using a variety of materials, work with a team to design a model of a protective case. Test the protective cases by putting a raw egg or a fragile toothpick sculpture in the case and dropping it from a certain height.
- METAL MANIA. Tobin uses many different kinds of metals in his sculpting. Look at samples of different metals and **alloys**. Make sketches and record observation notes. Research common uses for the metal and discuss its properties. Find the metals on the periodic table of elements. Explore the magnetic properties of the different metals. Work with a partner to build a sculpture held together with magnets and small metal objects.
- MOLD MAKING. Most bronze sculptures start by creating a **mold** of an object (ie. tree roots or clay object) with plaster that is then filled with wax. Discover a creative way to make a **mold** and replica of something from nature such as a branch, seashell, pinecone etc. For younger students: use materials such as masking tape, newspaper and paper mache paste, saran wrap, aluminum foil, rubber cement, play dough or chocolate. For older students: use materials like plaster of Paris, wax, clay, resins, polymers and sand.



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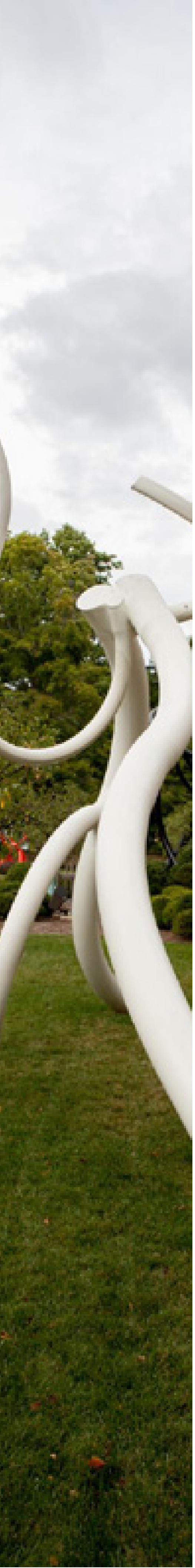
STEVE TOBIN
STEAM ACTIVITIES CONTINUED...

- ENVIRONMENT. Tobin's root sculptures have been installed in many different locations. Discuss how the environment where a sculpture is installed changes the way we feel and think about that sculpture. Use photo-editing software such as SumoPaint or Pixlr to cut the root sculpture from an online image and preview it against different backgrounds. Discuss how each background changes the feel of the sculpture. How does the environment like weather, atmosphere, temperature effect the sculpture and its material?
- YOUTH AUDIO TOUR. View and research several Steve Tobin sculptures. Work in teams to create an audio tour introducing the sculptures in a personal, creative and engaging way. Share some factual information about the artist, title, date, material and process as well as discussing the elements and principles of design like shape, form, color etc. Listen to sample audio stops www.spts.us/mam/youth-audio-tour then use Podcast technologies such as Fotobabble or Vocaroo to create an audio tour with several stops. Share with classmates or with family.
- ROOT SYSTEMS. Learn about different root systems and their purpose. Why are they shaped the way the are? Demonstrate how roots absorb water and nutrients from the ground by cutting the stem of a white carnation in half vertically and putting one half in a jar of colored water and the other half in a jar of a different color. The carnation will absorb the colors through the stem and the colors will travel to the flower where they will mix together.



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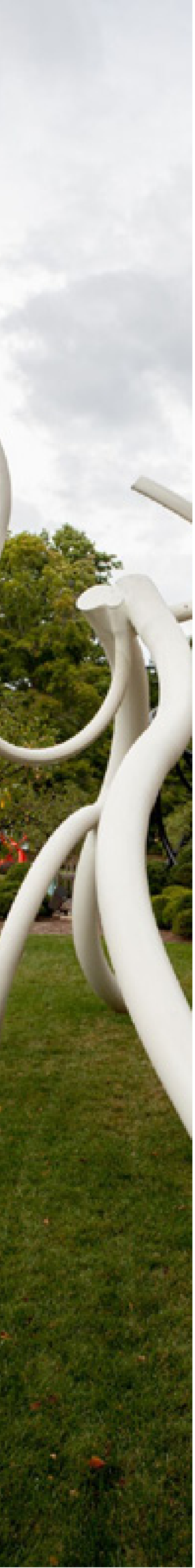
STEVE TOBIN
STEAM ACTIVITIES CONTINUED...

