GONZAGA Science in Action!

Annual Report

2018-2019

Table of Contents

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I. Executive Summary

The Gonzaga *Science in Action!* Program (*SIA!)* is celebrating its 12th year of science outreach to the Spokane community. The *SIA!* Program serves the local community through our **Science Education Programs** (such as *SIA!* In The Classroom and Afterschool) and additional **Community Outreach** (such as participating in school STEM nights or science fairs). This year, we had 143 volunteers, who completed 2,820 hours of service in 38 classrooms and 3 afterschool groups, reaching 926 K-6 students. We served an additional 850+ students through our Community Outreach efforts. A new branch of *SIA!* was also started in Baltimore, Maryland by GU alum and current Johns Hopkins graduate student Chad Hicks.

This report provides a detailed summary of the activities, service hours, volunteers, local schools and classrooms served, and community outreach events performed by *SIA!* during the 2018-2019 academic year.

II. Vision Statement

We envision that all students, no matter their background, will be truly engaged in science early on in their education. We envision a world in which everyone understands that science is a way of thinking, a strategy to figure out how something works (whether it is a machine or a muscle fiber), and that science is a tool that, in the end, will enable us to make our world a better place.

III. Mission Statement

Gonzaga University (GU) is committed to building partnerships within the local community and creating an education community that prepares its students for lives of leadership and service for the common good. Honoring these Jesuit traditions, *Science in Action!* is an outreach effort through the Biology and Chemistry & Biochemistry departments that partners with students, faculty and staff and aims to promote enthusiasm of STEM (Science, Technology, Engineering, and Math) subjects and scientific literacy for young minds within our local community.

The goals of *Science in Action!* are to: (1) Cultivate K-6 student curiosity in science, knowledge in science, and overall scientific literacy; (2) Recruit science majors into the teaching field; (3) Help pre-service teachers develop confidence in their abilities to teach science by providing them with a toolkit of science exercises and activities and a real world setting to test teaching strategies; (4) Provide additional resources to our partner teachers and schools to help them teach science.

IV. Support and Staff

Science in Action! is currently made possible through support from the Biology and Chemistry & Biochemistry Departments at Gonzaga University as well as the Robert and Claire McDonald Work-Award Program. *SIA!* has a full-time Science Outreach Coordinator (Jiana Stover, M.S.) and a staff of 5 part-time student employees. This year we also partnered with the Clean Energy Institute (CEI) at the University of Washington, Seattle to expand community awareness and knowledge of solar energy technology. Past support for *SIA!* has included: Howard Hughes Medical Institute through the Undergraduate Science Education Program, George Luger, Avista Foundation, Hollister-Stier, Rotary Club 21, Washington STEM, and Itron.

V. Science Education Programs

The primary outreach offered through *Science in Action!* occurs through our **Science Education Programs.** Currently, we have two main Science Education programs: *Science in Action!* In The Classroom and Afterschool and Bringing Research Into Classrooms (BRIC). A summary and description of each of these programs is provided in the sections below.

Science in Action! In the Classroom & Afterschool

The original and longest running component of *Science in Action!* is our In The Classroom initiative. In the spring of the 2017-2018 academic year, we expanded this program to begin serving After-School programs as well.

Figure 1. An *SIA!* volunteer assists students in Tiffiny Santos' 3rd grade class at Westview Elementary with their "Shrink the Skittle" experiment

The *SIA!* In The Classroom & Afterschool is a program that pairs groups of GU undergrads with local K-6 classrooms or Express Afterschool groups in the Spokane Public School (SPS) district to teach eight hands-on, inquiry-based science lessons over the course of the semester. Students from all majors and disciplines apply to volunteer and local K-6 teachers and afterschool leaders apply to participate each semester. Students complete 20 hours of service that involves weekly workshops to plan and practice the lesson and then go and teach the lesson in the classroom.

Table 1. Summary Statistics for the *SIA!* In The Classroom Program for 2011-2019

	Fall 2018	Spring 2019	Annual Total	2008-Present
GU Volunteers	74	70	143	1,032
Volunteer Hours Completed	1,480	1,340	2,860	20,640
Local Teachers Served	21	16	37	389
Afterschool Groups Served	0	3	3	5*
Number of K-6 Students	450	476	926	8,713

**Only began serving afterschool groups in Spring 2018*

Since the inception of *Science in Action!* in 2008, volunteer participation has steadily grown each academic year (See Figure 1 below for a summary of the statistics on *SIA!* volunteers). *SIA!* is currently serving 70+ volunteers per semester from a range of academic disciplines, including those seeking a teaching certification (Pre-service or Masters in Teaching).

