4.3 STEAM-ing Ice-Cream

This minimum 90-minute STEAM project helps 2nd-grade students develop problem-solving and flexibility as they turn liquid ingredients into ice cream without a machine. Through a "shake-freeze-pass" process, children build connectedness and teamwork by rotating roles and supporting each other during the experiment. Students sharpen their reasoned based thinking by observing how temperature and motion change materials, adjusting their strategy if the mixture does not freeze evenly. The session concludes with a reflection where teams evaluate their collaboration and suggest improvements for future scientific trials.

Basic Information Sheet

Age group	Student number	Duration	Number of stages	Subjects connection and relevance
2nd grade students	12-14 students in small groups	minimum 90 minutes	5 stages	natural sciences (states of matter, temperature change), Social-Emotional Learning

STEAM Event Summary

This session playfully introduces children to scientific observation as they watch a liquid turn into ice cream. Teachers guide the critical shaking phase using a "musical statues" game, which helps manage energy levels and ensures a fair, peaceful rotation of roles within the team. Alongside science concepts like cooling and states of matter, students practice hygiene and care for their peers' food allergies. It is highly recommended to choose this activity because it teaches cause-and-effect relationships through the creation of a highly appealing, everyday treat. Furthermore, the delicious, instant result guarantees enthusiasm and naturally builds strong teamwork among the students.

SPIRIT Skill Focus

- Connectedness
- Valuing people and nature
- Sense of wonder / Curiosity / Openness

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Complementary/Secondary SPIRIT Skill(s)

- Flexibility
- Problem-solving

National curriculum Link and Objectives

- Observe and describe a change of state (liquid → semi-solid) through cooling and mixing.
- Understand in a simple way that ice + salt gets colder and helps freezing happen.
- Practice basic measuring (cups/spoons) and following a sequence safely.
- Build vocabulary: freeze, melt, shake, cold, mix, teamwork, share, experiment.
- Explore cause–effect: shaking, spreading, time, and temperature impact results.

Real-world STEAM Connection and Problem definition

Real-world connection (student perspective): People can make ice cream without a machine by using cold + movement. Scientists and chefs both test ideas, observe changes, and improve their method step by step.
Problem definition (students' perspective, age-specific):
"How can our team work together to turn a liquid mixture into ice cream using ice, salt, and shaking - and how can we solve problems and change our strategy if it doesn't freeze evenly?"

Materials at a Glance

- Vegan ice cream base per team: plant-based milk, plant-based cream, sugar, vanilla essence, pinch of salt
- Measuring cups/spoons, small bowls, whisk/spoon
- 1 small zip-top bag (ingredients) + 1 larger zip-top bag (ice/salt bath) per team
- Ice and rock salt (or coarse salt)
- Towels (for shaking + protecting hands)
- Sprinkles/sauces or safe toppings
- Music player for "musical statues"
- Allergy/sensitivity checklist + hygiene materials
- Cups/spoons for sharing, bin, cleanup cloths

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Indoor/Outdoor and Classroom layout

- Central gathering spot for intro, safety, allergy check
- Team tables/floor areas for measuring and bag setup
- Open space for the “musical statues” shaking (indoors or shaded outdoors in mild weather)
- Decoration + cleanup station.

Notes on Research-based approach and integration

In this activity, children explore a familiar real-life phenomenon - ice cream freezing - through playful scientific inquiry and teamwork. They begin by predicting what will happen when a liquid mixture is placed in a very cold ice-and-salt bath, drawing on everyday experiences with melting and freezing. Then, they test their ideas by measuring ingredients, sealing bags carefully, and shaking in a structured routine that allows observation and comparison.

This follows a simple research cycle: students predict, test, and observe how cold and motion change materials, then adjust their approach when problems appear (uneven freezing, weak mixing, cold hands, leaks). They also connect science learning to values by practicing care for people (allergies, fairness, hygiene) and care for nature (plant-based ingredients, minimizing waste, cleaning up). The result is immediate and meaningful: students experience how curiosity, cooperation, and smart strategy lead to a shared outcome.