- PLANT DESIGN CHALLENGE. Create your own plant with unique root systems that you think will be able to retain the most water. Use materials like fabric, yarn, paper towels, paper, sponges, vaseline, tape, etc. Test the theory by sitting all of the root systems in a bowl with one cup of water for several hours. Remove the plants and measure the remaining water. The person with the least amount of water remaining created the most absorbant plant. Check back the next day to see which plant retained the water the best without drying out.
- RECYCLED ART DESIGN CHALLENGE. Tobin creates his *Steelroots* by connecting several pipes and shaping the joists to curve the **forms**. Work in small groups to create a recycled material sculpture with curved lines. Connect paper towel and toilet paper rolls with masking tape to make curves from straight objects.
- PAPER ROOTS DESIGN CHALLENGE. A sculpture needs to be strong enough to support its weight and balanced enough so it won't fall over. As a team, use a newspaper and masking tape to create an **abstract** sculpture inspired by Tobin that is strong enough to support weight and balanced enough that it won't fall over. Test the strength by sitting a wood block on top. Then let other teams try to blow it down. The team(s) that create a structure that can support the trunk and do not fall over are the winners. Reflect and adjust.

National and State Standards: AH.9.1, AH.9.2, AH..9.3, AH .9.4, S3.A.2, S3.A.3, S3.B.1, S3.B.2, S3.B.3, S3.D.1, S3.4.3.C1, CC.2.1.3, CC.2.2, CC.2.3, CC.2.4.3



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STEVE TOBIN
PAPER ROOTS DESIGN CHALLENGE LESSON PLAN

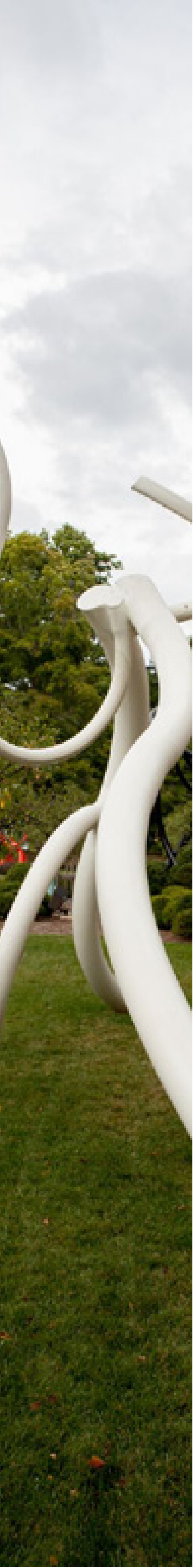
Grades: 2-8
Interdisciplinary: Science, Engineering, Art, Language Arts
Objectives: **TSW** discuss and analyze *Dancing Steelroots* and *Romeo and Juliet* by Steve Tobin.
TSW compare the ways a three-dimensional sculpture gets strength and stability to the way a tree gets strength and stability.
TSW design and engineer a sculpture using newspaper and tape.
TSW collaborate with a team to design and build something.
Materials: Photographs of *Romeo and Juliet* and *Dancing Steelroots* by Steve Tobin, newspaper, masking tape, wood block, scissors
Differentiation: Students can create a larger-scale sculpture. Other materials can be used to create the roots. Students can sketch their design before constructing the sculpture. Students can paint and decorate their final designs. Students can study more about root structures at the start of the lesson. Students can display their sculptures outside or in an environment of his choosing. Create a second sculpture to pair with the first like in *Romeo and Juliet*. Students can view all team's sculptures and make predictions about how well they will do in a stability test.

Standards: AH.9.1, AH.9.2, AH.9.3, AH .9.4, CC.1.1, CC.1.2, CC.1.3, CC.1.4, S3.A.2, S3.A.3, S3.B.1, S3.B.2, S3.B.3, S3.D.1, S3.4.3.C1, CC.2.1.3, CC.2.2, CC.2.3, CC.2.4.3

Procedure: As a class, look at *Romeo and Juliet* and *Dancing Steelroots* by Steve Tobin. Discuss the art work and the accompanying looking questions. Discuss why the roots are shaped the way they are. The sculpture also needs a sturdy base because it doesn't have the soil to keep it from falling over like a tree does. Break students into small groups. Each group will receive a newspaper and masking tape. Students will manipulate the newspaper by rolling, folding and cutting/tearing to create a root-like structure. Attach the pieces using a few pieces of masking tape. Test the strength of your sculpture by placing a wood block on the top. Test the stability by wiggling the table, lightly pushing or blowing on the sculpture. Adjust the sculpture if necessary. Present your sculptures to the class who will give it a stability test by blowing on the sculpture.

