6.2 Soap Bubbles challenge

In this multi-week project, 4th graders act as "community scientists" to solve the challenge of creating long-lasting bubbles. Students develop critical thinking by following the scientific method to test how changing different ingredients affects their results. Teams practice problem-solving and creativity by designing various wands and fixing designs when bubbles pop too early. The project strengthens connectedness and responsibility as students plan a safe and sustainable bubble event for their school community. By analysing their data and trying again, students build resilience and learn that every failed test provides important evidence for improvement.

Basic Information Sheet

Age group	Student number	Duration	Number of stages	Subjects connection and relevance
4th-6th grade students	Whole class (max. 30 students) working in teams	8 sessions of ~45–60 minutes each (over ~3–4 weeks) + community bubble event	8 stages	Science (scientific method, materials, mixtures, variables, data, conclusions) + community/civic engagement (embedded)

STEAM Event Summary

SPIRIT Skill Focus

- Problem-solving
- Curiosity, sense of wonder and openness
- Critical thinking
- Valuing people and nature

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National curriculum Link and Objectives

- Understand and apply the scientific method: observation → question → hypothesis → experiment → analysis → conclusion → iteration.
- Identify and control variables in fair tests (change one thing at a time).
- Collect, record, and interpret empirical data (bubble size, longevity, quality notes, environmental conditions).
- Make evidence-based decisions using comparisons and patterns.
- Plan and implement a real-world outcome for a real audience (school community), including safety and sustainability choices.

Real-world STEAM Connection and Problem definition

Real-world connection (students' perspective):
Scientists don't just "learn facts" - they test ideas, improve designs, and use evidence to make something work better in real life. Bubble makers, engineers, and scientists all need to understand mixtures, materials, and conditions to create strong bubbles that last.

Problem definition (students' perspective, age-specific):
"How can we, as a team of young scientists and community builders, create the best bubble solution and wand to make big, strong bubbles - and share that joy safely and responsibly with our school?"

Materials at a Glance

- Bubble ingredients: dish soap, water (tap or distilled), glycerin and/or corn syrup
- (optional enhancers: cornstarch, gelatin, guar gum - teacher choice)
- Measuring cups/spoons, mixing containers, stirrers
- Wand-making materials: sticks/dowels, wire, straws, string/cotton loops, clothespins, weights
- Data sheets/notebooks (tables + observation notes), clipboards (helpful outdoors)
- Timers/stopwatches; simple "size reference" tools (string circles, meter sticks, chalk circles)
- Safety: goggles, aprons, towels, non-slip mats (if needed)
- Posters/chart paper: hypothesis board, variables board, team roles, timeline, event plan
- Event supplies: signage, distribution trays, cleanup materials, feedback slips/cards.

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Indoor/Outdoor and Classroom layout

Indoor:

- Team tables for planning/research/data work
- Central wall/board: “Science Board” (questions, hypotheses, variables, timeline, roles)

Outdoor (preferred for testing/event):

- Marked “test lanes” or zones (safe spacing, non-slippery surface)
- One station per team: solution container + wand + data recorder spot
- One “wash/cleanup” station

Circle area:

- Quick debrief circles at the end of each session (skills labelling + next steps).

Notes on Research-based approach and integration

In this activity, children are encouraged to explore a familiar, playful phenomenon - soap bubbles - through the lens of real scientific research and a real community purpose. They begin by observing bubbles and wondering why some pop quickly while others float longer, using their own experiences to generate meaningful questions. Then, they apply those ideas to design and test bubble recipes and wands that can create “the best bubbles” for a school event.

This process mirrors a basic research cycle: students observe bubble behaviour, define questions, and create hypotheses about what might improve size and durability (ingredients, ratios, wand shapes, technique, wind/shade). They then test fairly by changing one variable at a time, collect evidence, and analyse patterns before choosing a final solution and design. Finally, they extend their learning by planning and hosting a real bubble event - where they must consider people, nature, safety, and sustainability while adapting in real time.

Because the outcome is joyful and shared with others, the learning becomes more meaningful: students experience that careful thinking, teamwork, and responsibility can create something that benefits their community - not just their own group.

