

2022 STARS Crystal-Growing Summer Camp Volunteer Service Hours Report and Verification

Prepared by Andrew Fang, Rita Dwivedi, and Dina Xu Callaway

If there are any questions, concerns, or a need for further clarification or documentation regarding this report or our summer camp activities, please contact any of our officers or our club at waltonstars@gmail.com.

After the success of our 2021 Crystal-Growing Summer Camp and 2022 Crystal Growing Competition, seeing so many young scientists excited to learn about science and crystallography, we were naturally eager and encouraged to provide this experience to more students and host our 2022 STARS Crystal-Growing Summer Camp to bring our mission of “crystallizing student interest in science” to yet another class of young scientists. In doing so, we decided to retain largely the same format as last year, with some modifications to the curriculum and new officers to host the summer camp’s activities.

Summer Camp Summary

In summary, our camp, advertised for all students K-12, took place online and was completely free of charge. It took place for four days, Monday, July 11th through Thursday, July, 14th, during the hours of 8AM to 12PM and consisted of lectures, crystal-growing labs, and games which introduced students to a variety of topics related to crystal-growing and crystallography including:

- The theories of crystallography.
- The methodologies of taking observations and recording data on a lab notebook.
- The process of setting up and maintaining a crystal solution, with a focus on salt and sugar crystals and how to use tonic water and highlighter ink to grow glow-in-the-dark crystals.
- How bioluminescence and glowing genetically modified organisms relate to crystallography.
- How crystallography can be used in the scientific field to treat diseases, such as cancer and COVID-19 through X-ray diffraction, structure determination, small molecule design, and therapeutic drug discovery.

Throughout the course of the summer camp, we delivered quality information to six students (see attached spreadsheet of participants) in elementary and middle school for the dual purposes of inspiring them in the very promising and vanguard field of crystallography, and even if they choose not to pursue crystallography further, moreover to teach them the analytical and critical thinking skills required for success in any scientific or academic field, such as any upcoming science classes that they will take in future years.

Preparation

To give a timeline, in the week before the first day of the camp on July 11th, the officers of the STARS Club worked extensively, both together and on their own time, to plan for the camp. These officers were:

- Susanna Huang, Founder
- Selina Huang, President
- Andrew Fang, Vice President
- Rita Dwivedi, Secretary and Treasurer
- Dina Xu Callaway, Multi-Media Marketer

On July 6th, the STARS officers met on Zoom between 4 PM to 5:30 PM to create a plan (see attached plan) for the summer camp, which was adapted from last year's plan. In the days following, each officer individually created a poster and script (see attached posters) to promote the summer camp through mediums such as Discord, WeChat, text messages, and Instagram. They also individually researched, created educational powerpoints, scripts, review games on Quizizz and Kahoot, teacher notes, and prepared materials for use during the camp, depending on their different roles in the plan. Lastly, the officers met on Zoom on Sunday, July 10th between 8 AM and 10 AM for a compressed rehearsal of the first day's activities.

In terms of material preparation, our summer camp required conveniently accessible and safe materials for our participants. We decided during our planning to have students use only salt, sugar, and highlighters to make the crystal solutions. These compounds are relatively simple and safe and can be readily found in many households. While these compounds of salt and sugar may seem trivial, we decided that they serve as good substitutes to introduce students to the complex field of crystallography because the methodologies and crystallization theories used to crystallize salt and sugar are remarkably similar to those for crystallizing macromolecular crystals, such as DNA/protein complexes, which can be used to treat diseases. Moreover, the patience and persistence that students gain through these simple crystallization experiments eventually help prepare them for more complex experiments in the future.

Lesson and promotional materials created in preparation for this summer camp can be found either attached to this report, or in a Google Drive folder, the link for which is also attached.

Individual Preparation Summary

Besides our collective preparations, each officer individually put in a significant amount of effort to prepare for and make the 2022 STARS Crystal-Growing Summer Camp come to life. These efforts include:

- Susanna and Selina prepared and tested the experiments they would teach to students ahead of time.
- Rita communicated with our registered participants with reminders and material lists and prepared presentations and explanations for why scientific note-taking is important for her students.
- Andrew researched about the scientific topics before creating the presentations to explain the complex topics to the students in an easily understandable way.
- Dina made various Kahoots and Quizizzs and researched videos, articles, and other examples to explain scientific topics for the participants.

Daily Activities

Once our preparation concluded and the camp began in earnest, we began each day at 7:40 AM by opening the virtual meeting, greeting the students, and dividing them into two groups on the basis of grade, one for students between kindergarten and 5th grade, and the other for students 6-12. These two groups would go to separate zoom sessions where they could receive instruction tailored to their grade level. Each day consisted of four sessions, with each one lasting roughly 40-50 minutes long with a 10-20 minute break in between. One to two officers hosted each session, and our officers would rotate during the day between teaching the K-5 group and the 6-12 group. Specifically, Susanna, Rita, and Selina would host the first two sessions for the K-5 group, while concurrently, Andrew and Dina hosted the first two sessions for the 6-12 group. The officers would switch meetings at the beginning of the 3rd session around 10 AM and teach the other group for the remaining 2 sessions. At the conclusion of the 4th session around 11:40 AM, the two groups would combine into one meeting for a wrap-up session, where we discussed the students' experiences, the information they learned that day, and answer remaining questions. At around 12 PM, the students would be dismissed. The officers would then remain for around 20-30 minutes to discuss our performance for the day, offer critiques and improvements, and prepare for the next day's activities.