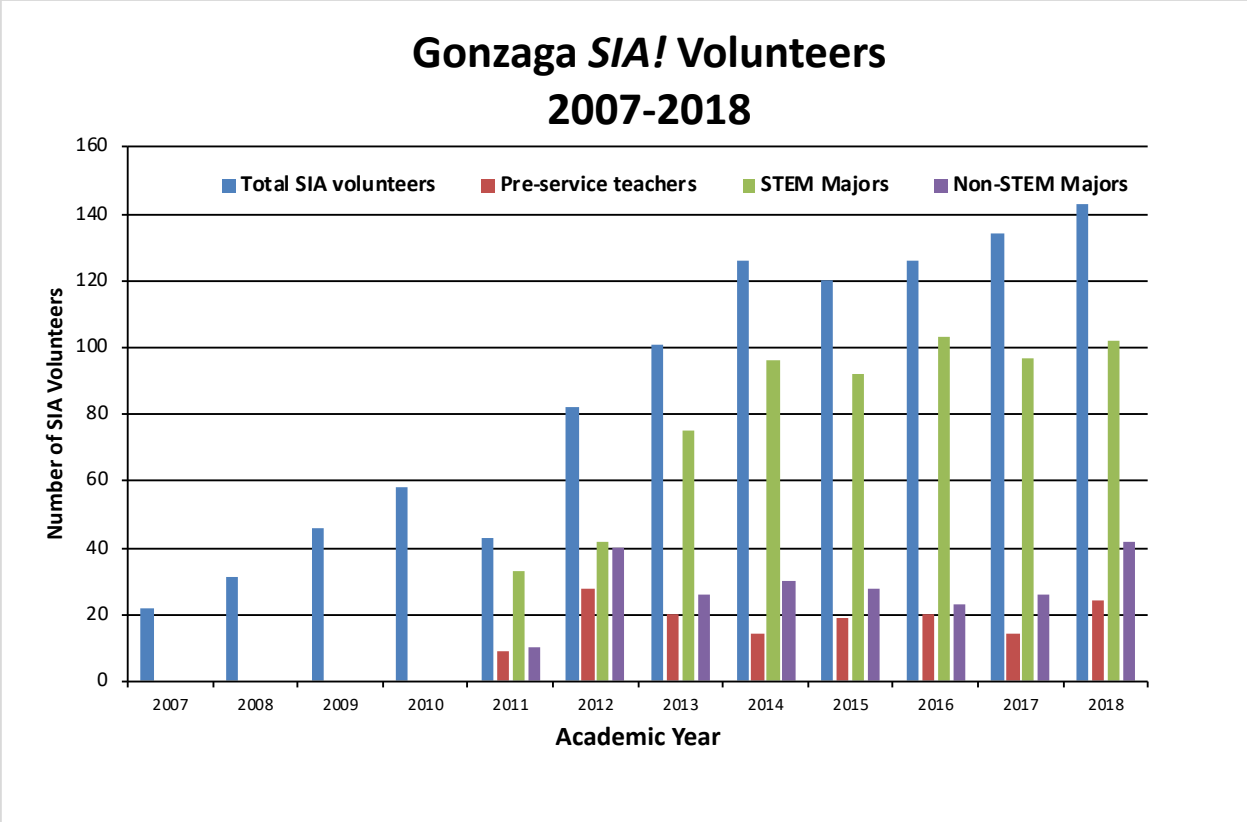


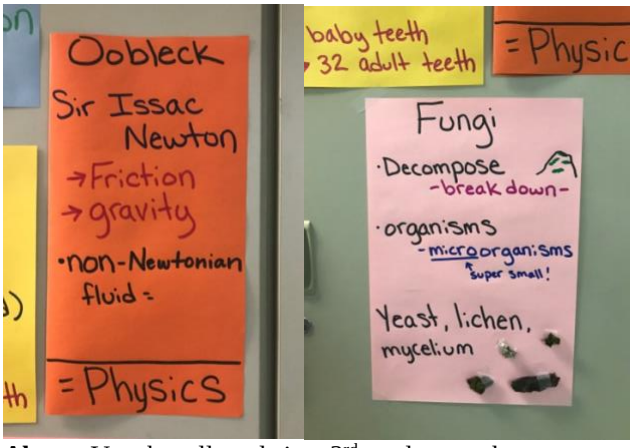
Figure 2. Graph showing an historical overview of data on *Science in Action!* volunteers.

