



Curriculum Units by Fellows of the National Initiative
2026 Volume V: Chemistry of Cooking

Chemistry, S.T.E.A.M., and Culture of Popcorn!

Curriculum Unit 26.05.07, published September 2026
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Rationale

This Science, Technology, Engineering, Arts, Math, or S.T.E.A.M. teaching unit connects to Yale's Professor Gary Brudvig "Chemistry of Cooking" seminar. Through the lens of S.T.E.A.M. this unit will explore popcorn as the focus through Psychology, Physics, Chemistry, and the Science of popcorn. We will also look at the culture and history of one of America's most favorite snack, popcorn. Social Emotional Learning or S.E.L principles will be addressed through popcorn as an analogy. The term "the popcorn theory" will be introduced when making this analogy. The transformation process within the subject of Chemistry will be examined through a deep dive in popcorn learning. The scientific structure of liquids, solids, gases and the concepts of changing properties, mixtures, substances, chemical reactions, making changes, or transformations from one product into an entirely new product will be introduced in this unit. Students will better understand physical changes versus chemical changes from this popcorn unit. Art materials will be the vehicle for the students to drive their learning about themselves and many aspects of popcorn. Students will be able to better understand the chemist in the art studio and kitchen through this popcorn deep dive. Chemical reactions or physical changes will be discovered through color mixing. Students will see how baby kernels can get so large that eventually the hard shell explodes to turn into white fluffy popcorn. Students will come to see the transitions, transformations, physical changes, or even possible chemical changes in popcorn. Students will learn the chemistry of popcorn. The focus group is eleventh grade students that are required to take an Art foundations Art course in order to graduate. This unit will be taught to high school junior students. This unit of study will help students better understand the world around them through the small lens of popcorn. This S.T.E.A.M. unit of study will also touch on social emotional learning theories through the culture of popcorn. This unit can be easily modified or adapted for grades K-12.

School Setting

This unit plan is designed for students who attend a unique public magnet high school in New Haven Connecticut. The Sound School is a magnet school that focuses on hands-on learning. The school is made up of students from over twenty five school districts and is located on a campus in the City Point area of New Haven which is a historic district and was originally an oyster village. The Sound School is situated on a campus including five buildings. Students walk freely from building to building with scenic views of Long Island Sound always on one side of the sidewalk at all times. Approximately 330 students attend the Sound

School, and the focus group will include approximately 30 students. The school is 47% female and 53% male. The student demographics include 43% White, 41% Hispanic, 12% Black, 3.3% two or more races and 57% are economically disadvantaged. The students weekly have five one-hour long classes that meet daily on a rotating schedule so one day every rotation is missed. The Sound School is known for its creative curriculum, vet tech, scuba, sailing, operating vessels, as well as traditional subjects preparing students for college, careers, and the military. This school is a part of the New Haven public school system. This school is a premier aquaculture, agriculture science, and technology education (ASTE) center school. The students' strengths are that they are critical creative thinkers who naturally engage in S.T.E.A.M. hands-on learning as a normal weekly part of many classes. The students' weakness I suppose could be that because of the teaching styles of the school many students' academic learning style preferences need information presented in an unique "outside the box" or varied manner.

Introduction

The unit of study is for an Art Foundations course, this is a required Art course. Art will be created that literally shows the transformation of popcorn. The concept of transformations is the overarching goal of this unit. Through this study of popcorn through S.T.E.A.M., how a kernel becomes a little fluffy piece of tasty popcorn will be discovered. Students will come to learn art vocabulary through this S.T.E.A.M. popcorn unit of study. The unit will kick off with some essential questions as well as the students considering themselves as little kernels of popcorn and considering the quote from September 18, 2025 by Jason Bass, "People are like Popcorn Kernels". The popcorn kernels will be used as an analogy for self-discovery, transformations through art, and connecting with the popcorn theory. Three works of art will be adhered to a black paper each side by side. Students will take a photo of the triptych which will then get uploaded into the class digital popcorn portfolio. Pencil and charcoal popcorn still life drawings will be the first art composition created. Shading, and value scale principles will be taught, as well as the science process of a kernel evolving into a light, fluffy tasty piece of popcorn. Next, students will create something new, a transformation visually will occur in colored pencil. Color theory ideas will be discussed. The science of color mixing. The last art creation will be created with crayon, watercolor paint, and markers. Students will discuss wax resist another science concept rolled into the arts. The same transformed image will be done but this time in crayon, watercolor, and markers. I currently imagine the curriculum unit will be introduced as a fall kick off unit for the introduction of The Sound School Art Foundations program. I want students to see that in this Art studio course students will be creating Art that connects to self, culture, and S.T.E.A.M. subject content areas. From the start, students should immediately see that this Art Foundations course will be expansive and involve critical thinking. As well as the kernel seen as an analogy for themselves. I want students to grasp the idea that something small also can have so many unique big transformations during the school year, just like them! Students will engage in the creative problem-solving process since the students are expected to transform a piece of popcorn into a new visual narrative(s) using emotion or culturally relevant themes or symbolism in artwork to accomplish a visual transformation. Students can consider culture when making popcorn transformations. Students will create one triptych art composition made from three special art popcorn compositions. These three compositions will allow students to experiment with varied art materials. Students will learn the vocabulary of triptych art compositions as well as learn some art history of artists that use food in art, use triptych compositions, or use mixed media. Students will view a prepared google slide that showcases different popcorn connections to Science, Chemistry, Art, Culture, and History. Next, students will have the opportunity to engage in various

