Rainflower

L.E.A.P.

A youth research vision

From curiosity to evidence—and from evidence to solutions

THE RESEARCH PROMISE

Learn what matters. Experiment carefully. Analyze local evidence. Pilot solutions that can improve real lives.

White paper for Rainflower student researchers

First cohort • 2026

“When it rains, the flower blooms.”

rainflower.world

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The Rainflower research vision

Rainflower invites young people to study one of the most important resources in their lives: water. The goal is not simply to memorize facts. It is to notice local conditions, ask useful questions, collect dependable information, interpret what that information means, and build solutions worth testing.

LEAP IS A CYCLE

A pilot creates new questions. Those questions lead to more learning, better experiments, stronger analysis, and improved pilots.

What L.E.A.P. means

L — Learn Understand water use, rainfall, conservation, access, and community needs. **E — Experiment** Use a repeatable method to measure or test something in the real world. **A — Analyze** Turn observations, measurements, images, and stories into defensible evidence. **P — Pilot** Design, build, deploy, and evaluate a small solution before attempting a larger one.

A shared research journey

Each student may begin with a different home, building, street, or city. LEAP gives everyone a common method. This makes it possible to compare findings across neighborhoods and regions of Bangladesh and, as the program grows, across countries. A single observation may be interesting; many consistent observations can reveal patterns.

What makes the work research?

- A clear question that can be investigated.
- A method another researcher could understand and repeat.
- Honest records—including unexpected or incomplete results.
- Evidence that supports a conclusion without exaggeration.
- Reflection on limitations and what should be studied next.

Supervision, consent, and research ethics

Rainflower research is conducted by students in grades 9 through 12, much of it in homes, streets, and neighborhoods where people live. Every researcher therefore works inside a supervision structure. No student conducts field work alone, unannounced, or without permission.

How Rainflower is organized

Rainflower runs on four layers. Direction and method flow down; evidence, questions, and field reality flow back up. A student is never more than one step from an adult who knows their work.

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Founder and lead researcher Ethan Kabir — 11th grade, Rocklin High School, California	Sets research direction, maintains the LEAP method, and is accountable for the project as a whole.	
Advisors	Academic, technical, business, and government-agency experts worldwide	Review methods, mentor on domain questions, and test whether findings hold up to outside scrutiny.
Coordinators	Professional teachers, computer engineers, and MSc students across Bangladesh	Lead a regional group, approve field activity before it begins, and review every submission.
Student researchers	Grades 9 through 12	Ask the questions, collect the evidence, and produce the findings the project exists to create.

Advisors are deliberately drawn from more than one world. An academic can challenge a method, an engineer can challenge a device, someone from industry can challenge whether a solution can be sustained, and an agency expert can say whether a finding is one a public body would act on. A student researcher reaches them through their coordinator.

Safeguards that apply to every study

Assignment	Every student belongs to a named coordinator before any data is collected. Unassigned work is not part of the record.

Parental agreement Every participant under 18 completes a digital permission agreement signed by a parent or guardian.

Approval first A coordinator approves the plan — households, locations, timing — before field work begins.

Escalation Any unsafe condition, refusal, dispute, or unexpected risk goes to the coordinator the same day. Stopping work is always an acceptable decision.

Working with people and their homes

- Before asking any survey question, explain who you are, what Rainflower is, and how the information will be used.
- Anyone may decline or stop at any time. Record a refusal as a refusal, never as missing data or an estimate.
- Do not record names, house numbers, phone numbers, or exact addresses. Report location by neighborhood or general area.
- Photograph conditions, not people. Do not photograph identifiable faces without explicit permission, and do not photograph other children.
- Do not enter private property without an invitation from an adult resident, and tell your coordinator where you are working before you go.

CONSENT IS ONGOING

Permission to ask a question is not permission to publish a photograph. Ask for each, and honor a change of mind.

Water is research material until it is proven otherwise

Rainflower exists to help communities reach clean drinking water, which makes it especially important that no one treats a research device as a drinking source. Water collected by a pilot unit is evidence to be measured, not water to be consumed, until it has been tested and cleared by a coordinator or advisor. Report contamination, insects, odor, or discoloration rather than emptying a tank and moving on—the failure is itself a finding.

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LEARN

Understand the system before trying to change it.

Example: household water consumption survey

Students can conduct a simple survey in their own home, apartment building, and neighborhood. The

purpose is to understand how families obtain and use water, how much drinking water they consume, and what other daily activities depend on water.