Each semester, lesson plans are chosen to match the curricula and skills of each grade level and also to align with the Next Generation Science Standards (when possible) for that grade. Each science lesson contains key vocabulary and inquiry-based activities where students are able to explore the themes and science of the activity. Below (Figure 3) are a few examples that show our In The Classroom Program in action.

Schools Served During the 2018-19 Academic Year

During the 2018-2019 academic year, *SIA!* served the following Spokane Public Schools in Fall 2018: Cooper, Holmes, Grant, Franklin, Westview, and Mullan Road Elementary as well as the Salish School of Spokane and the Spokane International Academy. In Spring 2019 we served: Longfellow, Grant, Holmes, Stevens, Arlington, Roosevelt and Cooper Elementary, the Salish School of Spokane, and served Whitman, Longfellow, and Westview Elementary afterschool programs.

Above: Students in a 3-6th grade class working on an Earthquake Engineering challenge at the Salish School



Above: Vocab wall made in a 3rd grade over the course various *SIA!* ITC lessons

Above: Fungi growth experiment plates from various 4th grade classes

Above: A student in a 3rd Grade learns about density and experiments with how to get an egg to float

Figure 3. Selected Photos from classroom activities during the 2018-19 academic year

Bringing Research Into Classrooms (BRIC)

Drawing upon the myriad scientific resources at Gonzaga, the BRIC program encourages science enthusiasm and literacy by connecting students in local schools to GU science faculty and their exciting scientific research. This year, *SIA!* partnered with Dr. John Orcutt on a Fossil Day event

and also with Dr. Betsy Bancroft and her research students on the creation of new curriculum for our *SIA!* In The Classroom & Afterschool program based on their research on local invasive species.

Fossil Day

SIA! teamed up with professor Dr. John Orcutt (GU Department of Biology) to host a Fossil Day event in the GU Biology Department for all the students of the Salish School of Spokane.

Left: *SIA!* Outreach Coordinator Jiana Stover, M.S. helps students explore trilobite fossils. **Right:** Dr. John Orcutt explains regional geologic history and his research and shows students a display case containing some of the regional Northwest fossils he has collected.

Left: A 3rd-6th class student enthusiastically holds up a crinoid calyx she is investigating. **Right:** A 7th-12th class student enjoys the beauty of a agatized ammonite fossil.

Invasive Species Lesson Plan

As part of our BRIC initiative, *SIA!* partnered with Dr. Betsy Bancroft (GU Biology Department) and her team of research students to create a new ecology lesson based on their research of the effects of local aquatic invasive species. This partnership also helps local Spokane students understand and connect to their local environment through the inclusion of "place-based knowledge." The lesson was tested in two 1st grade classes at Libby School in Spokane which reached **50** students and will be as part of our regular curriculum in our ITC-AS Program.

Three students from the lab, which studies how the invasive Brook stickleback fish affects the population of native Long toed salamander. The lesson plan included an engagement activity that taught students generally about food chains and food webs, and then an experiment where they modeled the effect an invasive species can have on a native species by altering the food web in an ecosystem and through direct competition.

Left: Invasive "Brook Stickleback" (*Culaea inconstans*). **Right:** Native Long toed Salamander larvae (*Ambystoma macrodactylum*).

Johns Hopkins University *Science in Action!* Program

During the fall of 2018, Gonzaga University alum and *SIA!* volunteer Chad Hicks (Biochemistry '18) contacted the Gonzaga *SIA!* Program with an interest in starting a branch of *Science in Action!* at his current institution of Johns Hopkins University (JHU) where he is a graduate student. He and several fellow graduate students successfully began working with several classrooms at William Paca Elementary School in Baltimore, Maryland which is also close their JHU campus.