art supplies in one composition so they can see how each tool can be used to create lines, shapes, and colors. Students will use a pencil and better understand how graphite as an art tool is vastly different from using a pencil for writing sentences. Students will see how a mark in pencil can carry so many different values, hues, textures, and meanings. Learning how to upload their completed art compositions into the google popcorn portfolio as well as include their name is an important final step. Creating brief artist statements to describe their popcorn transformation or any other learning gained will show that providing words can give a different context or can add another layer of understanding to the visual art piece for the viewer.

Background Knowledge and Content

Is popped popcorn a chemical or physical change? What is the science or Chemistry behind popcorn? How do our noses impact food taste, what molecule is involved in popcorn? Is Kettle popcorn a chemical or physical change? All the questions and more will be uncovered during this S.T.E.A.M. unit of study that is inspired by Yale professor Gary Brudvig and the summer 2026 seminar “Chemistry of Cooking”. The unpopped kernel consists of a starchy core and water droplets encased in a tough dense hull. The steam builds inside the kernel but it cannot escape the tough hull. Eventually the pressure builds and the hull ruptures with a “pop” and that is the sound of escaping gas. Heat cooked the starchy core, and as it emerges from the cracked hull it sends the kernel spinning. The starch blooms from the force of the steam. In milliseconds, the innards cool and the kernel is now much larger than the original size and fluffy popcorn is ready to be served. The magic combination of tough airtight hull and steamy pressure created a delicious treat.

The overall goal of this unit of study is the understanding of transformations in science, chemistry, psychology, arts, and ideas. Through the understanding of popcorn having many scientific steps students will see that a small kernel can have so many different interpretations or meanings and transformations. Life is full of transformations and little things that have big meanings. Chemistry is all around us, especially since chemistry is involved in the digestion process as stated by Yale’s National seminar leader, Gary Brudvig. Through learning of the Chemistry of popcorn many things unfold. Popcorn kernels maybe embedded in other subject areas. S.T.E.A.M. principles are all around us and even popcorn has many overlapping concepts. The world’s transformations are multi-faceted and they exist in various subject areas. The idea of the caterpillar becoming a butterfly or the kernel turning into popcorn or yellow turning into green, this unit of S.T.E.A.M. will reveal many transformations all around us.

By the end of the unit, students will see that transformations are everywhere, in the art studio, in the kitchen, in a science lab, in who we are as humans, and that we are all constantly growing or making self-transformations. Why does popcorn “pop” and what is occurring in this transformation? Popcorn is a light fluffy snack but at first it was a kernel and endosperm. The endosperm is made up of starch. In making a prediction of what will happen, students will use observations to see if it is possible to see the change from kernel to popcorn. Not all transformations or changes are chemical changes. While the popcorn explodes and it appears to have changed from a kernel to a light fluffy piece of popcorn however, professor, Gary Brudvig made clear that this change is only a physical change unless the popcorn burns.

The social emotional learning or S.E.L. overarching concepts will “pop” through this popcorn unit. Popcorn comes in many shapes and sizes and so do humans. Popcorn kernels pop at varied temperatures and so do humans. Butterfly popcorn is light and looks like “wings” are popping out of it. The popcorn industry sorts

kernels into three categories based on which way the wings pop. While classification is a science vocabulary word, other subject areas sort as well. Through the study of popcorn, we will see the S.T.E.A.M. overlapping areas and how culture is connected to food. We are all micro unique popcorn kernels that can turn or “pop” into a macro unique people that can transform into something. This kernel connection is the S.E.L. part of the popcorn unit. The S.T.E.A.M. of popcorn, how popcorn connects to many content areas, will mainly be the journey this popcorn unit touches on.

History of Popcorn

Additionally, when was the earliest popcorn found? Popcorn has been a popular snack for thousands of years dating back to 3600 BC in Mexico. Archaeologists found 5,600 years old popped kernels in a Bat Cave in New Mexico and in Peru. What are the cultural connections existing surrounding popcorn? How to connect popcorn or kernels to their own family story or legacy. I am hoping students consider themselves and their own family heritage when they consider the direction of the transformation for the popcorn art journey. They will investigate how popcorn is cooked in differing cultures. Popcorn drizzled with melted butter, sprinkled with chili powder, and topped with a squeeze of fresh lime juice, creating a tangy and spicy delight is a Mexican tradition. Asian Nori popcorn is seaweed with roasted popcorn roasted and crumbled into tiny pieces, then mixed together. In India, Masala popcorn is spicy seasoned with a blend of spices turmeric, cumin, coriander, and chili powder. Brazilian cuisine embraces acai which is considered a superfood berry. So, this South American treat has a unique combination of nutty and fruity flavors.[1] I want students to wonder about their own culture and how popcorn may have connected to their ancestors.