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Lesson Flow Overview (linked to details below)

Stage	Title	Brief Description	SPIRIT Skills	Duration	Link to Details
1st	**Team Building and Framing**	Students play short team challenges to practice cooperation and strategy, then connect these habits to their new mission: becoming "community scientists" who will bring bubble joy to the school	• Connectedness • Problem-solving • Critical thinking • Valuing people Sense of wonder	1 session (45–60 min)	**STAGE 1 – Team Building and Framing**
2nd	**Scientific Method and Research**	Students learn/review the scientific method, explore kid-friendly bubble research, and choose a few testable variables. They write simple hypotheses and agree on fair testing rules.	• Sense of wonder • Critical thinking • Problem-solving • Connectedness • Valuing people and nature	1 session	**STAGE 2 – Scientific Method and Research**
3rd	**Prototyping Solutions and Wands**	Teams mix first recipes and build first wands. They label everything clearly and prepare for fair testing, practicing safe and responsible material use.	• Problem-solving • Critical thinking • Valuing people and nature • Connectedness	1 session	**STAGE 3 – Prototyping Solutions and Wands**
4th	**Testing and Data Collection**	Teams run fair tests outdoors, record bubble size and longevity, and note conditions (wind/shade). They repeat trials and keep roles rotating for accuracy.	• Critical thinking • Problem-solving • Resilience • Connectedness • Sense of wonder	1 – 2 session	**STAGE 4 – Testing and Data Collection**
5th	**Evidence-Based Selection and Planning**	Teams compare results, choose a "final" recipe and wand, and design their bubble booth for the community event with roles, safety, and sustainability in mind	• Critical thinking • Problem-solving • Connectedness • Valuing people and nature	1 session	**STAGE 5 – Evidence-Based Selection and Planning**

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6th	**Rehearsal and Preparation**	Students do a full practice run of the bubble stations, rehearse welcoming visitors and explaining the science, and improve the plan using feedback from the rehearsal.	• Connectedness • Problem-solving • Resilience • Valuing people	1 session	**STAGE 6 – Rehearsal and Preparation**
7th	**Community Bubble Event**	Students host the bubble event for peers/teachers/guests. They manage flow, support visitors, solve problems in real time, and gather feedback respectfully	• Connectedness • Valuing people and nature • Problem-solving • Critical thinking	1 event session	**STAGE 7 – Community Bubble Event**
8th	**Reflection and Celebration**	Students analyse feedback and results, reflect on skills and community impact, and celebrate growth. They identify what they would improve next time and why.	• Critical thinking • Connectedness • Resilience • Sense of wonder • Valuing people and nature	1 session	**STAGE 8 – Reflection and Celebration**

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

- **Challenge:** Too many variables at once → results are confusing.
  Tip: Use a class rule: change ONE thing per test; keep a "variables board" visible.
- **Challenge:** Unequal participation in teams.
  Tip: Use rotating roles (Mixer / Wand Builder / Bubble Blower / Data Recorder / Safety Monitor).
- **Challenge:** Weather (wind/rain) affects testing or event.
  Tip: Have an indoor backup: smaller bubbles with trays + technique testing near open windows, or a sheltered area.
- **Challenge:** Slippery surfaces and safety concerns.
  Tip: Test on safe ground, set boundaries, add cleanup station, and use a "slow walking zone."
- **Challenge:** Teams get disappointed when bubbles fail.
  Tip: Normalize iteration: "failed test = useful evidence." Track "What we learned" each session.

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Difficulty level tailoring notes

- **Beginner learners:** limit to 2–3 recipe options; provide sentence starters for hypotheses and conclusions; teacher provides wand base, students modify.
- **Intermediate:** teams test 1 ingredient variable + 1 wand variable; full data tables; compare patterns.
- **Advanced learners:** add environmental variables (shade/wind) or sustainability focus (eco-friendlier choices, minimal waste plan); create a short "teaching guide" for visitors.

STEAM Program Debriefing and Reflection Questions

- Where did you use critical thinking - what evidence helped you decide?
- When did you need problem-solving, and what strategy worked best?
- How did you show connectedness as a team and as a class community?
- In what ways did you practice valuing people and nature (safety, fairness, care for the space)?
- What gave you the biggest sense of wonder, and what new question do you still have?