Possible research questions

- How much drinking water does a family consume each day?
- How does consumption change with household size, weather, or season?
- What are the largest non-drinking uses—cooking, washing, bathing, cleaning, gardening, or sanitation?
- Where does the water come from, and is it treated, filtered, boiled, purchased, or stored? Where do families believe water is wasted or could be conserved?

A simple method

1. Define Choose the households, time period, and exact questions before collecting answers.

2. Ask Request permission and record answers consistently. Do not collect names unless necessary.

3. Estimate Use liters or another common unit. Explain how estimates were made. **4. Compare** Calculate per-person use and compare household patterns.

5. Reflect Identify what remains uncertain and what a better follow-up survey should ask.

ILLUSTRATIVE FINDING

"Among 12 participating households, drinking water use averaged 2.1 liters per person per day. Cooking used more water than respondents initially expected."

This example is not a result to copy. It shows the difference between a general impression and a specific, bounded finding. Students must report what their own evidence supports.

Expected researcher output

A short survey summary, anonymized data table, one or two charts, key findings, limitations, and one new question.

EXPERIMENT

Measure carefully so observations can be compared.

Example: neighborhood rainfall measurement

Rainflower provides rainfall-measurement devices and a common reporting method. Young researchers install a device in a suitable open location, observe rainfall, and submit daily or weekly reports. When many students follow the same method, the community can study differences among neighborhoods and cities.

What students are investigating

- How much rain falls at the measurement location?
- How often does rainfall occur, and how long do wet periods last?
- Do nearby Rainflower stations record similar totals?
- How do local observations compare with public weather estimates?

Good experimental practice

Placement Use open sky exposure. Avoid roof runoff, trees, walls, splashing surfaces, and sprinklers.

Timing Read and reset the device at a consistent time. Record missed readings honestly. **Units** Report rainfall in millimeters and use the same precision throughout the study.

Metadata Record date, time, location area, season or monsoon phase, device condition, and unusual circumstances.

Quality check Repeat questionable measurements; never change a value merely because it looks unusual.

SAMPLE WEEKLY OBSERVATION

“Our station recorded rain on four of seven days. The largest 24-hour total was 38 mm. A nearby station reported 35 mm, suggesting a shared event with some local variation.”

Expected researcher output

A measurement log, weekly summary, basic chart, brief comparison with nearby observations, and notes about placement or device limitations.

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ANALYZE

Develop evidence, find patterns, and explain what the evidence can—and cannot—show.

Example: a photo record of local rainfall impact

Students can publish a carefully documented set of five to ten photographs showing how rainfall affects their neighborhood. Possible subjects include standing water, blocked drains, erosion, roof runoff, unsafe walking conditions, traffic disruption, damaged roads, water entering homes, or areas where drainage works well.

A photograph becomes evidence when it has context

Where? Neighborhood or general location—without exposing a private address. **When?** Date, approximate time, and relationship to the rainfall event.

What? A factual description of what is visible.

Why relevant? The connection to drainage, safety, collection, access, or another research question. **What is unknown?** What the image alone cannot prove.

From observation to analysis

Suppose five photographs show water accumulating near drains. The responsible conclusion is not automatically “the drains caused flooding.” The images may support a narrower statement: water accumulated near several drain locations after heavy rain, and some openings appeared obstructed. Confirming the cause may require rainfall measurements, repeated visits, interviews, or drainage inspection.

EVIDENCE RULE

Describe first. Compare second. Explain third. Claim only what the evidence supports.

Expected researcher output

A five-to-ten-image evidence story with captions, a pattern summary, at least one alternative explanation,

limitations, and a recommendation for the next investigation.

Example: a water source and handling record

A second Analyze project studies the water itself. Students record where household drinking water comes from, how it is carried and stored, and what treatment it receives before anyone drinks it. Where test kits and coordinator

supervision are available, simple field measurements can be added. The discipline this project teaches is knowing exactly what a measurement proves.

Source and handling How water is obtained, transported, stored, and treated. This describes practice, not water quality.

Clarity and odor Visible particles, color, or smell can flag a problem worth investigating. Clear, odorless water can still be unsafe.

Simple field tests Measurements such as pH, temperature, or dissolved solids describe general character. They do not certify that water is drinkable.

Laboratory testing Only an accredited laboratory can determine whether water meets a drinking-water standard. Report the lab, method, and date alongside any result.