Lesson Flow Overview (linked to details below)

Stage	Title	Brief Description	SPIRIT Skills	Duration	Link to Details
1st	**Intro and Team Mission**	Students do a quick pair-share about favourite cold treats, then hear the mission: make ice cream without a machine. They review hygiene/allergies and make a class “scientist promise” to work safely and kindly.	• Connectedness • Curiosity • Valuing people and nature	15 minutes	**STAGE 1 – Intro and Team Mission**
2nd	**Plan, Measure and Set Up (Research/Design)**	Teams follow picture recipe cards to measure and mix ingredients, seal the inner bag, and prepare the ice-and-salt bath. They assign roles and solve setup problems (spills, sealing, missing tools).	• Problem-solving • Valuing people and nature • Connectedness	20 minutes	**STAGE 2 – Plan, Measure and Set Up (Research/Design)**
3rd	**Shaking Experiment**	Teams wrap the bags in towels and play musical statues: shake → freeze → pass. They observe changes and adjust strategy	• Flexibility • Connectedness	20-25 minutes	**STAGE 3 – Shaking Experiment**

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

	(Musical Statues)	(spreading mixture thin, steadier shaking, switching roles) to freeze more evenly	• Curiosity • Problem-solving		**(Musical Statues)**
4th	**Taste, Decorate and Share (Analysis and Conclusion)**	Students open the inner bag, scoop the ice cream, decorate, and share fairly. They describe the change from liquid to ice cream and name how their team helped the result happen.	• Valuing people and nature • Connectedness • Curiosity	10 - 15 minutes	**STAGE 4 – Taste, Decorate and Share (Analysis and Conclusion)**
5th	**Reflection and "Next Time" Ideas**	Teams reflect on what worked, what problem they solved, and what they would change next time. They end by sharing one new wonder-question to explore later.	• Curiosity • Flexibility • Problem-solving • Connectedness	15 minutes	**STAGE 5 – Reflection and "Next Time" Ideas**

Tips and Tricks for dealing with challenges (for the whole STEAM program)

- **Challenge:** Bags leak/spill.
  Tip: Double-seal and do a "squeeze test" over a bowl before shaking; keep backup small bags ready.
- **Challenge:** Cold hands.
  Tip: Always wrap in towels; rotate shakers frequently; allow an observer/coach role for short turns.
- **Challenge:** Unequal participation.
  Tip: Use rotating role cards: measurer, mixer, sealer-checker, shaker, observer-encourager.
- **Challenge:** Mixture freezes unevenly.
  Tip: Flatten/spread the inner bag often and keep ice packed around it; shake steadily rather than wildly.
- **Challenge:** High energy during musical statues.
  Tip: Practice one round without bags first; keep music bursts short; teach "freeze like a statue" rule.

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Difficulty level tailoring notes

- **Beginner learners:**-Pre-measure ingredients; use picture cards; use verbal observation prompts instead of writing.
- **Intermediate learners:** Students measure themselves and explain “cold + shaking” in their own words.
- **Advanced learners:**-Compare two conditions (e.g., spread thin vs. not spread; longer shaking vs. shorter) and vote on which strategy worked best and why.)

STEAM Program Debriefing and Reflection Questions

- Where did you show connectedness today - how did you help your team?
- How did you practice valuing people and nature (allergies, hygiene, fairness, cleanup, not wasting)?
- What gave you the biggest sense of wonder - what surprised you about the change?
- When did you need flexibility - what did you change when something wasn’t working?
- What problem did your team solve, and how did you solve it?

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

4.3.2. Stage details and Activities Flow

STAGE 1 – Intro and Team Mission (Connect)

How does this develop particular SPIRIT skills

- Builds connectedness by helping students share personal ideas, listen to a partner, and feel part of a shared team mission
- Sparks sense of wonder/curiosity by inviting children to predict how "cold + shaking" could transform a liquid into ice cream
- Reinforces valuing people and nature by setting allergy-aware, hygienic, and respectful rules before touching materials.

