



Educational Proposal Information: Students on the Beamlines

Canadian Light Source

2021-2022

Tracy Walker - Education Programs Lead 306.657.3525
Bernie Petit - Education Coordinator Indigenous Programs 306.657.3727
Anna-Maria Boechler - Education Coordinator 306.657.3745
Amanda Pfeiffer - Education Coordinator 306.657.3848

The Students on the Beamlines Program

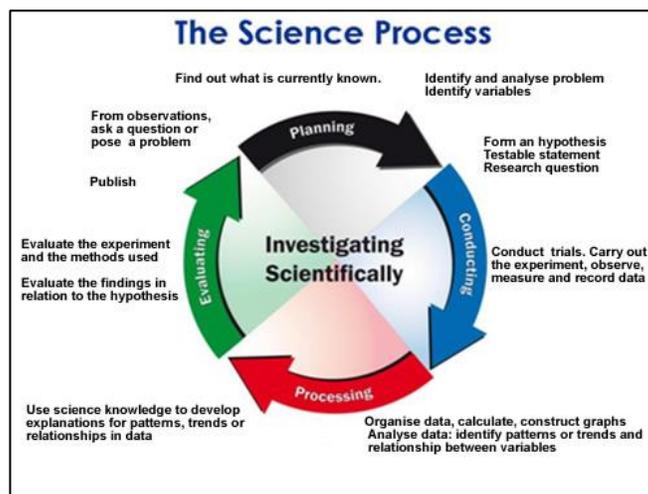
The Students on the Beamlines (SotB) program is designed to provide an authentic scientific inquiry experience for high school students. Participants must be a minimum of 14 years of age when they are collecting data on the beamline. By authentic scientific inquiry, we mean that the students are driving the scientific process. There are four important aspects of the program to keep in mind.

1. Student Driven

The students collectively make decisions regarding the direction of their project. Students are supported by mentors such as CLS staff, their teacher, and often subject matter experts. The mentor and expert's role is to provide enough information and advice to enable students to make sound decisions but not to make the decisions for the students. CLS staff & teachers are responsible to ensure students' safety throughout the whole process. The goal is to balance desired education outcomes (learning by doing with a focus on the process) and science outcomes (rigorous and structured research with a focus on results).

2. Authentic Scientific Inquiry

The SotB program is designed to provide students an *authentic* scientific inquiry experience. By authentic scientific inquiry we mean that students will follow a process as close to a professional scientist as possible. Students are expected to review relevant peer reviewed literature and consult with other scientists to inform their question, hypothesis, and experimental plan. They must also communicate what they have learned through presentations, posters, articles or other relevant mediums, so that other scientists, the community, and the public can benefit.



3. Synchrotron Relevant

Students participating in the SotB program have the opportunity to use synchrotron techniques to aid in answering a research question. It is important for students to understand that a synchrotron is just one tool in a research toolbox. They are encouraged to develop a robust project that includes more than one technique to address a research question. However, part of the question must require synchrotron techniques in order to access beamtime.

4. Teacher Training

Teachers or supervisors interested in participating in the SotB program **are required** to attend the annual CLS Teachers' Workshop to become familiar with a synchrotron research facility as it is very different than a classroom. Student safety is our priority and to ensure the safety of students we require at least one teacher or supervisor participating in SotB to be familiar with the facility and its environment before bringing in students. This is a requirement to bring students to the facility. For more information about the Teachers' Workshop visit our website: https://www.lightsource.ca/professional_development

Dates to Remember

CLS has a January-December yearly cycle which does not fit well with the school September - June academic cycle. When you are planning your project, be aware of the following:

- **Beamtime runs in 2 cycles: January – June and July – December.** The call for proposals for each cycle goes out to all registered users at the beginning of the previous cycle with the deadline set at midway. Those proposals go through a peer review process, where beamtime is allocated and then scheduled. Education projects have a later deadline but are scheduled at the same time. **This means that SotB beamtime applied for January – June is typically scheduled in November of the previous year and beamtime applied for July-December is typically scheduled in the month of April prior to beamtime.**
- We have **two long periods of time when the synchrotron shuts down** user operations in the spring and fall. The purpose of these shutdowns is to prepare equipment for extreme weather changes and to allow maintenance, upgrades, or construction to happen that cannot take place during a user 'run'. There are a few endstations that have alternate sources of light that are able to continue running during these shutdowns. **Be aware if these shut downs when planning on coming to the CLS by checking out the operations schedule:** http://www.lightsource.ca/operations_schedule.html.