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6.2.2. Stage details and Activities Flow

STAGE 1 – Coordinate Plot and Shape Discovery

How does this develop particular SPIRIT skills

- Builds connectedness by creating shared success through teamwork, listening, and trust
- Develops problem-solving as students coordinate actions, plan moves, and adjust strategies together
- Strengthens critical thinking through noticing patterns, predicting outcomes, and reflecting on what caused success
- Reinforces valuing people through respectful turn-taking, encouraging teammates, and fair participation
- Sparks sense of wonder by showing what groups can achieve when everyone contributes.

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: describe how teamwork helped the group succeed and name one supportive behaviour they used (listening, taking turns, encouraging).
- Problem-solving: use a simple strategy (plan → try → adjust) during a team challenge and explain what they changed and why.
- Critical thinking: notice a pattern or "rule" in a game and use it to make a better decision in the next round.
- Valuing people: demonstrate fair participation by sharing roles and speaking respectfully during team decisions.
- 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

Foundations for scientific method habits: observation, planning, teamwork, recording patterns.

Materials and tools needed for implementation

Elastic-band cup pyramid set, cups, nim counters, simple observation sheets.

Preparation notes

Prepare team sets; model rules quickly; keep rounds short; assign rotating roles.

Guided Questions

- "What did your team try first - and what did you change?"
- "What helped everyone stay included?"
- "What patterns did you notice that helped you win?"

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Stage Debriefing Questions (Optional)

- "What made teamwork easier?" "What made it harder?"

Tips and Tricks for dealing with stage challenges

- **Challenge:** One student dominates.
  Tip: role cards + timer turns.
- **Challenge:** Some students stay quiet.
  Tip: sentence starters ("I noticed…", "I suggest…") + assign a "voice-caller" role.

STAGE 2 – Measure and Calculate Lengths (Scale Plan)

How does this develop particular SPIRIT skills

- Strengthens sense of wonder by turning curiosity ("Why do bubbles pop?") into testable questions
- Builds critical thinking by comparing sources/recipes and deciding what seems most reliable or logical
- Develops problem-solving as teams choose a fair test plan and select variables that can actually be tested
- Builds connectedness through shared discussion, negotiation, and joint decision-making
- Supports valuing people & nature by considering safety, cleanliness, and responsible ingredient use.)

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:

- Sense of wonder: generate at least one "I wonder…" bubble question and turn it into a testable question.
- Critical thinking: compare two recipe ideas and explain which seems more promising and why (based on reasons, not guessing).
- Problem-solving: choose one variable to change and one thing to keep the same for a fair test.
- Connectedness: reach a group agreement by listening, voting, or combining ideas respectfully.
- Valuing people and nature: identify at least one safety/sustainability rule for ingredients and cleanup.

Academic/Curriculum Objective connection

Scientific method: question, hypothesis, variable identification; research literacy.

Materials and tools needed for implementation

Devices/printouts, scientific method poster, hypothesis worksheets, "variables board."

Preparation notes

Curate kid-friendly sources; provide a comparison template; set a time limit for research.

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Guided Questions

- "What do you think makes bubbles stronger?"
- "Which ingredient or wand feature will you test first - and why?"
- "How will you make sure your test is fair?"

Stage Debriefing Questions (Optional)

- Which hypothesis are you most excited to test?"

Tips and Tricks for dealing with stage challenges

- **Challenge:** Too many ideas at once.
  Tip: limit to 1–2 variables per team.
- **Challenge:** Copying random online recipes.
  Tip: require a "because…" reason for each choice.

STAGE 3 – Prototype Solutions and Wands

How does this develop particular SPIRIT skills

- Develops problem-solving through careful measuring, mixing, labelling, and building workable tools
- Strengthens critical thinking as students connect hypotheses to specific design/ingredient choices
- Reinforces valuing people & nature through safe handling, minimizing waste, and choosing materials responsibly
- Builds connectedness through shared roles and coordinated teamwork.

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 mixing plan and correct mistakes (wrong amount, missing label) using checks.
- Critical thinking: explain how their recipe/wand choice matches their hypothesis ("We chose X because we think it will…").
- Valuing people and nature: demonstrate safe, careful use of materials and follow cleanup rules to protect people and the environment.
- Connectedness: collaborate in roles so the team completes a prototype with shared contribution.

Academic/Curriculum Objective connection

Experiment setup: controlled mixtures, tool design, preparation for fair testing.

Materials and tools needed for implementation

Ingredients, measuring tools, containers, wand supplies, labels, aprons/goggles.