Information and screenshots for activities on particular days and sessions can be found in the Summer Camp Plan, which is attached to this report.

Individual Roles & Activities

The role of each officer and the activities they hosted can be described as follows:

Susanna and Selina Huang guided the students through four different hands-on crystal-growing experiments on each of the four days:

- Monday: Growing salt crystals out of supersaturated and undersaturated solutions
- Tuesday: Growing glow-in-the-dark highlighter ink salt crystals
- Wednesday: Growing sugar crystals with and without a crystal inducer

- Thursday: Growing glow-in-the-dark tonic water salt crystals on top of a crystal inducer (which was the cleaned granite rock).

They explained the steps needed for each different experiment, teaching the importance of precision and accuracy, explained the relationships between temperature, solute concentration, rate of evaporation, and rate of crystal formation, and explained how to maintain a solution with a seed crystal, which acts as a crystal inducer in a saturated solution.

Rita Dwivedi guided the students through the note-taking process for each day's experiments with our custom-made 2022 STARS Summer Camp Crystal Journal printables (see attached) that students used for each observation entry. She held discussions with the students and had them compare observations and inferences before discussing their significance for the experiment. As the crystals grew and the experiment progressed, Rita had students compare the data they collected in previous experiments to the one that they had created for that day's session. This comparison helped the participants understand how different procedures created different results in their solutions. Throughout her sessions, she also explained the importance of each section of the Crystal Journal for scientific lab keeping.

Andrew Fang taught students the scientific principles of crystallography, the difference between inorganic, organic, and macromolecular crystals, and how DNA crystals can be used for X-ray diffraction and structure determination as well as other intricacies in crystallography. He also taught the students that for an ideal salt crystal, students should be looking for a large, clear, and very faceted crystal. Andrew combined information across the sessions by teaching the students the ideal saturation for solutions based on their solution makeup (i.e., inorganic, organic, macromolecular molecules) while also teaching them the importance of crystallization in the professional field, such as structure determination and the development of therapeutic medicine.

Dina Xu Callaway held sessions that showcased videos that depicted what Andrew taught in his session, providing students with practical examples to internalize what he taught. Dina also held fun review sessions that covered all the material that the students learned on that day with the other leaders. In total, Dina created two Kahoot and one Quizizz review games and personally wrote all 86 questions, with the first Quizizz being 27 questions, the first Kahoot being 29 questions, and the last and final "Kahoot Showdown" being 30 questions. In these review games, Dina mixed in a variety of questions, many of them very challenging. The students were persistent and very enthusiastic about the review games.

Altogether, these activities provided four hours of educational content and hands-on application daily, imbuing our participants with knowledge about the field of crystallography and the scientific skills necessary for academic success.

Conclusion

As the Walton STARS Team, we see the beauty in crystallography with its simplicity and its complexity. We see its significance and key role in structural biology. We see the importance of spreading the excitement to younger generations for we see its promising horizons, awaiting to be explored.

We, as the Walton STARS team, want to inspire others, spur creativity, and kindle the spirit of scientific exploration. To that end, the 2022 STARS crystal-growing summer camp has been a great success, the honor of educating fellow students well worth the effort, and one we are eager to repeat in the future.

Service Hours calculation:*Preparations for the Summer Camp (making flyers, advertising):*

Susanna Huang (2 hours); Rita Dwivedi (2 hours); Selina Huang (2 hours); Andrew Fang (2 hours); Dina Xu Callaway (2 hours)

Preparation meetings for the Summer Camp (1.5 hrs for July 6th drafting, 2 hrs for July 9th rehearsal):

Susanna Huang (3.5 hours); Rita Dwivedi (3.5 hours); Selina Huang (3.5 hours); Andrew Fang (3.5 hours); Dina Xu Callaway (3.5 hours)

Teaching at the Summer Camp over all four days (four hours each day):

Susanna Huang (16 hours); Rita Dwivedi (16 hours); Selina Huang (16 hours); Andrew Fang (16 hours); Dina Xu Callaway (16 hours)

Preparing the summer camp lessons over all four days (four hours each day): (Researching, creating powerpoints, lecture scripts, teacher notes, preparing and testing experiments, review games, etc.)

Susanna Huang (16 hours); Rita Dwivedi (16 hours); Selina Huang (16 hours); Andrew Fang (16 hours); Dina Xu Callaway (16 hours)

Total Service Hours claimed for hosting the 2022 STARS Crystal-Growing Summer Camp:

Susanna Huang (37.5 hours); Rita Dwivedi (37.5 hours); Selina Huang (37.5 hours); Andrew Fang (37.5 hours); Dina Xu Callaway (37.5 hours)

Appendix

Lesson Materials:

https://drive.google.com/drive/folders/1jz3_shDJ96OxWxs5vZkN1ZHzQTIAqM1U?usp=sharing

Kahoot and Quizziz links:

Monday:

6-12

<https://quizizz.com/join/quiz/62cbc7bc7403da001e8f558e/start?studentShare=true>

k-5

<https://quizizz.com/join/quiz/62cace05999255001d8499e9/start?studentShare=true>

Wednesday:

K-5

<https://create.kahoot.it/share/third-day/d41c51e1-db49-432c-a3ad-fb8b186dc62f>

6-12

<https://create.kahoot.it/share/third-day-harder/9ac8df13-0f2a-4346-b7ad-97ec2a43a672>

Thursday:

6-12

<https://create.kahoot.it/details/6114623c-81e1-4090-b20c-cc60a5908223>

k-5

<https://create.kahoot.it/share/final-2/e1edce6f-9792-44a2-a2f8-d7926acc04d5>

Summer Camp Daily Plan

K-5th	Monday (July 11th)	Tuesday (July 12th)	Wednesday (July 13th)	Thursday (July 14th)
7:50-8:00: Attendance	Salt Crystal Day	Glow in the Dark Day	Sugar Crystals Day 2	Glow in the Dark Day 2
8:00-8:40: Session 1	<p>Setting up and growing salt crystals - Susanna and Selina</p> <ul style="list-style-type: none"> Take them through the process Undersaturated, saturated, supersaturated We want single crystals for the competition If grow too fast, too many crystals, all too tiny Need to grow them slow, and they will be large <ol style="list-style-type: none"> Slightly undersaturated supersaturated 	<p>Setting up and growing tonic water crystals - Susanna and Selina</p> <ul style="list-style-type: none"> Take them through the process Pour out some tonic water Explain why it glows (Simple Experiment (calameo.com)) UV light activating phosphors in the tonic water, converting UV light (that we can't see) into the visible light, which is why we see it as glowing in the dark 	<p>Setting up growing sugar crystals / put fishing string onto seed salt crystals- Susanna and Selina</p> <ul style="list-style-type: none"> Take them through the process <ol style="list-style-type: none"> On a string (for fun) Serious version, grow single crystals of sugar Usually the sugar crystallizes on the surface of solution because the water is evaporating from the surface, making it saturated on the surface, and crystals crystallize <ul style="list-style-type: none"> These are seed crystals, but they are not big enough These will fall to the bottom, turn large enough, and then attach fishing string? 	<p>Setting up and growing highlighter ink crystals - Susanna and Selina</p> <ul style="list-style-type: none"> Take them through the process Open up a highlighter (might need help of parents) Take the middle of it, and soak it into water Get the ink out Put some salt or alum into it Remind them that it is the phosphors doing the glowing
9:00-9:40: Session 2	<p>Guiding how to take lab notebook notes - Rita</p> <ul style="list-style-type: none"> Take them through the process Crystal-journal prototypes Talk them through the different parts of the Crystal Journal Have students note down how they set up today's solutions Students share their observations At the end, each student should have Entry #1 for the salt crystal 	<p>Guiding how to take lab notebook notes + share observations - Rita</p> <ul style="list-style-type: none"> Guide them through the process of looking for any changes in the values in the lab notebook between day 1 and day 2 Have students note down changes Have students note down how they set up today's solutions Take them through the process of sharing observations At the end, each student should have Entry #1 for salt crystal, and Entry #1 for tonic water crystal 	<p>Guiding how to take lab notebook notes + share observations - Rita</p> <ul style="list-style-type: none"> Guide them through the process of looking for any changes in the values in the lab notebook between day 1 and day 2 Have students note down changes Have students note down how they set up today's solutions Take them through the process of sharing observations At the end, each student should have Entry #1 and #2 for salt crystal, and Entry #1 for tonic water crystal, and Entry #1 for sugar crystal 	<p>Guiding how to take lab notebook notes + share observations - Rita</p> <ul style="list-style-type: none"> Guide them through the process of looking for any changes in the values in the lab notebook between day 1 and day 2 Have students note down changes Have students note down how they set up today's solutions Take them through the process of sharing observations At the end, each student should have Entry #1, #2, for salt crystal, and Entry #1, #2, for tonic water crystal, and Entry #1 for sugar crystal, and Entry #1 for Last crystal
10:00-10:40: Session 3	<p>Introduction to crystals and salt crystals more specifically - Andrew</p> <ul style="list-style-type: none"> Properties of crystals What they are Explain the salt crystal category Crystals need to be single, large crystals [In total three types of crystals: macromolecular (DNA), organic (sugar), and inorganic (salt)] Explain inorganic crystal properties 	<p>How to make Glow in the Dark messages/Introduction to growing creative crystals - Andrew</p> <ul style="list-style-type: none"> Explain at the competition, growing creative crystals, can go with any of your imagination Explain creative crystal category Creative crystals don't need to be single, large crystals, introduce dyes, and colors Explain how that relates to making messages, glowing in the dark Explain what aluminum potassium sulfate (alum) is, and how it can be used for the crystal-growing competition 	<p>Introduction to sugar crystals, and explain the difference between salt and sugar crystals - Andrew</p> <ul style="list-style-type: none"> Explain at the competition, growing creative crystals, can go with any of your imagination Explain creative crystal category Explain organic crystal properties, and differences from inorganic crystals It's harder to crystallize sugar crystals 	<p>Introduction to DNA crystals, and explain the difference between DNA crystals and the rest - Andrew</p> <ul style="list-style-type: none"> Explain macromolecular crystal properties, and differences from organic and inorganic crystals Talk about something creative about glow in the dark things for children

11:00-11:40: Session 4	Kahoot - Dina (simplified version) <ul style="list-style-type: none"> Review about what was taught to students so far. Inorganic crystals Salt crystal category Properties of crystals 	Video - Dina <ul style="list-style-type: none"> Triboluminescence, even animals glow in the dark Genetically modified organisms that glow in the dark 	Kahoot - Dina (simplified version) <ul style="list-style-type: none"> Review about what was taught to students so far. Inorganic crystals Salt crystal category Properties of crystals Organic crystals Triboluminescence X-ray diffraction/crystallography questions Lab notebook 	Video - Dina <ul style="list-style-type: none"> Video: glow in the dark 11:20 - 12:40 Kahoot final showdown
11:40-11:50 Ending	What did we learn today?			