More information on Chad Hicks and his efforts can be found in this Gonzaga article here: https://www.gonzaga.edu/news-events/stories/2019/2/19/alumnus-chad-hicks-takes-science-in-action-to-baltimore. Gonzaga *SIA!* Science Outreach Coordinator, Jiana Stover, has been working closely with Hicks and his group over the course of 2018-2019 and assisting with providing lesson plans, troubleshooting, and giving guidance and direction on how to successfully implement a science outreach program. Since beginning in 2018, Hicks and his group have already successfully garnered official recognition as a club at Johns Hopkins and hope to continue expanding their efforts.

Left: JHU grad student teaching a lesson about density in a 5th grade class in Baltimore, MD. **Right:** Two 5th grade students are preparing their solution to extract DNA from strawberries.

VI. Community Outreach

Each year, *Science in Action!* also performs additional community outreach whenever possible. Activities range from school science fairs or science nights, science demonstrations at local events, and more. Community outreach events from the 2018-2019 year are detailed below.

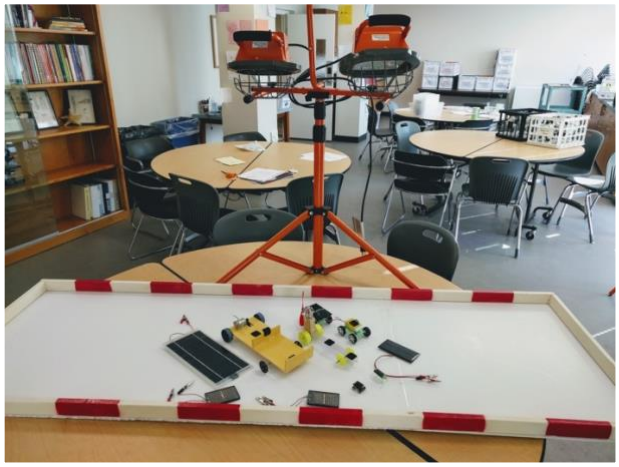
Gonzaga University Center for Community Engagement

One of our largest community outreach efforts is partnering with the Gonzaga Center for Community Engagement (CCE) for their Fall Festival and Spring Carnival events. These events are held at Gonzaga and serve the students in the CCE SMILE Program, a mentoring program for K-6 students at local elementary schools (schools located close to GU that serve predominately low-income students). During the Fall Festival, *SIA!* served approximately **390 SMILE students** a rocket science lesson and provided a hands-on alka-seltzer rocket activity at our station. During the Spring Carnival event, *SIA!* served approximately **350 SMILE students** a lesson about food webs and ecosystems and provided a fun ocean ecosystem and ocean pollution game at our station.

Left: A SMILE participant getting help setting up an alka-seltzer rocket from an *SIA!* volunteer at Fall Festival. **Right:** A SMILE participant collecting "zooplankton" in our ocean food webs and plastic pollution game at Spring Festival.

Solar Car Racing & Solar Energy Lessons

In March of 2019, *Science In Action!* received a solar car racing and energy kit from the **Clean Energy Institute** at the University of Washington, Seattle for the purpose of advancing education to the public about sustainable energy and the science and engineering behind developing these technologies (more info on CEI can be found here: https://www.cei.washington.edu). The kit includes various types of solar panels (representing different technologies), a race track, 500-watt halogen lights (in the case of doing the activity indoors), various car bodies with leads and various solar panels to connect to the cars.



Left: Small sampling of solar car racing components: one 500-watt light, race track, examples of car bodies, and some solar cells. **Right:** Seven different types of solar panels with leads that can be used for education and testing.

Above: 2018-2019 *SIA!* Staff after completing training on the new solar lesson kit.

Since receiving the kit, *SIA!* has performed several outreach events:

- ***March for Science Spokane May 4th Science Event***
  SIA! brought our solar kit to the March for Science event and served **30 children and adults** with a hands-on, inquiry-based solar car racing activity (which solar panel can power each car body? Connect one and test it!).

Above: Children and their parents having fun racing and testing their solar cars at the Spokane "March for Science" Event

- ***Solar Car Demo Lesson at Adams Elementary School***
  A trial run of a lesson using our new solar car kit was done with 23 students and their teacher in a 5th grade class at Adams Elementary. Students learned about engineering, CO2 emissions and global warming, and solar energy from Shaun Taylor, Education Director at CEI and students were highly engaged as they got to experiment with building different solar cars and testing them on the race track.