In this unit of study, students will learn the chemistry of popcorn, the culture of popcorn, the history of popcorn, and the art of popcorn.[2] They will learn how popcorn in fact touches on many areas or differing concepts. How food is often a subject for artists to create art from will be discussed in this popcorn unit. Art involves transformations from color mixing to pottery, transformations that exist in Chemistry as well as other areas.

S.T.E.A.M. and Popcorn

Science of Popcorn

It turns out popcorn is even connected to physics. Unpopped kernels of popcorn are small and hard. When the kernel is applied heat, from a pot, air popper, or microwave, the kernels pop becoming larger and softer. Inside each kernel there is water and hard starch. Heat is needed to soften the starch and break open the kernel. The physics of steam is not only involved in making popcorn, it also powered the industrial revolution. When waves of a microwave oven were used to pop popcorn, the density of popcorn changed. The density is how much mass the small popcorn kernel has versus the popped kernel size it takes up. When popcorn is made or popped students will notice how much more space it takes up. Students can see the transformation of how little space or volume kernels take up in comparison to how much more space is needed or increased volume for popped popcorn. They can discover that heat and energy are all around us. Energy can exist in many forms and one of them is heat. Heat is transferred in different ways; when popcorn is heated different forms of heat transfer take place. Energy is used to make popcorn. Heat is actually the energy from molecules moving around, which is called kinetic energy. The kernel is a closed vessel, so the volume stays the same. When popcorn is heated the water in the kernel is heated, this heat increases the steam which increases the energy inside the kernel. The pressure of the steam builds up until the kernel can no longer withstand the pressure. At the weakest point of the kernel, the surface is torn open, and the popcorn expands with a pop and it increases volume. At this point the steam causes the starch and protein in the popcorn to expand

rapidly making a physical change from hard dense material to a light and soft snack. The hull of the kernel is very difficult to break open without heat and pressure. Heating the kernel in a pot with oil, an air popper, a microwave, or on the stove directly inside a self-contained pan are the ways students will see how they can make the kernel pop.[3]

Popcorn lung is a rare irreversible respiratory disease, and this was originated in early 2000's from an outbreak among workers who inhaled the artificial butter-flavoring chemical diacetyl. Workers can be exposed to this chemical from coffee plants, animal feed plants, bakeries, and candy factories.[4] Now in 2026, Popcorn lung is caused by vaping. I am hoping to use this science information to encourage students to "just say no" as this was an anti-drug campaign in the 1980's and 1990's lead by Nancy Reagan even though proven ineffective since it was not focusing on evidence-based science information. I am hoping this science perspective of popcorn makes a difference. The same chemical in the butter flavoring is put in e-liquid to enhance taste. This chemical creates inflammation.[5] I hope this analogy or connection will help students make safe choices and say no to vaping.

Technology of Popcorn

The industry of farming and the tools or technology needed to make the kernels are aspects of the technology of popcorn. Making popcorn kernels to pop popcorn includes different technology. To cook the kernel and make popcorn, heat is required. There are many different types of technology items needed to go from a kernel to a bowl of fluffy popcorn. The stove, pot, or electric air popper, Jiffy pop, or microwave are technology tools needed to cook the popcorn. Students will better understand the three primary heat principles of conduction, convection, and radiation as well.[6]

Engineering of Popcorn

One important job for chemical engineers is the sustainability, which involves analyzing an environmental process from the beginning to end, from production to disposal or from cradle to grave as it is referred to by engineers. Engineers evaluate the material to minimize energy use and make the product better. Going into the field of engineering is a possibility and thinking of a favorite snack to help motivate the pursuit of engineering as a career to develop the skills to help our environment and avoid one poorly made product after another. Considering the various ways to cook popcorn this is what the engineers will be considering when evaluating the environmental footprint.[7]

Arts of Popcorn

Art history will be introduced to present artists that use food into their art creations. Several artists will be introduced. Rene Magritte's, *The son of a man* 1946 will be used to show Abstract and surrealism art. Paul Cezanne's *Still life with Carafe, Milk Can, Bowl, and Orange* of 1879-1880 will be used to teach that fruit is often used as still life subject matter. Andy Warhol's *Campbell Soup* of 1962 will show how food labels are an art form in the graphic design and commercial art world. Andy Warhol's *Popcorn*, 1976-1986 gelatin prints will show mass production of art, including Campbell Soup art creations as well as his ice cream creations. *Spoonbridge and Cherry* is the sculptural fountain designed by Claes Oldenberg and Cossje van Bruggen; this art will show that food can be used as subject matter for both 2D and 3D artists. This art history connection will allow a brief snapshot to better understand that artists make art connected to many themes or directions including food. History and Humanities falls under the arts as well. The history and cultural connections to popcorn and art will be made. This unit will connect or touch upon some S.E.L. principles. This unit will make abstract connections between individual kernels and individuality themselves. Humans are like individual