What do we want to achieve regarding SPIRIT skill development (student understanding and/or behaviour)?

As a result of this activity, students will be able to:

- Connectedness: share an idea with a partner, listen respectfully, and use kind team language ("We can do it together").
- Curiosity / wonder: say one "I wonder..." or prediction about what will happen to the mixture when it gets very cold.
- Valuing people and nature: follow one safety/hygiene rule that protects others (allergies, clean hands) and respects ingredients.
- Sense of wonder: express curiosity about how these teamwork habits will help them succeed in the bubble mission for the community.

Academic/Curriculum Objective connection

Introduces state change and sets an observation mindset.

Materials and tools needed for implementation

Visual aid (liquid → ice cream), team assignment cue, allergy checklist.

Preparation notes

Prepare simple visuals; confirm allergies; group students into teams.

Guided Questions

- "What do you think will happen when our mixture gets very cold?"
- "How will we work as a kind, fair team today?"
- "What rule keeps everyone safe and included?"

Stage Debriefing Questions (Optional)

- "What are you most curious about right now?"

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Tips and Tricks for dealing with stage challenges

- **Challenge:** Some students don't speak.
  Tip: sentence starters ("My favourite…", "I wonder…").
- **Challenge:** Students rush safety.
  Tip: "Science pause" - no materials until rules are repeated.

STAGE 2 – Plan, Measure and Set Up (Research/Design)

How does this develop particular SPIRIT skills

- Develops problem-solving as students follow a sequence, measure carefully, and fix setup issues (sealing, spills, missing tools)
- Reinforces valuing people and nature through careful ingredient use (no waste), hygiene, and respecting dietary needs
- Builds connectedness by sharing roles and helping teammates succeed with accuracy and patience.

What do we want to achieve regarding SPIRIT skill development (student understanding and/or behaviour)?

As a result of this activity, students will be able to:

- Problem-solving: follow a step-by-step recipe plan and solve one setup problem (seal better, clean spill, re-measure) without giving up.
- Valuing people and nature: measure carefully to reduce waste and follow allergy-safe and hygiene routines.
- Connectedness: cooperate in roles (measurer, mixer, checker) and support a teammate when a step is tricky.

Academic/Curriculum Objective connection

Measuring + preparing the experiment environment for cooling/freezing.

Materials and tools needed for implementation

Measuring tools, bowls, whisk/spoon, small and large zip-top bags, ice, salt, towels.

Preparation notes

Picture recipe cards, adult demonstrates sealing, supplies ready per team.

Guided Questions

- "How many spoons/cups did you add?"
- "How can you check if your bag is sealed safely?"
- "What will you do if something spills?"

Stage Debriefing Questions (Optional)

- "What helped your team stay accurate and calm?"

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Tips and Tricks for dealing with stage challenges

- **Challenge:** Measuring confusion.
  Tip: pre-marked scoops or quantity picture cards.
- **Challenge:** Leaks.
  Tip: double-bag the inner bag; do a quick squeeze test over a bowl.

STAGE 3 – Shaking Experiment with Musical Statues (Design and Research)

How does this develop particular SPIRIT skills

- Builds flexibility as teams adjust their method when freezing is uneven (spread thinner, change shaking style, switch roles)
- Strengthens connectedness through fair turn-taking, encouragement, and shared rhythm during the shake–freeze–pass routine
- Sparks curiosity/sense of wonder as students watch the mixture change step-by-step and ask "What's happening now?"
- Develops problem-solving by identifying what isn't working and choosing one improvement to test next.

What do we want to achieve regarding SPIRIT skill development (student understanding and/or behaviour)?

As a result of this activity, students will be able to:

- Flexibility: try a new strategy when the first approach doesn't work well (spread the bag, shake steadier, rotate turns faster).
- Connectedness: take turns fairly, encourage teammates, and follow shared game rules without conflict.
- Curiosity / wonder: describe at least one observed change inside the bag over time (thicker edges, icy bits, softer middle).
- Problem-solving: name one problem (too runny, too cold hands, uneven freezing) and choose one solution to test.