Participants List

Student First Name	Student Last Name	Grade level in the upcoming school year (in the Fall 2022 semester)
Carson	Li	6th grade
Hughes	Liu	8th grade
Dennis	Xu	8th grade
Jacey	Wu	6th grade
Jonathan	Wu	7th grade
Steven	Huang	4th grade

Daily Lab Notebook Template

2022 Cobb County Crystal-Growing Competition: Crystal Journal

Name: Grade: Salt Division/Creative Division (circle one)

Entry #: Date: Time: Temperature:

Methods/ Procedures/ Actions taken today:	
Observations:	
Inferences/ Conclusions from Observations:	
Future ideas to try for improving crystal growth:	

Sketches and/or photos of crystals:

Promotional Materials

Flyers

**WALTON STARS 2022
CRYSTAL GROWING SUMMER
CAMP**

JULY 11-14, 8AM-12 PM

**A FREE, VIRTUAL EXPERIENCE
FOR ALL STUDENTS K-12 TO
ENJOY**

**LEARN TO THINK LIKE
SCIENTISTS**

**UNCOVER THE SECRETS
OF CRYSTALLOGRAPHY**

**HAVE FUN CREATING YOUR OWN BEAUTIFUL
SALT AND SUGAR CRYSTALS**

**SCAN ME
^SIGN UP^**

SIGN UP:
(CASE-SENSITIVE)
bit.ly/crystalcamp

+OUR WEBSITE, SUMMER CAMP
INTRO VIDEO, & CRYSTAL-GROWING
TUTORIAL :
bit.ly/waltonstars

Walton STARS Presents
**2022 Crystal
Growing Summer Camp**

From July 11th to July 14th
8 AM to 12 PM EST

Enjoy a free, virtual crystal-growing
experience for all students K-12

Learn the complete
crystal growing process
and spur your creativity

Don't miss this amazing
opportunity!

Sign up here:
<https://forms.gle/zPWbRDE2AYbGFBiq6>




SCAN ME

WALTON STARS 2022 CRYSTAL GROWING SUMMER CAMP

JULY 11TH - 14TH
8AM - 12PM EVERYDAY

**Free & online experience
for K - 12 students**

An opportunity to teach your students and children important scientific skills and foster interest in the field of crystallography

Sign up at:
<https://forms.gle/zPWbRDE2AYbGFBiq.6>





STARS CRYSTAL-GROWING SUMMER ONLINE CAMP

- LEARNING THE CRYSTAL-GROWING PROCESS,
- ENHANCING CRITICAL AND ANALYTICAL THINKING SKILLS,
- PREPARE FOR THE FALL CRYSTAL-GROWING COMPETITION.

Summer Camp video: <https://youtu.be/GIUIJkyYmv4>
(K-12 students, Limited space)

REGISTER HERE:

[HTTPS://FORMS.GLE/ASXBBO6DW6WTWVSQ8](https://forms.gle/ASXBBO6DW6WTWVSQ8)

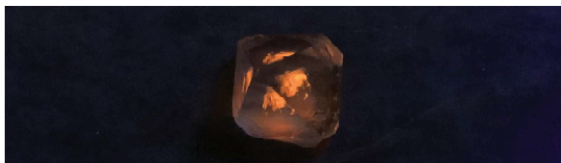


walton.stars@gmail.com

<https://starsanticaner.wixsite.com/researchsociety>

STARS CRYSTAL-GROWING SUMMER CAMP

Registration is now open!



Our nationally-awarded and experienced team will guide students through the crystal-growing process, teaching them the scientific method, enhancing students' critical and analytical thinking skills.



But don't worry. We will provide engaging sessions that target students of all grade levels K-12.



Also, because we will be hosting our annual **Cobb County Crystal Growing Competition** again next year, at this summer camp we will be preparing students for the crystal-growing competition by **sharing our key insights and skills** of crystal-growing and **providing real-time feedback** for students.

This summer camp will take place **online** from **Monday, July 11th to Thursday, July 14th**.

Summer Camp video: <https://youtu.be/GIUIJkyYmv4>

There is limited space, so if you are interested, make sure to sign up before the spots are filled.

Register here: <https://forms.gle/asXBbo6dW6wTwvsQ8>

We hope to see you there!