kernels that will eventually transform into fluffy pieces of popcorn that will then transform into something else. How the kernels all pop at the time when the temperature is just right for each popcorn kernel. The kernel is as humans grow, develop or “pop” when the time is right.[8] I want to use this popcorn snack as a way to understand that in life timing is essential. No one should feel pressured of their own time to pop. Everyone on this earth should transform or pop at just the right time for them. Showing how something so small as a kernel can have so many bigger, deeper meanings as well. I am also excited to reveal how something so small, micro can be possibly overlooked yet in reality can actually be so expansive or macro and important or valuable to many. Popcorn is a great analogy, some people peak or pop early on, others take a little longer to pop. Stop comparing oneself to others especially in the world of social media and gathering “likes”; through popcorn, this is discussed!

Math of Popcorn

Kernels pop and become popcorn when heat is applied to the kernel. The heat creates so much steam or pressure inside the kernel. The temperature or math has to do with the heat and creating pressure inside the kernel. The kernels popping at various times is math and measuring the pressure to make the kernel pop. Measuring is also essential to make popcorn when considering ratios of oil to popcorn kernels, counting the kernels’ volume vs the popped popcorn’s volume, and how just a little amount of kernels makes a bowl of popcorn. Math is also involved in the time of how long each kernel takes to pop, the weight of unpopped kernels versus fluffy kernels and the three second rule for cooking popcorn.

S.T.E.A.M Popcorn Studies grades K-12

The S.T.E.A.M. of popcorn is the focus of this unit of study which is created for an eleventh-grade focus group; however, teachers can certainly adapt this unit for grades K-12. Teachers will have to change the goals and objectives. All students can benefit from learning S.T.E.A.M. through popcorn as well as creating triptych art creations.

S.T.E.A.M Popcorn Overview for Focus Group

Through the creation of an art composition depicting popcorn, students will see popcorn transformations visually on paper, in three compositions. Students will also see the science of a kernel to white fluffy popcorn. Students will dip their toes in the science waters to become chemists or scientists that tests matter to see what it is made of and how it reacts with other matter. While some chemists work with medicine, others work with food. Chemists work with the newest technology to study and test matter. Chemistry is the study of matter and the way it changes. In this S.T.E.A.M. unit of study, students will consider the changes of the popcorn kernel of matter. Students will better understand the physical changes, mixtures, and chemical changes of popcorn. Some chemists engineer new food products. They may put additives, or additional matter, into food so it is safer to eat, lasts longer, or maybe is healthier. Some chemists work in schools and colleges, others create products, others study evidence.

Instructional Strategies and Lesson Plans

Each lesson is designed for a sixty minute or more studio art class. For some lessons, you may find sixty minutes is not enough time due to student engagement or clean up delays. For other lessons, you might find your students are ready to move on. Students can always work on artist statements if done with art early. Students will go through many steps to create artwork. Students will plan, make, refine, upload, present, and exhibit their popcorn triptych art. Students will demonstrate practicing the process of using varied art materials or specialized materials in the way that they are designed to be used. Students will not have mastery level; yet student experimentation will enable them to become masters at knowing where all art materials exist in the art studio and how to clean up after themselves. Students will embark in the art studio on a deep S.T.E.A.M. dive. Students will learn about art history, as well as how S.T.E.A.M. has supported many art ideas well before it became an acronym. Students will be introduced to S.T.E.A.M. principles through a guided teacher slide show, peer share, turn and talk, guest speakers if possible, and other academic experiences that are designed to raise awareness and insight. Students will learn about drawing, painting, illustration in conjunction to other styles and historical art periods. Students will learn the value of how Art has supported science and history for many years. Students will learn about the power of art as with social emotional connections. Students will come to see how scientific illustration art was needed to classify plants, animals, and used in understanding science. Students will learn how artists and anatomists worked together to investigate the human body through dissections. Students will see how together they produced images of the human body that were supporting science by combining medical knowledge with an artistic vision. Students will also see how art was used in conjunction to support history and spread information or be a communication platform with propaganda posters given there was no internet years ago to spread information. Students will gain skills in researching, layout, graphic design, public speaking, and skills in creating art renderings that depict popcorn and the transformations. Students will see how art supports science, science classifications, science labeling, science findings or science documentations, solving crimes, and more.

Lesson One

Students will be introduced to the final triptych art project and to the final artist statement.

Students will create three single cohesive artworks that are all connected to popcorn.

Students will learn about still life drawing and value scale.

Students will be introduced to the vocabulary word of triptych.

Students will be introduced to the many gray tone shades that a pencil can create.

Students will be asked ten essential questions of popcorn.

1. What is popcorn?
2. Are popcorn kernels seeds?
3. What is the process of a kernel turning into popcorn?
4. When do you think popcorn was invented?
5. What is popcorn lung?