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Preparation notes

Safety briefing; label stations; provide a “standard solution” backup.

Guided Questions

- “How will you measure accurately?”
- “How will you label your recipe so it’s repeatable?”
- “What part of the wand might affect bubble size?”

Stage Debriefing Questions (Optional)

- “What surprised you while making your prototype?

Tips and Tricks for dealing with stage challenges

- **Challenge:** Messy stations and wasted materials.
  Tip: a “materials monitor” role + measured ingredient trays.
- **Challenge:** Wands don’t hold film.
  Tip: add string loop / adjust shape / slow dip technique.

STAGE 4 – Testing and Data Collection (1–2 sessions)

How does this develop particular SPIRIT skills

- Strengthens critical thinking by collecting evidence, spotting patterns, and comparing results fairly
- Develops problem-solving through controlled changes and improvements based on data
- Builds resilience by normalizing failed trials and encouraging calm iteration
- Reinforces connectedness through shared roles, shared sense-making, and respectful disagreement
- Keeps sense of wonder alive through direct observation of surprising results and “What if?” questions.

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:

- Critical thinking: record consistent data across repeated trials and identify at least one pattern from results.
- Problem-solving: change one variable at a time and use results to decide the next test.
- Resilience: respond to failed bubbles by trying again with a new strategy (technique, wand adjustment, or recipe tweak).
- Connectedness: rotate roles and collaborate to keep testing fair and organized.
- Sense of wonder: ask at least one new question based on what they observe during testing.

Academic/Curriculum Objective connection

Analysis phase: evidence-based reasoning, fair testing, repeated trials.

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Materials and tools needed for implementation

Data charts, timers, size reference circles, wind/shade log, clipboards.

Preparation notes

Mark test zones; demonstrate “one variable rule”; model one clean data entry.

Guided Questions

- “What variable are you changing today?”
- “What stayed the same to keep the test fair?”
- “What does your data suggest you should try next?”

Stage Debriefing Questions (Optional)

- “Did your evidence match your hypothesis? What might explain it?”

Tips and Tricks for dealing with stage challenges

- **Challenge:** Students change multiple variables.
  Tip: a “fair test checker” role + checklist before each trial.
- **Challenge:** Data gets inconsistent.
  Tip: standardize: same blower, same dip time, same count method.

STAGE 5 – Selection and Project Planning

How does this develop particular SPIRIT skills

- Builds critical thinking by choosing final designs based on evidence (not favourites)
- Develops problem-solving through logistical planning, prioritizing resources, and anticipating problems
- Strengthens connectedness by coordinating roles and aligning the team around a shared community goal
- Reinforces valuing people and nature by planning for visitor needs, safety, inclusion, and cleanup.

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:

- Critical thinking: justify their final choice using evidence from data (“We chose this because…”).
- Problem-solving: create a realistic event plan with roles, materials list, and simple timeline.
- Connectedness: assign roles fairly and describe how teamwork will help the event run smoothly.
- Valuing people and nature: include at least two safety/sustainability actions in the plan (e.g., safe zones, cleanup, minimal waste).

Academic/Curriculum Objective connection

Conclusion + application: using evidence to decide and planning for real-world implementation.

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Materials and tools needed for implementation

Planning templates, poster paper, markers, role cards, checklist.

Preparation notes

Provide example booth layout; prompt “audience empathy” (younger kids, adults, accessibility).

Guided Questions

- “What does your evidence say is best?”
- “Who is your audience and what do they need?”
- “What could go wrong - and what’s your backup plan?”

Stage Debriefing Questions (Optional)

- “Does everyone understand their role and why it matters?”

Tips and Tricks for dealing with stage challenges

- **Challenge:** Arguments over “best.”
  Tip: use a data rule: choose based on agreed criteria (size + longevity + ease + safety).
- **Challenge:** Over-ambitious plans.
  Tip: “Must-have / nice-to-have” planning.

STAGE 6 – Rehearsal and Preparation

How does this develop particular SPIRIT skills

- Builds resilience by using rehearsal feedback to improve rather than feeling discouraged
- Strengthens connectedness through coordinated practice and support for anxious teammates
- Develops problem-solving by finding fixes for setup issues, timing, and visitor flow
- Reinforces valuing people through practicing welcoming language and inclusive facilitation

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:

- Resilience: accept feedback and make at least one improvement to their setup or plan.
- Connectedness: support teammates through role practice and shared responsibility during the dry run.
- Problem-solving: identify one likely event problem (spills, crowding, wand breaks) and practice a solution.
- Valuing people: rehearse respectful welcoming and clear instructions so visitors feel safe and included.