Left: Adams 5th grade students and their teacher building and testing solar cars. **Right:** Two students learning about and investigating one of the solar panel models.

- ***Solar Car Demo for Gonzaga University Students, Faculty, & Staff***
  In an effort to promote collaborations with interested groups at GU, *SIA!* hosted an open, on-campus demonstration event of our Solar Car & Energy kit during Spring 2019. Over

30 students and faculty came and several potential partnerships for community outreach with Engineering and Physics faculty grew from the event.


Left: A group of GU undergrads has fun building solar cars. **Right:** *SIA!* staff members Ben Gallagher and Sarah Cooney demonstrating our solar kit to GU faculty, students, and staff during our demo day in Hughes Hall.

Science Fair Judging & Hands-on Activity

This fall, SIA! provided faculty and student judges for the Jefferson Elementary Science Fair as well an alka-seltzer rocket activity station. In addition to judging over 20 plus K-6 science fair posters, we served over 50 students at our rocket station.

Science In The Summer

SIA! continues it's community outreach efforts during the summer, schedules permitting. During the summer of 2018, SIA! coordinated activities for Na-ha-shnee Summer Institute students while they were staying on the GU Campus. The Na-ha-shnee Summer Institute is a two-week camp for Native American and Alaskan Native 9th-11th graders to provide exposure to careers in the health sciences that is sponsored by WSU Health Sciences Spokane and EWU Area Health Education Center. Na-ha-shnee students listened to several talks by research groups from the Biology Department and also received a tour of the department.

VII. Volunteer & Teacher Reflections

Teacher Reflections

Teacher Grade	What did you enjoy the most about participating in Science in Action! this semester?	Did you notice a change in your students related to enthusiasm for science after participating in Science in Action?
6th Grade Teacher	My students get sick of hearing my voice every day...so it's nice to get a fresh perspective and with students who are excited to be there!	Absolutely!! They LOVE it when GU comes!

3rd Grade Teacher	I enjoyed the vocabulary (new vocab and applicable to aspects of our curriculum or life) and the interactions between the students and college students.	Absolutely. They were eager for SIA to come, to do the experiments and to watch the experiments even change in the classroom (fungi experiment). They would often refer to our vocab wall that I created and use the words SIA taught them in their daily language.
3rd Grade Teacher	I loved and appreciated that you, Science in Action, made some adjustments to meet the needs of my learners. We were an after school group, we tried that for the first time. After the first couple of meetings, I asked about written recording sheets and they added those. Then when my wonderful leaders found out that we didn't have microscopes at our school, they changed plans and brought them back again for a wonderful activity around bees. It was the best one of the semester!! Thank you for adjusting to our needs!	Yes. My after school group is very disappointed that it is finishing. They asked if we could have it again next year.
Kindergarten Teacher	I loved having university students in the classroom introducing interesting and fun activities to my students. What great role models your students are, and I know that my students benefit from this in both the short and long term. The activities are age appropriate too!	Yes! They were always so excited when they knew that it was a Science In Action day.
Combination Class Teacher	The variety of science lessons, and how hands on all the activities are!	Yes, they were already pretty excited about science, but they are even more so now that we completed another semester!
2nd Grade Teacher	The enthusiasm of the students, the connections they made with my students, the organization of the lessons, and the topics taught.	My students LOVE science! We have an hour of science each week and I try to fit in as much as I can integrating into the curriculum, being a former GU Bio major I try my best! However, seeing the young scientists from GU was so different. They were asking on Monday when Thursday was just to see them and do the fun experiments. I thank you so much for making Oobleck . That lesson was incredible and so well done. Clean up was a breeze.