6. What is the popcorn theory?
7. Do you eat or like popped popcorn? Either way I want students to share other things they like in this world, be it food, sports, music, books, or anything.
8. What is the culture of popcorn?
9. What is the science of popcorn?
10. What are some popcorn uses?

Students will work together as a pair to come up with answers to these ten essential questions. Students will discuss answers at the end of class on day one as part of the introduction wrap up.

Some possible answers include:

1. What is popcorn?

Popcorn is a whole grain maize (*Zea mays everta*) with a hard outer shell and a starchy center, that makes a healthy snack when heated.

2. Are popcorn kernels seeds?

Yes, a popcorn kernel is a seed and a cereal grain; it contains all the parts of a seed needed to grow a plant an embryo (baby plant), starchy endosperm (food) a hard outer shell or coat (hull).

3. What is the process of a kernel turning into popcorn?

Popcorn is made by heating up the kernels. The water that is hidden inside the seed gets hot and softens the starch shell. The water wants to escape or boil to make steam so, as it gets hotter, the pressure builds up. The pressure gets so high that the seed coat bursts and we are left with fluffy popcorn.

4. When do you think popcorn was invented?

The earliest archaeological evidence was found in northern Peru 6,700 years ago.

5. What is popcorn lung?

It is a rare, irreversible respiratory disease. It occurs when the smallest airways in the lungs become scarred or inflamed which then restricts airflow. This name came from the early 2000's when there was an outbreak of factory workers who inhaled the artificial butter flavoring chemical diacetyl.[9]

6. What is the popcorn theory?

The popcorn theory is a term to make an analogy to humans and popcorn. The idea that kernels pop when the temperature or popping rates are just right for each kernel. America's favorite snack of popcorn is being used as an analogy in the world of science or psychology to encourage students to stop caring about what others do. Using the popcorn popping process as a way to hook students to stop worrying about others and focus only on their own timing and the knowledge that they will pop when time is right just like a kernel of popcorn when the time is right. I also want students to not care about social media "likes" through this popcorn unit of study.

7. Do you eat or like popped popcorn? Either way I want students to share other things they like in this world,

be it food, sports, music, books, or anything. Students will share about themselves and maybe this conversation can help when students are considering or brainstorming their transformation art compositions.

8. What is the culture of popcorn?

Various cultures enjoy popcorn around the world. Popcorn is one of America's favorite snacks.

9. What is the science of popcorn?

Kernels turning into popcorn.

Heat creates steam inside and the pressure builds up and eventually the kernel pops.

10. What are some popcorn uses?

Holiday tree trimming

Movies

Kernels used for stuffing to make corn hole baggo

Decorations

Lesson Two

Students participate in a class discussion reviewing what students together came up with and they share the essential questions they discussed the day before. Students participate in a class discussion reviewing what students together came up with. Then, students are introduced to the assignment. Students view the teacher's Google slideshow on popcorn. This slide show introduces art history, surrealism, and pop art. The slide show will include still life art and how food is often included in still life subject matter. Students will see surrealism and how this art style can possibly inspire or help students develop the next popcorn transformation composition. Students will take the pencil, use a value scale of black, medium gray, gray, and light gray to create realistic value scaled popcorn creations. The next day or lesson three students will transform realistic pieces of popcorn into colorful popcorn transformations. Lesson two students will learn about shading with pencil to see how many gray tones can come from one tool. Students will make crosshatching and stippling lines to establish tone range. The colored pencil and turning the fluffy popcorn image into something entirely colorful and that is entirely new is a transformation using colored pencil will be another day. Students will consider three different popcorn compositions in total. First in pencil, a realistic drawing of popcorn. The second art is in colored pencil; however, the composition is a transformed popcorn image. The third composition is in crayon, watercolor, and markers. The third composition can be the same composition design idea or same transformation as the second one in the colored pencil creation; however, the third is done with new materials. Students will come to understand the physical changes of popcorn unless the popcorn is burned or turned into caramel or kettle corn. Students will come to see how different tools make different marks on the paper.

Lesson Three

Students learned about still life drawing yesterday when they created a realistic popcorn drawing art piece. Students are reminded that yesterday students considered creating realistic still life drawings, using value

scale, smudging, cross hatching, stippling when creating pencil, and charcoal drawings of popcorn. Students learned drawing art vocabulary when creating popcorn black and white drawings. In lesson three, students learn about transforming again into a mixed media transformation. From these art transformation processes, students will learn about shading with pencil to colored pencil and turning the fluffy popcorn image transforms into something entirely colorful and that is entirely new and transformed. Students will consider three different popcorn transformation compositions in total as well as the science properties of popcorn. Students will come to understand the physical changes of popcorn unless the popcorn is burned or turned into caramel or kettle corn.

Lesson Four

Students will be asked to look at completed pencil drawings and consider what they see when looking at a drawing of a popped piece of popcorn. Students are asked to transform realistic pencil drawings and then turn them into something else on a new piece of paper. Students will transform, shift or change the still life into a colorful pencil drawing that is filled with imagination, surrealistic, or clever realistic inspirations to make a new transformed popcorn drawing. Students will draw a new image of popcorn. This new image will be created twice, once in colored pencil and then in crayon, watercolor, and markers. The colored pencils will give students who prefer controlling the art medium with color when drawing popcorn transformations.