Academic/Curriculum Objective connection

Preparation + reflection: applying learning, improving communication and procedures.

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Materials and tools needed for implementation

Final recipe cards, station signs, visitor script cards, feedback slips, “fix kit.”

Preparation notes

Simulate challenges intentionally (wind, too many visitors, spilled tray) to practice responses.

Guided Questions

- “What will you say to visitors first?”
- “How will you keep the area safe?”
- “What will you do if something breaks or spills?”

Stage Debriefing Questions (Optional)

- “What did you change after rehearsal - and why?”

Tips and Tricks for dealing with stage challenges

- **Challenge:** Students feel shy.
  Tip: pair ambassadors; allow a “co-speaker” role; use sentence starters.
- **Challenge:** Setup takes too long.
  Tip: timed practice + simplified layout.

STAGE 7 – Community Bubble Event

How does this develop particular SPIRIT skills

- Strengthens connectedness by creating shared joy and positive relationships across the school
- Reinforces valuing people and nature through safe hosting, fairness, care for space, and respectful interaction
- Develops problem-solving through real-time adaptation (wind, crowds, spills, tired arms)
- Builds critical thinking by reading audience needs and adjusting instructions and flow appropriately.

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: welcome visitors and create a cooperative, joyful experience that feels shared and inclusive.
- Valuing people & nature: demonstrate safety, fairness, and responsibility for the environment during the event.
- Problem-solving: handle at least one unexpected issue calmly using a planned strategy.
- Critical thinking: adjust the booth experience based on visitor feedback or observations (pace, explanation, setup).

Academic/Curriculum Objective connection

Real-world application: science + civic engagement + responsible practice.

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Materials and tools needed for implementation

Event-ready solutions, wands, signage, feedback tools, cleanup supplies.

Preparation notes

Coordinate schedule; have a weather plan; assign “floaters” to help any booth.

Guided Questions

- “How will you welcome and guide visitors?”
- “How will you keep the space safe?”
- “What feedback are you hearing?”

Stage Debriefing Questions (Optional)

- “What went well - and what did you solve in the moment?”

Tips and Tricks for dealing with stage challenges

- **Challenge:** Crowd control.
  Tip: simple queue system + roles (welcomer, helper, safety monitor).
- **Challenge:** Wind ruins bubbles.
  Tip: move to sheltered spot + adjust technique/wand.

STAGE 8 – Reflection and Celebration

How does this develop particular SPIRIT skills

- Strengthens critical thinking by reflecting on evidence, feedback, and what caused success
- Builds resilience by framing mistakes and changes as growth and learning
- Deepens connectedness by telling the shared story and appreciating contributions
- Reinforces valuing people & nature by reflecting on responsibility and impact
- Revives sense of wonder by recognizing how science + teamwork created something meaningful.

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:

- Critical thinking: explain what worked best and why, using both data and event feedback.
- Resilience: identify one challenge they faced and describe how they improved or adapted over time.
- Connectedness: recognize and appreciate at least one contribution from a teammate or another group.
- Valuing people and nature: describe how they kept others safe and cared for the environment during the project.
- Sense of wonder: share one new science question they want to explore next about bubbles, mixtures, or materials.

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Academic/Curriculum Objective connection

Completes the scientific cycle: conclusions, reflection, and “further investigation.”

Materials and tools needed for implementation

Feedback summaries, reflection prompts, celebration tokens/badges, class “lessons learned” poster.

Preparation notes

Compile visitor feedback; prepare sentence stems; celebrate both results and skills growth.

Guided Questions

- “What surprised you most?”
- “What did your evidence and feedback teach you?”
- “How did your team support others - and the school community?”

Stage Debriefing Questions (Optional)

- “What would you change next time, and what would you keep?”

Tips and Tricks for dealing with stage challenges

- **Challenge:** Only a few students share.
  Tip: think–pair–share first; allow written reflections.
- **Challenge:** Reflections stay “surface level.”
  Tip: require one skill word in every answer (connectedness, valuing, critical thinking, problem-solving, wonder).

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