4th Grade Teacher	The joy, knowledge, enthusiasm, and positive attitudes of the Gonzaga students was commendable. My class could not hardly wait til 9:00 on Thursdays because they knew it was SIA day. Mind you, that is only about 20 minutes of waiting. The choice of lessons was awesome as well. They kids really got their hands on activity time and everyone was able to participate.	Absolutely! That is all they talk about on Thursday and Friday after SIA comes.
4th Grade Teacher	The hands on activities were very engaging and the students loved it.	Yes, they saw that it can be "done" and not just read about.
4th Grade Teacher	I really enjoyed the activities and seeing my students interact with college students in a positive way.	Yes!
Combo class Teacher	My students loved having college students coming into our classroom and showing them that we can be scientists.	I loved that my students got to see a more fun side of science with the activities.
5th Grade Teacher	I enjoyed having Gonzaga students in the classroom--they led fun activities and had good discussion with the students. They also served as positive role models for the students. The Q&A the students had with the Gonzaga students about college was fun and informational. I feel like the Gonzaga students helped make science fun and hopefully motivated the students to want to go to college.	Yes! They looked forward to SIA and the activities every week!
Kindergarten Teacher	The students enjoyed it and it was an experience we all got to share together and then build upon it.	Yes, they were more curious and excited about science.
6th Grade Teacher	The varied science experiences this provides for our students	Yes! They enjoyed the hands-on experiments. The lessons are well designed and teach key scientific principles

Volunteer Reflections

Below is a selection of comments from students this year about their experience volunteering with *Science in Action!* as well as photographs of our volunteers in action teaching lessons at local elementary schools.

Volunteer Reflections:

"My favorite part of Science in Action! was watching the kids' faces light up when they were praised for an answer or came up with a question that they were really excited or curious about. A highlight was always when a student tell you that 'One day, I want to be a scientist like you!'."

"I really liked being able to get away from usual school and get help kids learn! It is very humbling to know I got to teach and help others learn."

"My favorite part about SIA! was getting to be a positive influence on some kids lives and hopefully inspire them to love science like I do."

"My favorite part of SIA! was seing how excited the kids get when they actually 'see the science; and also just seeing how smart they are. I can't wait to do this again!"

"My favorite part aout SIA! was getting to spend an hour of my week with awesome kids. It allows me to forget my responsibilities for a bit and just have fun!"

"My favorite part about SIA! was becoming friends with my group. Another awesome part was seeing the kids' faces light up when they get to be scientists." -

"My favorite part about participating in SIA! is learning how much the students know and also hearing how excited they are before and after the experiment. Something I am so happy I was able to do is I saw the Hispanic girls being drawn towards me. Such as one girl noticed we had the same hair and eyes as I was conducting an experiment. I just thought that was really cool."

"I always enjoy getting into the classroom and interacting with the students. They are at a point that they don't likely know what they want to do when they're older so it's fun sharing science with them"

APPENDIX

Fall 2018 Schedule of Activities & Lessons

		Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
	Dates	**Trees + Rolling & Ramps**	**Changes**	**Balance & Motion**	**Variables**	**Experiments w/plants**	**Mixtures & Floating**
week 1	**9/25 - 9/28**	Sorting leaves	Does it dissolve in water? + Identify an unknown substance	Rolling balls down different height ramps - making predictions, measuring, & gravity as a force without pushing or pulling	Testing out the "tongue map"	Parts of a seed, seed dormancy, and setting up germination experiments	Racing M&M colors - Dissolving at different temperatures and sugar concentrations
week 2	**10/2 - 10/5**	Function of Tree Parts	"Iced Tea" mystery story + designing their own dissolving experiments (emphasis on hot vs. cold water)	Rolling balls of different masses + car/seatbelt/inertia activity	Can you get an egg to float? challenge	Seed germination experiments week 2 + looking at plant tissues	Temperature Changes in Dissolving (Good Hot and Cold Packs)
week 3	**10/9 - 10/12**	Tree seeds - acorns & life cycle of an oak tree	Chromotography mystery activity - Who wrote the ransom note?	Spinning Tops - exploring variables that affect rotational motion + a mini-art project	Shrink the Skittle	Looking At Seeds	Using Chemical Change to Identify an Unknown
week 4	**10/16 - 10/19**	Battle of the Beaks	Battle of the Beaks	Chromatography Mystery	Alka-Seltzer rockets: variables that affect height flown, graphing results, & energy transformations	Flower dissection - Where do seeds come from?	Tongue Map Activity
NO SIA *(10/22 - 10/26)* due to GU Founders Day on 10/23							
week 5	**10/30 - 11/2**	Squirrels & Trees	Dissolving and Evaporation	Exploring pendulums activity	Balloon Rockets - How does changing part of the rocket affect the distance it travels?	Extracting Strawberry DNA	Exploring density with film canisters + egg float challenge
week 6	**11/6 - 11/9**	Rolling balls down different height ramps	Oobleck explorations - Is it a solid or a liquid?	Balloon Rockets	What's Growing on that Leaf? - leaf imprints & fungal growth on agar plates	What's Growing on that Leaf? - leaf imprints & fungal growth on agar plates	Extracting Strawberry DNA
week 7	**11/13 - 11/16**	Rolling balls of different masses	Bubble Bombs!	Marble runways - exploring friction	What's Growing on that Leaf? - leaf imprints & fungal growth on agar plates - week 2	What's Growing on that Leaf? - leaf imprints & fungal growth on agar plates - week 2	Alka-Seltzer Bottle Rockets
No SIA *(11/19 - 11/22)* due to Thanksgiving Holiday							
week 8	**11/27 - 11/30**	Spinning Tops Activity (with Art Project)	Alka seltzer rockets	Alka seltzer rockets	Chromotography mystery activity	Ooblek Exploration	Oobleck Exploration