Something that has become apparent to us is that the **more time students are able to spend learning about their chosen area of research and preparing for their experiment** (doing preliminary tests, collecting or growing samples, etc.) **the more meaningful the entire experience is for them**. If there is a way to build this advance planning time into their experiment, we highly recommend it.

October 15 th , 2021	Deadline for Educational Proposals For projects in Spring of 2022 or 2022/2023	
End of Sept. – Early Dec. 2021	Synchrotron Shutdown <ul style="list-style-type: none"> • No scheduled beamtime 	
March 15 th , 2022	Deadline for Educational Proposals For projects in 2022/2023 school year or 2023/2024	
Mid March – Mid May 2021	Synchrotron Shutdown <ul style="list-style-type: none"> • No scheduled beamtime 	Dates subject to change. Keep in touch with us!
Summer, 2022	Teachers' Workshop https://www.lightsource.ca/professional_development	

Competition - Educational Proposal

Competition for limited resources is a reality of the science world. We have a limited amount of beamtime, science mentorship support, and funding. As a result, we are forced to choose which groups we are able to support. **The focus of the competitive process is based on expected education outcomes.** These may come with an accompanying science idea but it does not have to.

- **Teachers** submit an educational proposal form outlining anticipated educational outcomes for your students, yourselves, your school, your community, etc. and a suggested science outline of the science planned for the project. We wish to work with the students to fully develop the science.
- **Student** contribution can be included when applicable.

Part of our goal with the educational proposal is to ensure that CLS (and hopefully other) scientists are helping students with the science planned for a project and help students through the science process. This way we are encouraging more collaboration in the project. With the educational proposal, we are looking for ways students can connect with other students, more scientists, and the public.

***Schools who have not yet had the opportunity to participate in the SotB program and who can establish a higher need for a program like SotB, will be at an advantage.**

Educational Proposal Outline

The purpose of this new educational proposal and review process is to enable a way for CLS to be able to determine which schools to support for a SotB experience with limited resources. To guide you with filling out the educational proposal, below you will find four different categories with suggested questions and a summary of what is expected.

Team (250 words)

- Who are you planning to involve in this project?
- Are you recruiting a student team with a cross-section of skills, abilities, interests and perspectives? What skills, abilities, interests and perspectives are you anticipating?
- Are you trying to reach or support a particular group of learners?
- How will you select these students?
- How many female and male students are you anticipating to join your team? If only female or male students, why do you anticipate a single gender group?
- Will you be including other teachers, scientist, or community members to the team? Travel to the CLS is not required by all team members – including students. Some members can provide advice or support in sample preparation or research prior to beamtime, as an example. What subject area expertise are you planning to add through these team-members to help support the students?
- Are there opportunities for cross-curricular or cross-disciplinary connections?

We are not looking for a list of names, but a description of the composition of the team you plan to have in place to contribute to the SotB project. Describing the strength of the team you are starting with (returning students, scientific and/or administrative support for example) is a good place to start, but remember to add your plans for team development. The ideal team would be composed of 3 to 15 students, but this can be adjusted depending on circumstances (please discuss this with us).

Outcomes for the Team (250 words)

***** What we mean by ‘outcome’ is the anticipated change or measureable change that has occurred because of the immediate participation in SotB (communication of program, personal growth, etc.).**

- What do you expect the team members (students, teachers, and potentially scientists) will be able to accomplish?
- What are some approaches and applications that will show the skills and knowledge attained by students through this program? Teachers? Other mentors?
- Have you, as a teacher, considered sharing your experiences with your colleagues? How so?
- What do you expect your team to learn?
 - Suggested areas to discuss in your proposal includes: students (either as individuals or as a group); yourself and your colleagues (how does the program fit with your personal pedagogical philosophies); and your classroom or school.
- Are you planning to present the results of the project to an audience? How? Who?
- How might the program influence team member’s skills (confidence, teamwork, leadership, etc.)?
- Is this an extra-curricular activity or something offered within a class – why is it constructed that way?
- If you have participated before, outline what your previous team(s) have learned and accomplished:
 - What audiences have you presented to?
 - What media (social or news) have you engaged with?
 - Have you written articles for any journals or newsletters?

For both new groups and returning groups, outcomes should involve a communications plan. Look for ways to involve your team in science and in learning BEYOND the project. For examples, students have talked about learning teamwork, time management, and presentation skills. And teachers have voiced changes in their perspectives towards assessment, how to implement inquiry-based instruction, and collaborative learning. **The focus for this category should be on what you plan on doing for the CURRENT project proposed, if you have previously participated in SotB then those experiences could be used as examples.**

Broader Impacts (350 words)

***What we mean by 'impact' is an anticipated change that is long-term, or a long-term effect of an outcome because of participating in the SotB program (change in learning, teaching, community outlook, etc.).