Vocabulary
- Three-dimensional

Assessment/Evaluation
- Student presentation and stability test.
- Peer or self-critique



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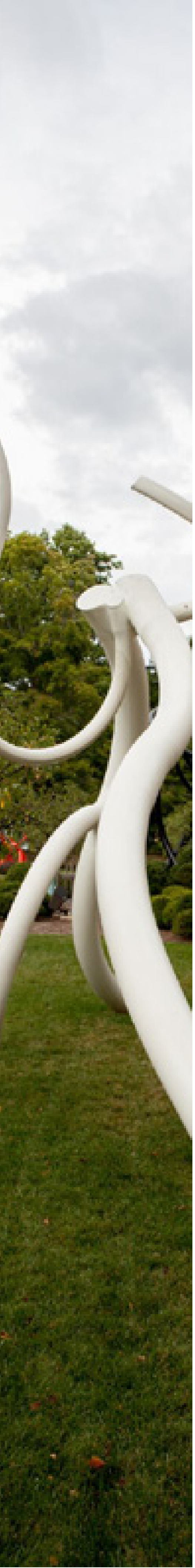
GLOSSARY

Abstract: a twentieth century art movement that explores the relationships of forms and colors, instead of being concerned with creating recognizable images.
Alloy: a mixture made of two or more metals or of a metal and a nonmetal usually made by being melted together.
Brittleness: how easily something is broken, cracked, or snapped.
Complementary colors: colors opposite on the color wheel that when placed near each other create contrast and when mixed together create a neutral.
Cone: a solid form that slopes evenly to a point from a circe base.
Cylinder: a geometric form with straight parallel sides and a circular or oval cross section.
Ductility: how easily something can be rolled thin like a wire or hammered thin without breaking.
Form: is a three-dimensional geometrical figure (i.e.: sphere, cube, cylinder, cone, etc.), as opposed to a two-dimensional shape.
Knitting: making fabric by interlocking loops of yarn with knitting needles, fingers or a machine.
Malleability: how easily something can be molded and shaped.
Mixture: two or more substances that are mixed together but not chemically combined.
Mold: a hollow form used to shape a melted material (like wax or metal) when it cools and hardens.
Monochromatic: Tints and shades of single hue or color.
Monument: something that serves as a memorial; especially : a building or statue honoring a person, place or event.
Oxidation: when something is exposed to or becomes chemically combined with oxygen.



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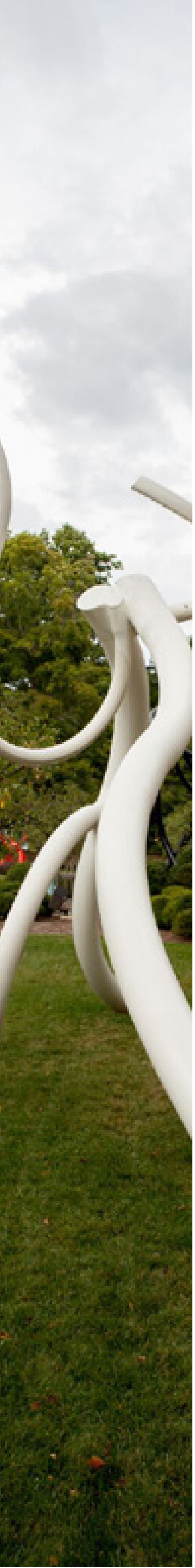
GLOSSARY CONTINUED...

Primary color: the basic colors that can be used to mix other colors; red, yellow and blue.
Patina: the surface or texture of bronze or similar metals, produced by oxidation over a long period or with man-made chemicals like liver of sulphur..
Percentage: a part of a whole expressed in hundredths
Ratios: the relationship in quantity, amount, or size between two or more things.
Realistic: true to life or nature.
Secondary color: a color made by mixing two primary colors; orange, green and purple.
Shadow: A shadow is a dark area where light from a source is blocked by an object. It is cast next to the object depending on where the light is coming from.
Street Art: visual art created in public locations.
Surface Area: the total area of the surface of a three-dimensional.
Texture: the way that something feels when you touch it or how it looks like it would feel.
Three-dimensional: when an object, scene or image has, or appears to have, length, width and depth.
Two-dimensional: when an object or image is flat; contains only length and height but lacks depth or the illusion of depth.
Weaving: making fabric by interlacing threads on a loom.
Yarn Bombing: covering objects or structures in public places with decorative knitted or crotcheted material.