Academic/Curriculum Objective connection

Experience state change and connect it to temperature, movement, and time.

Materials and tools needed for implementation

Prepared bags, towels, music player.

Preparation notes

Practice one round without bags; short music bursts; "gentle scientist shake" demo.

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Guided Questions

- "What do you notice changing inside the bag?"
- "What is one small change your team can try next?"
- "How can you make sure everyone gets a turn?"

Stage Debriefing Questions (Optional)

- "What strategy helped your team most, and why?"

Tips and Tricks for dealing with stage challenges

- **Challenge:** Too wild shaking.
  Tip: model gentle shaking; assign a safety monitor.
- **Challenge:** Cold discomfort.
  Tip: thicker towels, faster rotation, optional observer turn.

STAGE 4 – Tasting, Decorating and Sharing (Analysis and Conclusion)

How does this develop particular SPIRIT skills

- Reinforces valuing people and nature through fair sharing, hygiene, allergy respect, and appreciation of plant-based ingredients
- Builds connectedness by celebrating together, using kind language, and noticing each other's contributions
- Keeps curiosity/sense of wonder alive by connecting the tasty outcome to the scientific change they just observed.

What do we want to achieve regarding SPIRIT skill development (student understanding and/or behaviour)?

As a result of this activity, students will be able to:

- Valuing people and nature: share safely and fairly, follow hygiene rules, and show respect for dietary needs and ingredients.
- Connectedness: say one kind or grateful sentence to a teammate ("Thank you for…") and celebrate team effort.
- Curiosity / wonder: describe the "before and after" change using simple science words (liquid → thicker → ice cream).

Academic/Curriculum Objective connection

Reinforces observation and cause–effect with a real sensory result.

Materials and tools needed for implementation

Toppings, cups/spoons, prompt cards.

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Preparation notes

Hygienic sharing protocols; pre-portion toppings; separate spoons.

Guided Questions

- "How did it change from the start?"
- "What helped it freeze best?"
- "How did your team help each other?"

Stage Debriefing Questions (Optional)

- "What would you try differently next time?"

Tips and Tricks for dealing with stage challenges

- **Challenge:** Texture not perfect.
  Tip: celebrate learning; compare "soft serve" vs. "hard."
- **Challenge:** Cross-contamination risk.
  Tip: single-serve cups/spoons; clear allergy labelling.

STAGE 5 – Reflection and Closure (Further Investigation)

How does this develop particular SPIRIT skills

- Deepens curiosity/sense of wonder by turning the experience into new questions and "next experiments"
- Builds flexibility by helping students think about how they would change their strategy next time
- Develops problem-solving through naming what went wrong/right and choosing one improvement
- Reinforces connectedness by sharing reflections and appreciating teammates' efforts.

What do we want to achieve regarding SPIRIT skill development (student understanding and/or behaviour)?

As a result of this activity, students will be able to:

- Curiosity / wonder: share one new "I wonder…" question about freezing, shaking, or ingredients.
- Flexibility: suggest one strategy change they would try next time and explain why.
- Problem-solving: identify one problem their team faced and describe the solution they used (or would use).
- Connectedness: name one helpful team behaviour they saw and thank a teammate for it.

Academic/Curriculum Objective connection

Encourages further investigation and iteration mindset.

Materials and tools needed for implementation

Reflection sheet or sticky notes; sentence stems.

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Preparation notes

Keep it brief; provide stems: “Next time I would…”, “I noticed…”, “I wonder…”.

Guided Questions

- “What would you change to make it freeze faster?”
- “What problem did you solve today?”
- “What are you still wondering about?”

Stage Debriefing Questions (Optional)

- “What surprised you the most today?”

Tips and Tricks for dealing with stage challenges

- **Challenge:** Kids can’t think of a new idea.
  Tip: offer option cards (time, shaking, spreading).
- **Challenge:** Reflections stay vague.
  Tip: require one skill word in the answer (connectedness / valuing / curiosity / flexibility / problem-solving).

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.