Lesson Five

Students are either finishing edits to colored pencil rendering, doing final touches, or they are starting a third art creation which is also a popcorn transformation but this time using crayons, markers, and watercolor. The third image idea will not change, only the materials used to create artwork number three will change. Students will be learning about wax resist and watercolor. Students will be doing some color mixing. Students will come to better understand mixtures as changes from seeing colors mix. Students will learn chemical changes vs. mixtures through watercolor discoveries. Students will learn about primary and secondary colors and some basic color theory principles.

Lesson Six

Continue working. Reflecting the goal of these three works of art is that students see transformations, growth, and have an exploration with a variety of art materials. Students see transformations of drawings as well as physical and chemical changes. Students see mixtures and color mixing changes. Students should consider artist statements. The artist's statement needs to explain the drawing that transforms from a pencil drawing or popcorn to something entirely different, and then how the same transformation with different tools is different.

Lesson Seven

Continuing working, reflecting, adding details to the whole composition now that all three images are glued side by side next to each other on one 12 by 18-inch piece of paper. The goal of these three works of art is that students see transformations, growth, and artistic explorations of using food as an art subject matter. The variety of art materials allowed students to experiment with different tools. Students can begin narrative or artist statements. The artist statement will help tell the viewer the direction the student went in when making a transformation. There will be three composition images that are showing the unique creative transformation of the popcorn process: one drawing showing the full value scaled pencil or charcoal drawing of the popcorn image, next the realistic drawing transforms into a colorful pencil drawing of that piece of

popcorn that transformed into something entirely different, and the third creation will be the same transformed image recreated in the previous artwork, however this time using different materials. The third composition uses crayon, watercolor, and markers. The idea of three compositions is that students can see how a basic food item like a kernel can transform to a piece of popped popcorn and then allow creatively to turn or transform pencil popcorn drawing into something else while also learning about art vocabulary: value scale, line variety, cross hatching, stippling, color theory, watercolor techniques, wax resist, and how markers create a unique color tone. The triptych popcorn compositions will impart a visual narrative, create a sequence, and show different art materials of the same subject matter. Students will gain skills in working with different materials. Some students might master the value of knowing how life can transform so easily and how we are all precious kernels popping at the just the right time that is right for each of us!

Lesson Eight

Students glue finished art onto a black piece of paper, take photos of the art, and upload the photo into a popcorn portfolio with name on the bottom right-hand corner of a google slide. Students need to use craftsmanship when uploading art to digital portfolios. Students will participate in a very brief introductory oral critique sharing how visually their pencil drawing of popped popcorn transformed into something else and share what was their personal inspiration was for this visual transformation. I want students to gain skills in public speaking, evaluating, critiquing, and analyzing artwork using basic art vocabulary.

Formative Assessments:

It is very important when assessing the students that the whole child is considered, not just the final popcorn triptych art composition, final google portfolio upload, or final popcorn artist statement. The teacher observes all the students throughout all lessons as well as what is handed in. The teacher can assess the individual student with the support of asking the essential questions as a pre-test and having the artist's statement as a post-test to assess the findings of this S.T.E.A.M. popcorn unit. I encourage student class participation, student responsibility, student clean up, student collaborations, student individual oral assessments, and consideration of the student art and craftsmanship of the triptych layout. It is very important to listen to the student responses of how they consider the popcorn theory and the idea of all kernels popping at different temperatures. Student artist statement responses from pencil and charcoal popcorn still life drawings compared to the whimsical dreamlike amazing colorful popcorn transformation compositions created with different types of art mediums. Colored pencil for one and watercolor, crayon, and marker for the other. When assessing the art compositions again students need to consider smudging, color layering, and color mixing as just one aspect, name on art, and write up or artist statement on the transformation process or artist statement is another aspect to consider

Learning Objectives

Students will gain knowledge of content, methods, practices and life skills:

1. Students will have an increased awareness of the S.T.E.A.M. of popcorn. What exactly are popcorn kernels? Why do the kernels pop? What is required to make the popcorn pop? What happens in the inside of the kernel?
2. Students will see how something small a kernel can be filled with many big ideas.
3. Students will collaborate and generate ideas of what popcorn transformation direction they are considering.
4. Students will gain art vocabulary as well as the knowledge of the S.T.E.A.M. of popcorn. Students will experiment with varied art materials; students will see exactly how working in graphite pencil is different from colored pencils and different from watercolor with crayon and also marker.
5. Students will see how popcorn is used in Art.
6. Through art-making, artists make meaning by investigating and developing awareness of perceptions, knowledge, experiences, and popcorn transformations will show this.
7. Students will demonstrate responding skills by providing authentic evidence of pencil value scale and transformations of popcorn in selected triptych works of art.
8. Students will be able to understand that small things like a kernel are filled with complex vocabulary of embryo, hull, or fluffy popcorn. Students will increase awareness in the value of being who they are and feeling comfortable at popping when it is just the right time, without comparisons to peers.
9. Creativity and innovative thinking are essential life skills that can be developed.
10. Artists and designers develop excellence through research, practice, constructive critique, reflecting, revising, refining work over time, and oral critiques.
11. Individual aesthetic and empathetic awareness will be developed through popcorn transformation art that can lead to an understanding or appreciation of self, of others, and of the world around them through the S.T.E.A.M. of popcorn. Students will come to understand why popcorn pops and why each popcorn kernel is so special!
12. Students will be able to explore art materials through visual art compositions.
13. Students learn or navigate portfolio with online upload popcorn triptych.
14. Students gain critical thinking skills in creating triptych compositions, writing artist statements, and online portfolio upload.
15. Students identify and demonstrate diverse methods of artistic investigation to choose an approach for beginning a popcorn transformation work of art.
16. Students engage collaboratively in creating art-making, google slide portfolio, writing an artist statement in response to an artistic problem of what their popcorn transformed into.

Conclusion

Students will be taking a deep dive into the S.T.E.A.M of popcorn. This process will give them great comprehension of how artists brainstorm, research, sketch, edit ideas, and design in order to participate in the art process. Students will see firsthand that art making is not just placing lines, colors, shapes, and art

materials together; it is a deep reflection, creative process, and a unique response to process something else. Students will see that their still life popcorn is connecting or transforming to something bigger, deeper than what is present on the page. This S.T.E.A.M. popcorn art unit is an introductory art unit revealing the design art process so students will see through their own trial and errors that rarely is art created for no intended purpose. The art project has an overarching theme which is transformations and personal growth through S.T.E.A.M. I want to close this unit with the hope that students rethink comparing themselves to anyone else since we all pop at different times. I also want this unit to be a reminder that vaping is bad and can give you popcorn lungs which are not reversible, so I am hoping through conversations during this unit of study that conversation come up amongst students to “Just say no”.

Appendix on Implementing CT District Standards

HS Proficient-VA:Cr2.1.Ia- Shape an artistic investigation of an aspect of present day life using a contemporary practice of art or design.

HS Accomplished- VA:Cr2.1.IIa-Engage in making a work of art or design without having a preconceived plan.

HS Advanced-VA:Cr2.1.IIIa-Experiment, plan, and make multiple works of art and design that explore a personally meaningful theme, idea, or concept.

HS Accomplished-VA:Cr2.1.IIa Through experimentation, practice, and persistence, demonstrate acquisition of skills and knowledge in a chosen art form.

HS Accomplished -VA:Cr3.1.IIa-Engage in constructive critique with peers, then reflect on, reengage, revise, and refine works of art and design in response to personal artistic vision.

HS Accomplished -VA:Pr4.1.IIa -Analyze, select, and critique personal artwork for a collection or portfolio presentation.

HS Accomplished -VA:Pr5.1.IIa -evaluate, select, and apply methods or processes appropriate to display artwork in a specific place.

HS Proficient -VA:Re.7.1.Ia-Hypothesize ways in which art influences perception and understanding of human experiences.

HS Proficient -VA:Re9.1.Ia-Establish relevant criteria in order to evaluate a work of art or collection of works.

MS-PS1-4 – Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed (covers what's happening inside a kernel as moisture turns to steam).

MS-PS1-2 – Analyze data to determine whether a chemical reaction has occurred (useful for distinguishing that popping is a physical, not chemical, change).

5.MD.3–5 – Understand and measure volume using unit cubes; apply $V = l \times w \times h$ (good for comparing popped-corn volume across methods).

Vocabulary

Triptych - A picture or composition that is composed of three panels as one visual artwork. The panels are often on hinges. The three panels often tell a story of a beginning, middle, and end.

Transformation - A complete and total change in look, form, or character of someone or something.

Drawing - Is a visual art form that marks paper or another 2D surface.

Value Scale - To measure lightness to darkness.

Cross hatching - A drawing technique to create texture, tones, tone range, and value.

Stippling - Is a drawing technique that uses many small scratches or small dots to create depth and form when drawing.

Color theory - The historical body of color information discussing the relationships with color, the science behind color mixing, explaining contrast colors, color harmony, and many more theories.

Wet on wet - Watercolor vocabulary for painting watercolor on wet paper.

Wet on dry - Watercolor vocabulary for painting watercolor on dry paper.

Crayon wax resist - Watercolor vocab for placing crayon on paper and the watercolor soaks into the paper not the wax.

Surrealism - Is an art movement that creates not realistic combinations of objects, people, animals, etc. some feel it's almost a dream-like art state of mind.

Still life art - Is an art creation made from objects not moving and allows artists to consider lighting shadow, texture of the selected objects.

The Popcorn theory - Analogy stating the comparison that humans are kernels in a pot and exposed to heat and not all kernels pop at same time. The popcorn theory reminds us that people reach their potential at different ages and to stop comparing yourself to others.

Analyze - To study something deeply.