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RESOURCE LIST

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"Google Art Project." *James A. Michener Art Museum*, 2017. Accessed 4 April 2017. www.michenerartmuseum.org/collections-research/google-art-project/

"Steve Tobin's Steel Roots Yarnbombed." IshKnits, 2015. www.ishknits.com/steve-tobin-michener-museum-yarnbomb/

"James A. Michener Art Museum Online Collections Catalogue." *James A. Michener Art Museum*, 2017. Accessed 20 March 2017. www.collection.michenerartmuseum.org/mweb/

"Out of this World: Works by Steve Tobin." *James A. Michener Art Museum*, 2014. Accessed 6 April 2017. www.michenerart museum.org/exhibition/out-of-this-world-works-by-steve-tobin/

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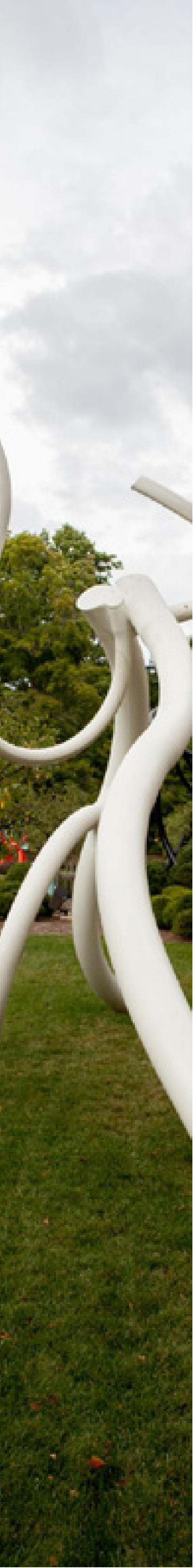
"Youth Audio Tour." *James A. Michener Art Museum*, 2017. Accessed 7 April 2017. www.spts.us/mam/youth-audio-tour



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ADDITIONAL STEAM RESOURCES

Download activity packets, curriculum guides and posters relating to the Michener Collection at: www.learnmichener.org

www.seadnetwork.wordpress.com/white-paper-abstracts/final-white-papers/the-importance-of-early-and-persistent-arts-and-crafts-education-for-future-scientists-and-engineers/

www.stemtosteam.org/

www.new.artsmia.org/wp-content/uploads/2014/07/STEAM-Curriculum_FINAL.pdf

www.philamuseum.org/teacherresources?lppID=1&lpsID=

www.metmuseum.org/learn/educators/lesson-plans/geometric-design-in-islamic-art

www.nga.gov/content/ngaweb/education/teachers/lessons-activities/new-angles.html

www.lacma.org/sites/default/files/ProjectBasedLearningUnitsSTEAM.pdf

www.mason.gmu.edu/~jsuh4/math%20masterpiece.pdf

www.arteducators.org/advocacy/articles/143-position-statement-on-steam-education

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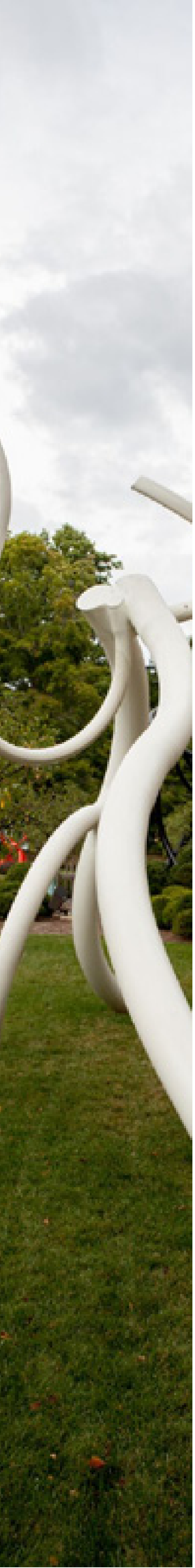

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RESOURCE LIST CONTINUED...

WEB TOOLS

Fotobabble: simple app to add audio to photographs or slideshows and share; great for talking postcards, short news segments and presentations at:
www.fotobabble.com and iTunes App Store

Google Art Project: virtually tour the Michener Art Museum and other museums around the world and view gigapixel photographs of the art in the collection at:
www.google.com/culturalinstitute/beta/partner/

Leopoly: computer program that allows you to easily build 3-D images and designs at:
www.leopoly.com

Pixlr: Easy online photo-editing app for web and mobile at:
www.pixlr.com and iTunes App Store or Google Play

Shadow Puppet Edu: create and share easy videos, slideshow, and presentations with photos and video clips. Add text, drawings, narration and music.
www.get-puppet.co/ and iTunes App Store

Sketch-up: computer program that allows you to easily create 3-D images and designs at:
www.sketchup.com

SumoPaint: Simple Flash-based photo-editing and paint app.
www.sumopaint.com and iTunes App Store or Google Play

Vocaroo: a simple voice recording website, great for podcasts at:
www.vocaroo.com