Chain of custody Record who collected the sample, when, in what container, and how long before it was tested. Without this, a result cannot be interpreted.

A LIMIT WORTH STATING

No student measurement should ever be reported as proof that water is safe to drink. Report what was measured, by what method, and what remains unknown.

This project also asks students to notice what households already do—boiling, filtering, purchasing, covering a stored container—and what makes those practices easy or difficult to sustain. A solution that ignores existing habits rarely survives contact with daily life.

Expected researcher output

A source-and-handling table for the participating households, a summary of what was measured and by what method, an explicit statement of what the evidence cannot establish, and one recommendation for further testing.

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PILOT

Build small, test safely, learn quickly, and improve.

Example: the Rainflower smart collection network

The namesake Rainflower pilot is a smart, flower-like device designed to collect rainwater. Multiple devices can work together through a mother–child network: a mother unit coordinates sensing, decisions, or reporting, while child units perform local collection and communicate their status.

The pilot idea

Sense Detect rain, water level, and relevant environmental conditions. **Respond** Open or activate collection behavior when conditions are suitable. **Collect** Guide rainwater into a protected storage path.

Coordinate Share status among mother and child units.

Report Record performance so researchers can evaluate the design.

Questions the pilot must answer

- How reliably does the device detect rain and activate?

- How much water can it collect during different rainfall events?
- What happens during high wind, debris, power loss, or a full tank?
- Can child units communicate reliably with the mother unit?
- Is collected water protected from contamination, and what uses are safe?
- What design changes improve reliability, safety, cost, and maintainability?

A PILOT IS NOT THE FINAL PRODUCT

Its purpose is to expose assumptions, generate performance evidence, and guide the next design.

Students may contribute to mechanical design, electronics, programming, environmental sensing, data analysis, field testing, safety review, documentation, and community feedback.

How the four stages connect

LEAP is strongest when the output of one stage becomes the input of the next.

Learn → Experiment A water-use survey reveals questions that require measurement. **Experiment → Analyze** Rainfall logs become a dataset for comparing locations and events. **Analyze → Pilot** Evidence of runoff or drainage problems informs a solution worth testing. **Pilot → Learn again** Pilot results reveal new needs, assumptions, and research questions.

One possible student journey

A student learns that several households buy drinking water but allow roof runoff to drain away. The student then measures neighborhood rainfall for six weeks. After comparing totals with photographs of runoff and standing water, the student analyzes where collection might be practical. Finally, the student helps test a Rainflower pilot, measures collected volume, documents failures, and recommends improvements.

Standards for every Rainflower researcher

- Accuracy: record what happened, not what you hoped would happen.
- Consistency: follow the agreed method and units.
- Transparency: disclose missing data, uncertainty, and limitations.

- Respect: obtain permission for surveys and avoid identifying people without consent.
- Safety: do not work in lightning, floodwater, traffic, unstable structures, or unsafe rooftops. Water safety: never drink, cook with, or distribute collected water that has not been tested and cleared by a coordinator or advisor.
- Stewardship: protect equipment, data, participants, and the environment.
- Collaboration: share methods and findings so others can learn and verify.

RESEARCH INTEGRITY

An unexpected result is valuable. A hidden, altered, or invented result is not research. An

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What success looks like

Success is not measured only by the number of surveys, rainfall readings, photographs, or devices. It is measured by the quality of the questions, the care used to collect evidence, the honesty of the analysis, and the usefulness of what the community learns.

For an individual researcher

- I can explain the question I investigated and why it matters.
- I can describe my method clearly enough for another student to repeat it.
- I can separate observation from interpretation.

- I can support my conclusions with evidence.
- I can identify limitations and propose a useful next step.

For the Rainflower community

- Comparable local data from many neighborhoods.
- A growing evidence record of rainfall, water use, and rainfall impact.
- Youth researchers who can collaborate across locations and disciplines.
- Pilot solutions shaped by real needs and evaluated with real evidence.
- Open knowledge that can help communities conserve water and adapt to rainfall.

THE INVITATION

Begin where you live. Ask one clear question. Collect one trustworthy piece of evidence. Share what you learn. Then take the next LEAP.

Closing perspective

Rainflower begins with rain, but its larger purpose is to cultivate researchers: young people who observe closely, reason carefully, build courageously, and work together on problems that matter. Through LEAP, students move from understanding the world to improving it.

Learn • Experiment • Analyze • Pilot

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