Spring 2019 Schedule of Activities & Lessons

SPRING 2019 SIA CLASS VISIT SCHEDULE		Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	After-School (Longfellow, Westview, Whitman)
DATE	SIA WEEK	Weather	Animal Classification	Solids, Liq, Gas, Instects & Plants	Structures of Life, Water & Weather	Landforms, Energy, Plants, Electricity	Space, Ecosystems, Variables + Sol'ns	Earth Science	Best Of
Feb 13-Feb 15	Week 1	Cancelled due to snow storm							
Feb 20-Feb 22	Week 2	Bird Beaks	Bird Beaks	Bird Beaks	Bird Beaks	Bird Beaks	Bird Beaks	Bird Beaks	Bird Beaks
Feb 27-Mar 1	Week 3	Make A Cloud Model	Make A Cloud Model	Bubble Bombs	Chromatography	Chromatography	Making a scale model of the earth and moon	Layers of the Earth	Balloon Rockets
Mar 6-Mar 8	Week 4	Types of Clouds & Clouds in A Jar	Types of Clouds & Clouds in A Jar	Layers of Time	Chromatography	Balloon Rockets	Atmospheric Gases on Diff Planets	Crayon Rock Cycle	AS Rockets
Mar 11-Mar 15	GU Spring Break		No SIA This Week						
Mar 20-Mar 22	Week 5	Bee Body	Bee Body	Bee Body	Ooblek	AS Rockets	AS Rockets	Ooblek	Ooblek
Mar 25-Mar 29	SPS Conferences		No SIA This Week						
Apr 1-Apr 5	SPS Spring Break		No SIA This Week						
Apr 10-Apr 12	Week 6	Animal Life Cycles	Animal Life Cycles	Ooblek	Strawberry DNA Extraction	Strawberry DNA Extraction	What's Growing on that? - imprints & fungal growth on agar plates pt. 1	Plate tectonics and types of plate boundaries + modeling plate boundaries	What's Growing on that? - imprints & fungal growth on agar plates pt. 1
Apr 17-Apr 19	GU Good Friday MAKE UP WEEK	Flower Dissection	Flower Dissection	Flower Dissection	What's Growing on that? - imprints & fungal growth on agar plates pt. 1	What's Growing on that? - imprints & fungal growth on agar plates pt. 1	What's Growing on that? - imprints & fungal growth on agar plates pt. 2	Different types of volcanic eruptions - modeling with alka-seltzer & sorting images	What's Growing on that? - imprints & fungal growth on agar plates pt. 2
Apr 24-Apr 26	Week 7	Acorns & Tree Lifecycle	Layers of Time	What's Growing on that? - imprints & fungal growth on agar plates pt. 1	What's Growing on that? - imprints & fungal growth on agar plates pt. 2	What's Growing on that? - imprints & fungal growth on agar plates pt. 2	Food Webs & Invasives Species	Earthquake Engineering	Earthquake Engineering
May 1-May 3	Week 8	AS Rockets	Food Web & Ocean Pollution Game	What's Growing on that? - imprints & fungal growth on agar plates pt. 2	AS Rockets	Ooblek	Ooblek	AS Rockets	Food Web & Ocean Pollution Game