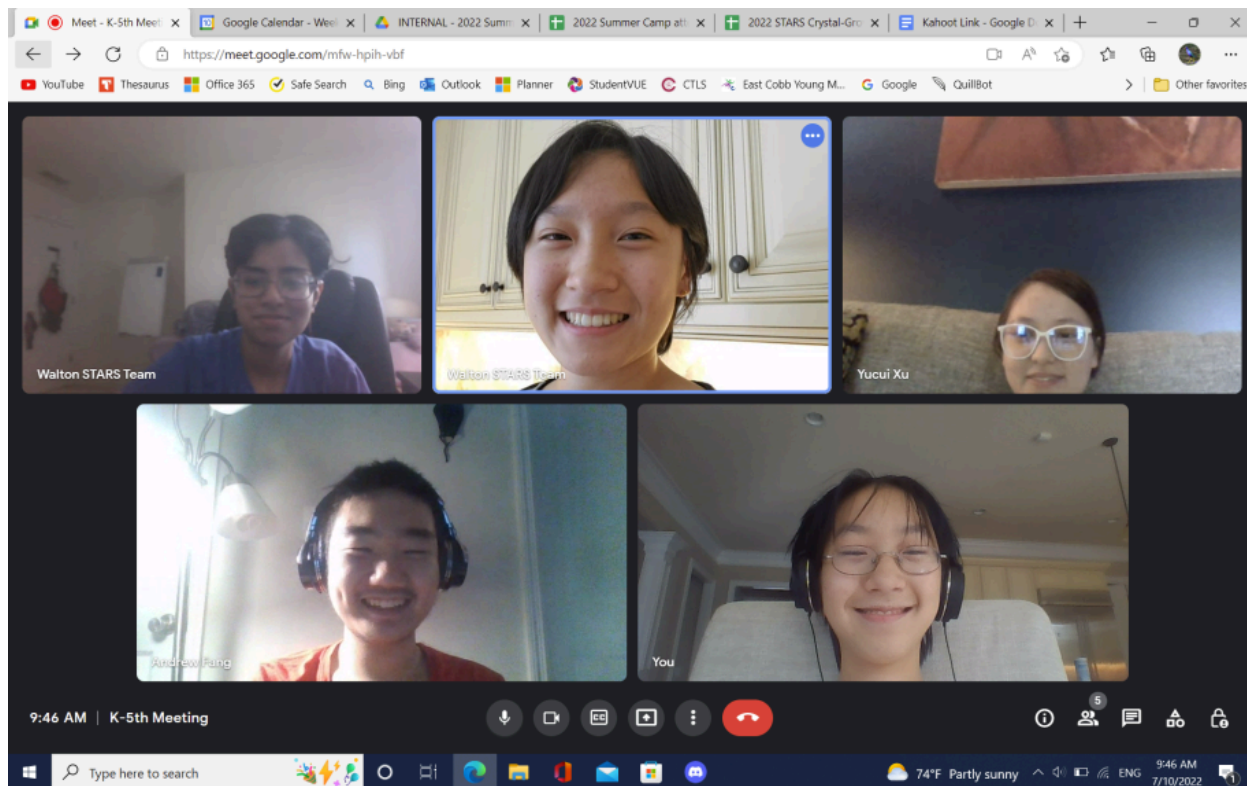
SCAN ME

walton.stars@gmail.com

<https://starsanticaner.wixsite.com/researchsociety>
Structural Nucleic Acid Anticancer Research Society (STARS)

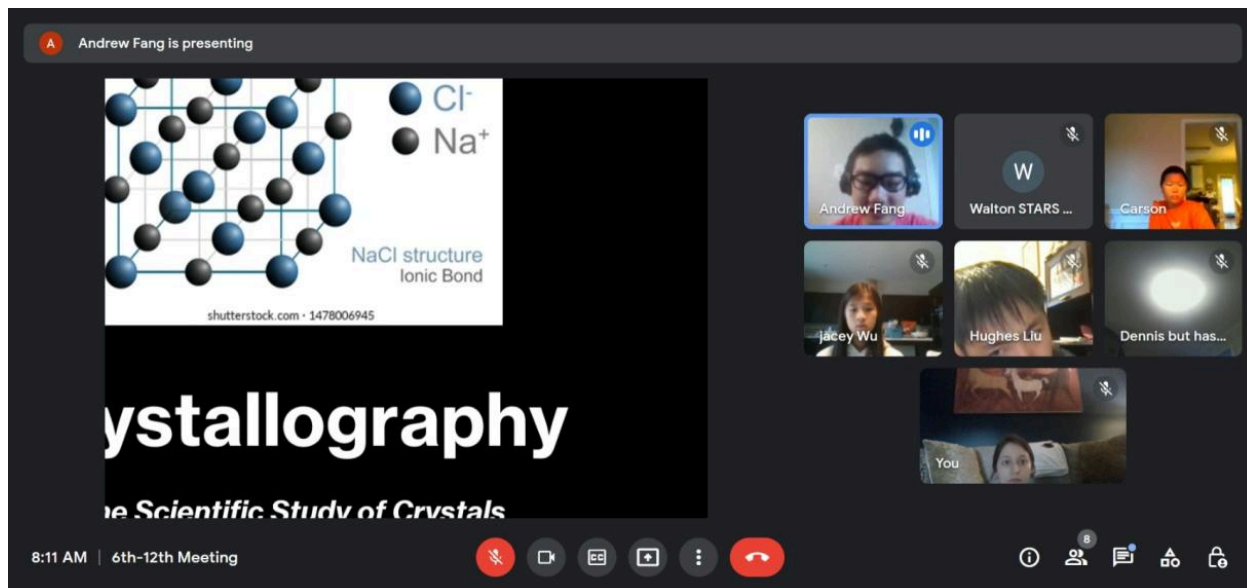
Screenshots from the Summer Camp

Sunday Officer Rehearsal



Monday

(6-12 meeting, session 1)



Tuesday

(K-5 meeting, session 3)

Walton STARS Team is presenting

Recap

- Crystals – solids whose molecular structures follow a repeating pattern
- Crystals come in several types: organic, inorganic, and macromolecular
- Crystals are used to advance biomedical science
 - Macromolecular crystals preserve DNA so proteins can be observed through x-ray diffraction
 - Discoveries can be used to create medicines and help cure diseases
 - Growing salt and sugar crystals simulates growing macromolecular crystals
 - So, like good macromolecular crystals, ideal crystals should be large, clear, have smooth, distinct edges, and be singular.