- What impact do you anticipate participating in SotB will have beyond the people specifically participating? On the school? In your community? In science education?
 - *This is a natural extension of the previous category topic.*
- If there are ways that you can expand the impact of this experience with other students in your school, how would you do that?
 - Can your group of students involve others in sample preparation or data collection?
 - Is there a way to involve the community at large?
 - Are there cross-curricular connections that can be made?
 - Can other teachers be involved?
 - Can what has been learned both scientifically and educationally/pedagogically be shared?

The past 10 years have shown us that the impact of this experience is far greater than we anticipated when we first designed the program. We would like to capture that and build upon it. Something that student groups consistently comment on after participating in SotB is how scientific research is a social construct. It requires that people work together to accomplish a common goal. We are looking for projects that can extend, build on, and reinforce this. Consider presenting a plan in how you want to engage the community.

Science Topic (150 words)

*** Student contributions are appreciated if it is appropriate for your situation.

***Not a part of the decision to grant the student group beamtime

- What is your team interested in researching? Why?
 - Your team can have more than one topic or interest for the time being.
- What do you want to find out about your topic(s)/interest(s)?
- Does the team's interest relate back to the curriculum? If so, how?
- Do you have a plan on how to approach the experiment?
- What samples are you planning on using?

We want to provide assistance in developing your project so that we can help you make sure to take advantage of the synchrotron techniques. The purpose of this section is to allow you or your team to describe the ideas that you already have. For example, if you have a group of experienced students and they would like to build on previous work or have a specific new idea of something they'd like to pursue – this is the section to describe that. It can be very general and open-ended, particularly if the proposal is submitted before you are able to build your student team, but it is required. It would be helpful for us to know if you are developing this as a part of a course and would like to make specific curricular connections. **What we are not looking for is a project that has already been fully developed without consulting with us.**

Funding

***Not a part of the decision to grant the student group beamtime

We have limited funding available. Each group is expected to try and find funding for their own project. There are a number of places that will fund educational opportunities, such as large companies that have operations in your area.

We are applying for a grant from NSERC PromoScience to support those groups for whom funding is a barrier to participate in SotB for the next 3 years. In this section, please outline what funding you have access to or plan to apply for. We are willing to assist with these applications. Outline your expected costs and how much support you are asking from other grants.

This section will not have an impact on whether or not you are selected to participate, but will help us plan our resources to support you if we can. It is possible that you will be granted beamtime and we will not be able to provide funding. A lack of funding will not adversely impact your score.

Scoring of Educational Proposals

Educational Proposals will be scored according to the rubric below. **The lower the score, the better.** Generally speaking we will be looking for educational proposals that achieve an average score of 2 or better.

- **1:** A score of 1 will be an educational proposal that encompasses innovative ways of doing things – a real “wow” factor.
- **2:** An average score of 2 indicates that there are plans for an excellent team, doing interesting things, learning from the project, and sharing what was learned both scientifically and in other ways.
- **3:** An average of 3 indicates that it is an acceptable proposal that will be granted beamtime only if there is time to give. In effect, a 3 is ‘ordinary’.
- **4 and 5:** An average score of 4 or 5 will not be granted beamtime. Essentially those projects do not convince reviewers that the time and resource it would take to do the project are worth the outcomes proposed. We do not anticipate there will be many of these.

Rubric

This rubric is used during the peer review portion of the competition. It is a great resource to use when filling out the educational proposal.

	Research Team	Outcomes for Participants	Impact on Community
Exceptional 1	Innovative team composition	Innovative approach and application of skills and knowledge attained	Innovative approach to engage the community in or with the project.
Excellent 2	Team includes new perspectives & additional support (eg: a diverse group of students, teachers, scientist, community members etc.)	Learning outcomes are extends to full team (student, teachers, etc.) where opportunities beyond the specific project are developed.	Engages non-team members at their school and/or their community in the project, includes cross-curricular connections.
Good 3	Team is made of science students and a teacher	Expected outcomes are focussed on student learning (personal, content and process).	Communicates experiences with their school or community
Needs Improvement 4	Too many students or too few students; No real plan for a research team	Focused on factual or “content” knowledge only	Only team members are involved
Unacceptable 5	Excluding people interested in the project	Focused on a pre-determined conclusion; Demonstration; Field-trip	Lack of communication or community involvement plans

*****Note:** There is no science category on the rubric as it is only used to gain insight into the team’s interests plans for a scientific experiment.