Design - To create a plan for something.

Develop - To work on something over time.

Material - Something used to make something else.

Bibliography

American Chemical Society. "The Secret Science of Popcorn." *Adventures in Chemistry*. Accessed July 13, 2026.

<https://www.acs.org/education/whatischemistry/adventures-in-chemistry/secret-science-stuff/popcorn.html>.

This short, kid-friendly page from the American Chemical Society explains why popcorn pops, the two kernel shapes, and why steam escapes a fresh bag. It is scientifically reliable but only surface-level, useful for quick facts rather than in-depth physics.

Bass, Jason. "People Are Like Popcorn Kernels." *The Citizen*, September 18, 2025.

<https://thecitizen.com/2025/09/18/people-are-like-popcorn-kernels/>.

This local-newspaper opinion column uses popcorn popping as a metaphor for personal growth and change. It is motivational rather than factual, contributing no historical or scientific information about popcorn.

Butler, Stephanie. "A History of Popcorn." History.com. A&E Television Networks, December 6, 2013. Accessed July 17, 2017. <https://www.history.com/articles/a-history-of-popcorn>.

This History.com article traces popcorn from Indigenous American origins through its rise as a nineteenth-century street food and movie-theater staple. It is written for a general audience and lacks citations, but its claims align with more detailed sources like Smith's.

Gaddi, Rosalie. *A Day at Work with a Chemist*. New York: Rosen Publishing Group, 2016.

Written for young readers, this career-exploration book profiles a chemist's daily work and the scientific method. It contains no content on popcorn specifically but supports the project's science angle by illustrating the profession behind investigating it.

Padros, Emma Marie, Marcella McMahon, Barnabas Gao, Brendan Weil, Robert P. Hesketh, C. Stewart Slater, and Kirti M. Yenkie. "Pollution Prevention Through Popcorn: An Introduction to Life Cycle Analysis." Paper presented at the 2025 ASEE Annual Conference & Exposition, 2025.

<https://nemo.asee.org/public/conferences/365/papers/48060/view>.

Written by Rowan University chemical engineering researchers, this conference paper uses four popcorn-popping methods to teach students Life Cycle Analysis, comparing the energy use and waste of each to evaluate their environmental sustainability.

Peterson, Cris. *Popcorn Country: The Story of America's Favorite Snack*. Honesdale, PA: Boyds Mills Press, 2019.

This photographic picture book for young readers follows popcorn from planting through harvesting, processing, and shipping, with a clear, age-appropriate explanation of the physics behind popping. It offers a solid visual introduction to production but is too simplified for advanced research.

"Popcorn Around the World: How Different Cultures Enjoy This Popular Snack." The Kettle Gourmet (blog), July 7, 2023.

<https://thekettlegourmet.com.my/blogs/news/popcorn-around-the-world-how-different-cultures-enjoy-this-popular-snack>.

Published on a popcorn retailer's blog, this article surveys popcorn flavor traditions worldwide, from Mexican elote popcorn to Japanese nori popcorn. It is promotional and uncited, so its claims are informal rather than authoritative.

"Popcorn Journey: How a Small Kernel Became a Global Favorite." PotatoPro. Accessed July 14, 2026.
<https://www.potatopro.com/about/popcorn>.

This sponsored, uncited industry overview on a potato- and snack-trade website covers popcorn's history, botany, popping science, nutrition, and market trends, making it a broad but unverified starting point.

Randle-Conde, Aidan. *The Physics of Popcorn*. Curious World of Kitchen Science. Tulsa, OK: Kane Miller Books, 2020.

Written by a particle physicist, this activity-based book explains the physics behind popcorn through twenty-two hands-on kitchen experiments. It offers more technical depth than the ACS web page while remaining accessible to younger readers.

Smith, Andrew F. *Popped Culture: A Social History of Popcorn in America*. Columbia: University of South Carolina Press, 1999.

A scholarly cultural history by food historian Andrew F. Smith, this book traces popcorn's origins and its rise as an American icon, testing popular legends against historical evidence. Its depth and documentation make it one of the strongest sources here for popcorn's history.

Vieth, Ken. *From Ordinary to Extraordinary: Art and Design Problem Solving*. Worcester, MA: Davis Publications, 2000.

This art-education resource presents structured problem-solving frameworks for creative projects, with no popcorn-specific content. It could support the design or presentation component of a popcorn-themed project.

Wolke, Robert L. *What Einstein Told His Cook: Kitchen Science Explained*. New York: W. W. Norton & Company, 2002.

Written by a chemist and food columnist, this popular-science book answers common cooking questions, including why popcorn pops, with accessible explanations grounded in real chemistry. It balances the technical depth of Randle-Conde's book with general-audience readability.

Notes

[1] Popcorn around the world

[2] Smith, Andrew

[3] Randle-Conde

[4] American Chemical Society

[5] American Chemical Society

[6] Padros, Emma Marie, Marcella McMahon

[7] Padros, Emma Marie, Marcella McMahon

[8] Bass, Jason

[9] American Chemical Society

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