10:03 AM | K-5th Meeting

(6-12 meeting, session 3)

Walton STARS Team is presenting

Entry #2 Walkthrough (6 - 12th)

Future ideas to try for improving crystal growth:

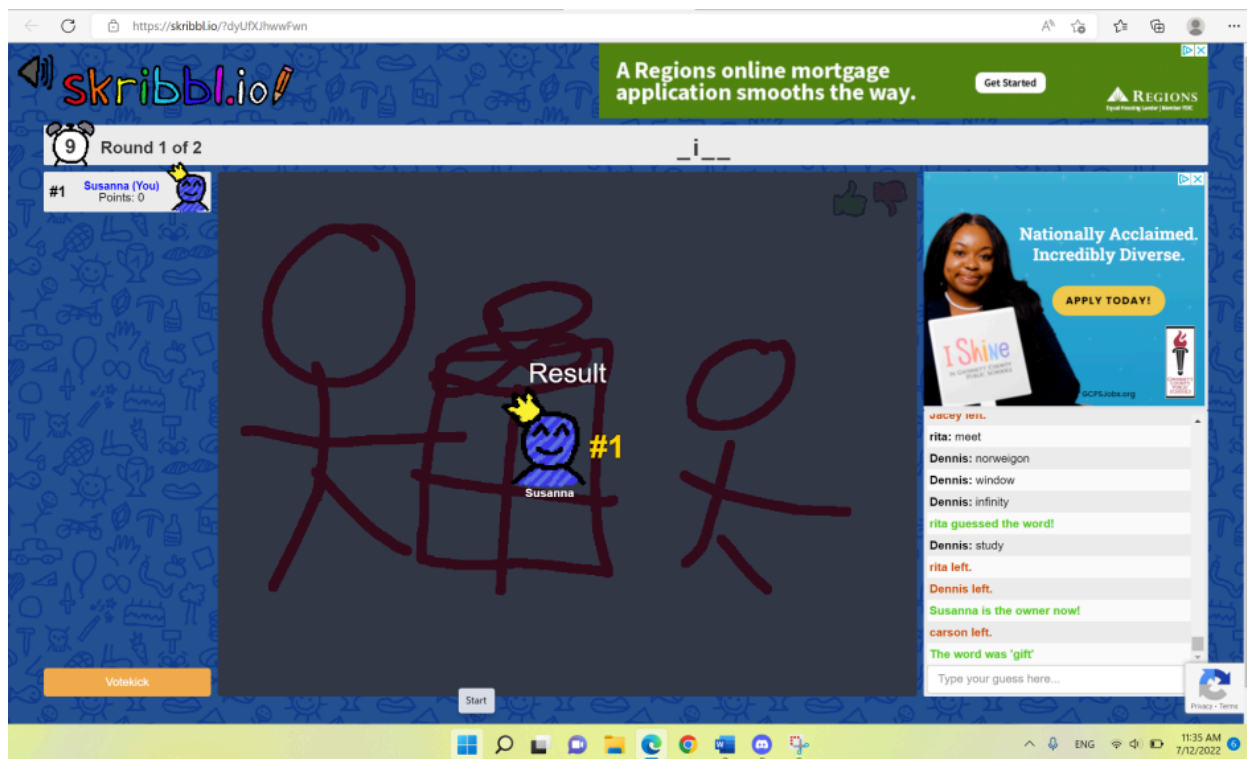
- Decanting the clear part of the solution and moving into a different container.
- It removes the impurities.
- We could add less salt.

Sketches and/or photos of crystals:

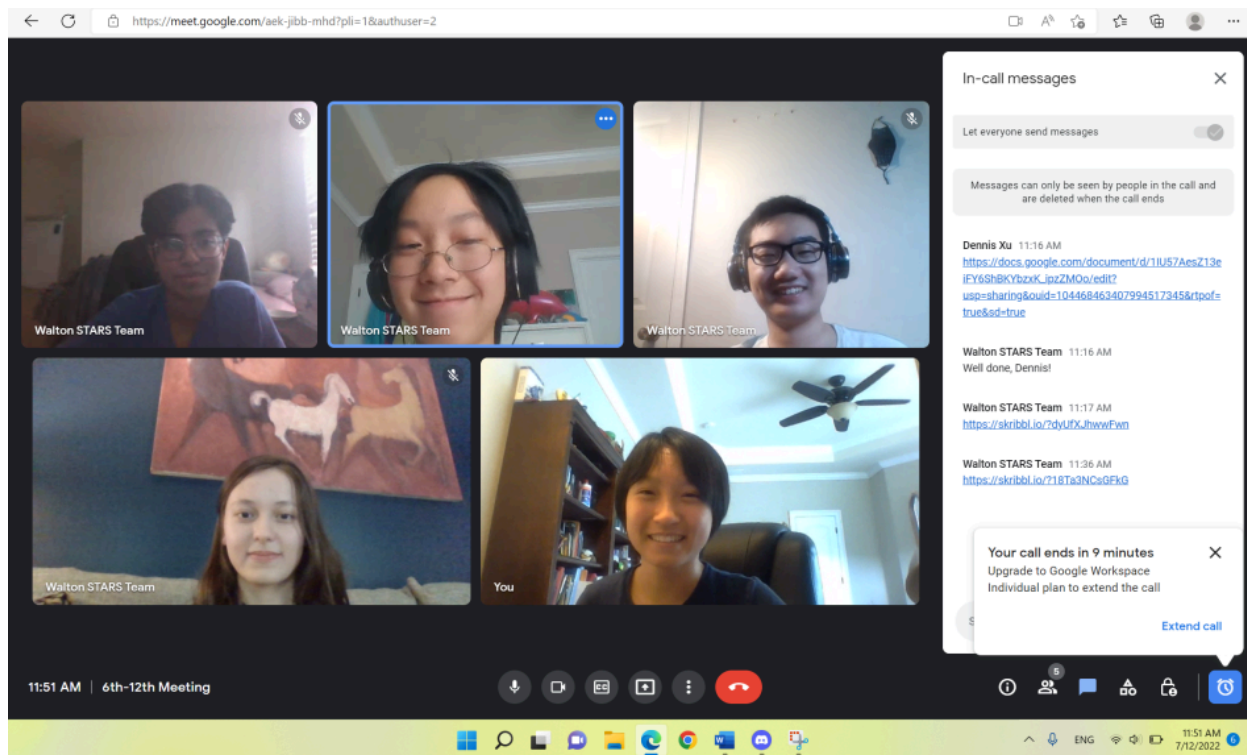
Changes noticed between Entry #1 and Entry #2:

11:09 AM | 6th-12th Meeting

(6-12 meeting, session 4)



(Post-camp officer meeting)



Wednesday

(combined end of day wrap-up session)



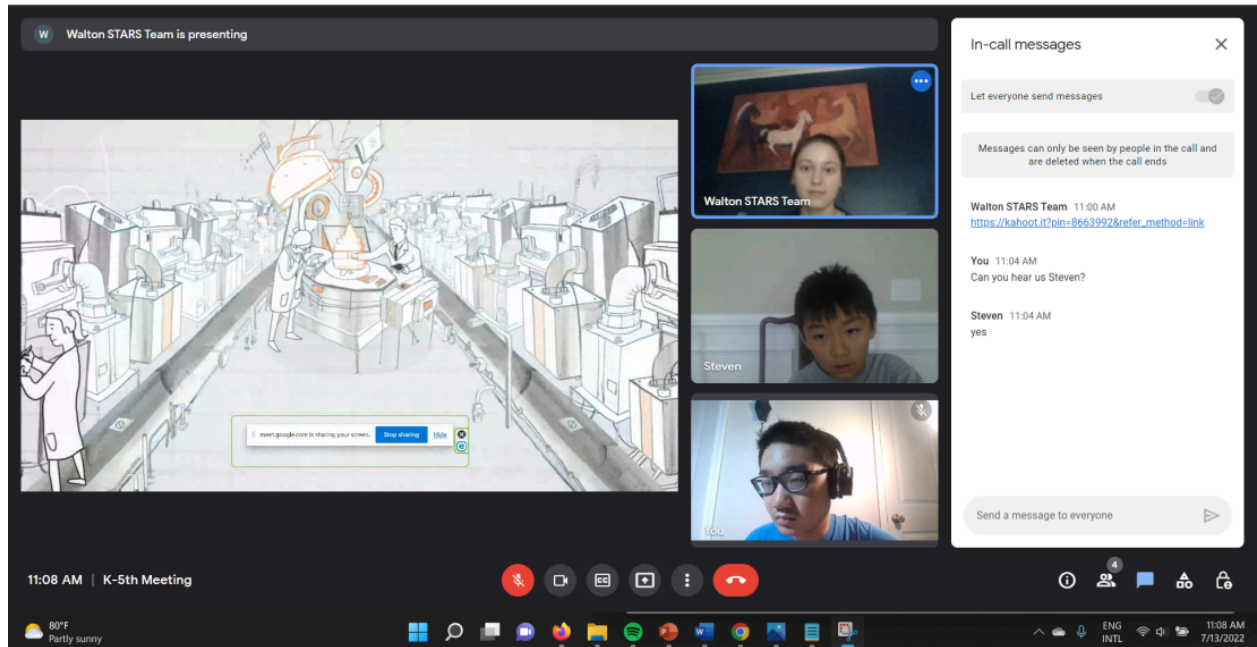
(Post-camp officer meeting)



(6-12 session 3)

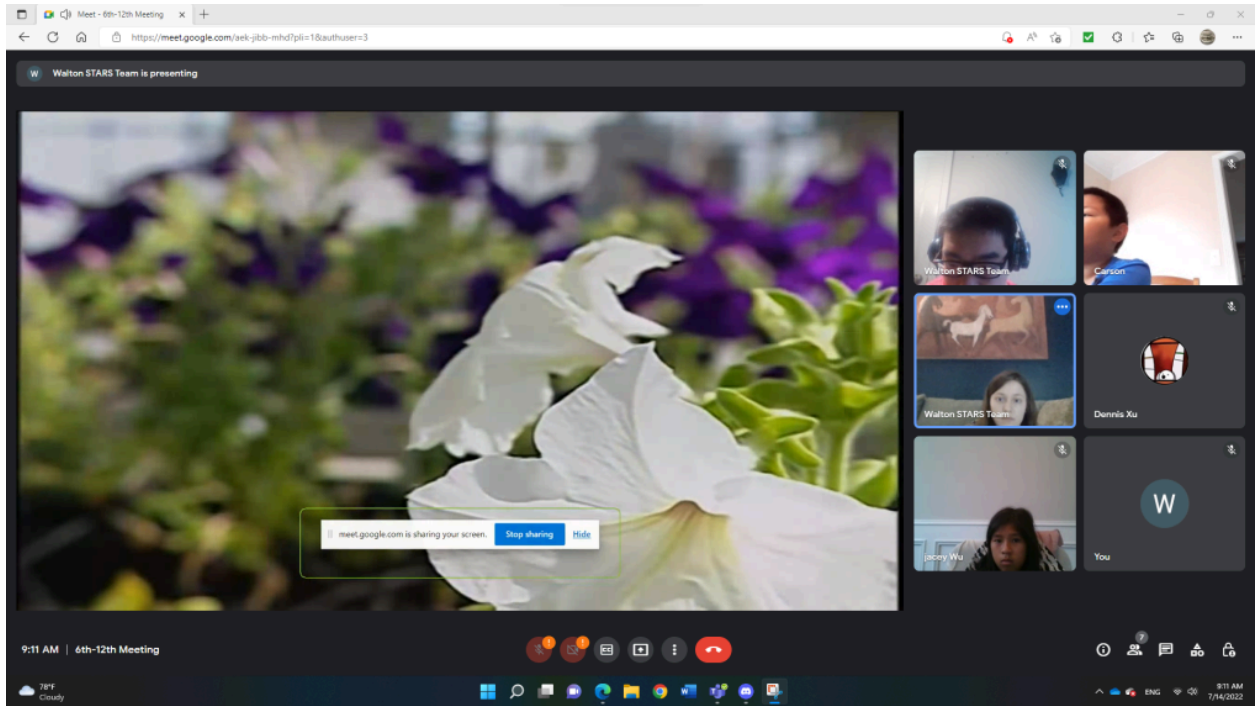


(K-5 session 3)

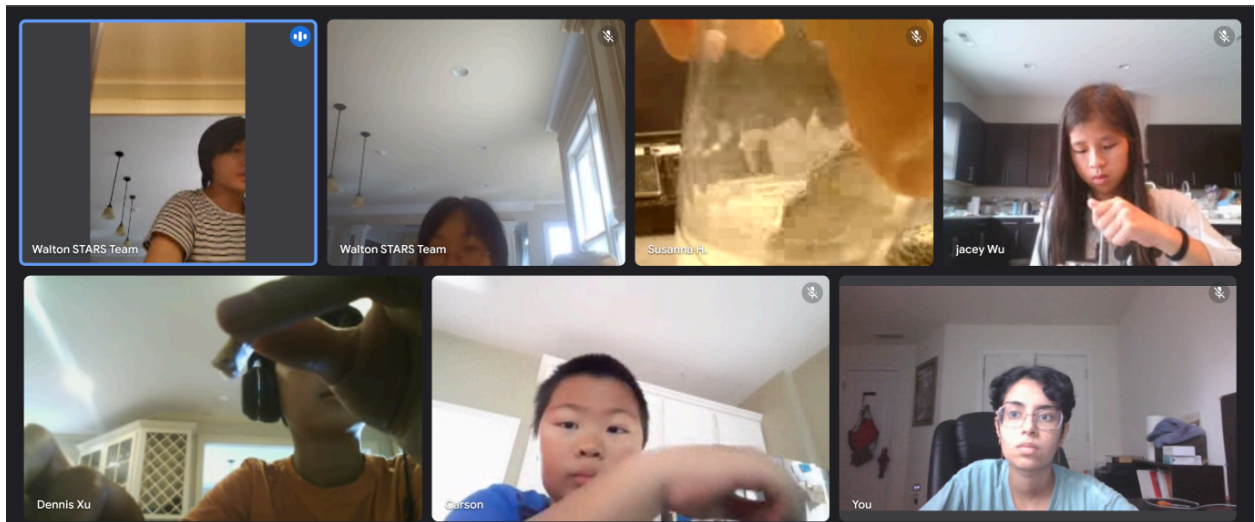


Thursday

(6-12 session 2)

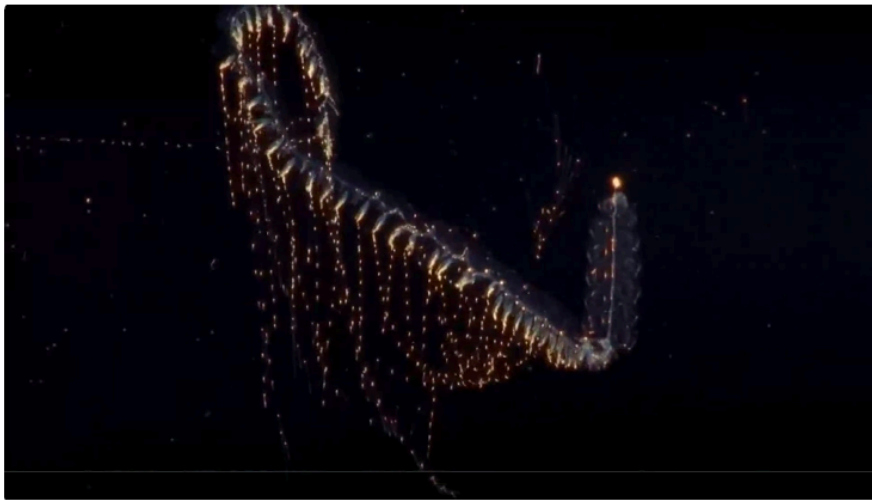


(6-12 session 3)



(k-5, session 4)

Walton STARS Team is presenting



11:37 AM | K-5th Meeting



A screenshot of a Google Meet interface. The main window shows a loading screen for a Kahoot! quiz with the URL 'https://play.kahoot.it/v2/?quizId=e1edce6f-9792-44a2-82f8-d7926acc04d5'. The screen displays the Kahoot! logo and the text 'Loading...'. Below the loading screen is a notification that says 'meet.google.com is sharing your screen.' with 'Stop sharing' and 'Hide' buttons. The right side of the screen shows a grid of three video thumbnails: 'Walton STARS Team', 'Steven', and 'You'. The bottom of the screen shows the Windows taskbar with the time '11:22 AM' and date '7/14/2022'.

(Combined end of day wrap-up session)

