



Students as Partners Fund – Proposal Form

Please note: This document is for reference only.

All proposals must be submitted through the online form by 3:00 pm on June 15, 2022.

- Before proceeding, please read all SaP fund criteria and application instructions at: <https://sap.ubc.ca/>
- We strongly encourage all applicants to consult with the CTLT prior to submission. You can request a 1:1 consultation at SaP.info@ubc.ca
- The online application system uses plain text. You will not be able to add tables, graphs, or charts in your proposal.

Project Title (200 characters max.)

Do not use all-caps.

Safer engineering: Enhancing control schemes and safety analysis in Chemical and Chemical & Biological engineering undergraduate capstone design courses

Applicants (500 words max.)

Indicate the following for all applicants: name, position, department (if applicable), and UBC email address. For example:

Zahra Jaghori, Faculty, Computer Science, z.jaghori@ubc.ca

Kyoung Han, Undergraduate Student, kyoung.han@student.ubc.ca

If your proposal is successful, this list will be published on the UBC SaP website (emails will be removed before posting).

FACULTY

Susan Baldwin, Professor, Department of Chemical and Biological Engineering, sue.baldwin@ubc.ca

Sergio Berretta, Adjunct Teaching Professor, Resident Expert in Process Design and Development, Department of Chemical and Biological Engineering, sergio.berretta@ubc.ca

Peter Englezos, Professor, Department of Chemical and Biological Engineering, peter.englezos@ubc.ca

Jonathan Verrett, Associate Professor of Teaching, Department of Chemical & Biological Engineering, jonathan.verrett@ubc.ca

STAFF

Marlene Chow, Director of Academic Programs, Department of Chemical and Biological Engineering, marlene.chow@ubc.ca

AC Deger, OER Support Pilot Strategist, Centre for Accessibility, ac.deger@ubc.ca

Will Engle, Strategist -Open Education Initiatives, Centre for Teaching, Learning and Technology, will.engle@ubc.ca

Erin Fields, Open Education and Scholarly Communications Librarian, Walter C. Koerner Library, erin.fields@ubc.ca

TLEF Overlap explanation

I had previously reached out to Roselynn Verwoord in December 2022 to ask about a potential conflict between a TLEF and SaP grant. SaP criteria states: "Applicants cannot concurrently hold a Teaching and Learning Enhancement Fund (TLEF) grant and a *Students as Partners in Course Design* grant for the same course". However the TLEF awarded focuses on a different topic, with a different team of instructors (except for myself), and only impacts the same



course (CHBE 453/454) 2 years after the SaP. Based on this, Roselynn encouraged me to apply, but to note this in my application. I elaborate on this below and am happy to provide additional details.

TLEF Description

I am part of a faculty team awarded a TLEF this year on professional skills development in laboratory and design courses in three programs: Chemical Engineering, Chemical & Biological Engineering, and Environmental Engineering. We will be developing resources to enhance student communication, teamwork, ethics, equity and project management skills in courses where students work in teams. This impacts a large number of courses in our programs. Our plan for the TLEF is a three-year roll out, first focusing on year 2 courses (2023W), then year 3 (2024W) and finally year 4 (2025W). This means CHBE 453/454 would only be impacted by the TLEF in 2025W. The faculty team for the TLEF includes: Zeina Baalbaki, Alireza Bagherzadeh, Pranav Chintalapati, Gabriel Potvin and myself.

SaP Description

The potential SaP fund proposal would focus only on CHBE 453/454 in 2023W and focuses on an entirely different aspect of the course, improving safety and process controls analysis in the course. The faculty team for the SaP includes: Peter Englezos, Susan Baldwin, Sergio Berretta and myself.

Primary Contact

For notification purposes, indicate who among the Applicants will be the primary contact for this proposal and enter their UBC email address.

Contact name:	Jonathan Verrett
Contact email:	Jonathan.verrett@ubc.ca

Target Course

For administrative purposes, there must be one UBC Vancouver credit course designated as the primary course where the SaP fund will be used (e.g. Course Code: ENGL 101; Section: 002; Year and Term: 2022, Sep).

Please note, if the course has not yet been approved by UBC Senate, we will contact your Department Head for confirmation of support.

Faculty, College, or administrative unit:	Faculty of Applied Science, Department of Chemical and Biological Engineering
Course code:	CHBE 453 & CHBE 454 (courses are taught together and impact two programs, CHBE and CMHL)
Course name:	Biological/Chemical Process and Product Design
Section(s) targeted:	001
Has this course been offered before?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Year and term revised course will be offered:	2023 Sept, 2024 Jan (2 term course, both terms impacted)
Average annual enrolment in course/sections:	120 (between both courses)

Project Summary/Goals (500 words max.)

Specify why you think this course could benefit from course redesign, what you plan to change (if known), and what you hope to see as result of this project. If your proposal is successful, this summary will be published on the UBC SaP website.



Engineering programs typically culminate in a capstone design course meant to integrate and apply knowledge and skills students have learned throughout their degree. The Chemical Engineering (CHML) and Chemical and Biological Engineering (CHBE) programs at UBC both have capstone courses and these are taught together as there is significant overlap in the skills developed in both courses. The key difference between these capstone courses is that the CHML course (course code: CHBE 454) focuses on chemical processes whereas the CHBE course (course code: CHBE 453) focuses on biological processes. This key difference results in unique features in each course, some examples of which are distinct control strategies and safety considerations.

The goal of this project is to improve student learning around critical engineering topics including process control scheme development and safety analysis. Historical feedback from both students and instructors has indicated that this is an area where more focus is needed to ensure students are confident in these areas as they graduate.

In terms of process control, students are well prepared to implement control schemes for individual pieces of equipment from their controls class they have taken in their 3rd year of their studies (CHBE 356). However complications arise as they combine control schemes from multiple pieces of equipment into an overall scheme for a process. As they do this, students must ensure that the overall process control methodology works cohesively together. This requires a different but complementary understanding which builds on the skills they have previously learned in analyzing control schemes for an individual piece of equipment. Some scaffolding for this learning is currently provided, including four one-hour lectures and a two-hour tutorial exercise. This is also followed by analysis of and feedback on student designs by instructors during regular weekly meetings.

In terms of safety, students perform a Hazard and Operability Study (HAZOP), which is a qualitative process hazard assessment (PHA) method. Various PHA methods are regularly used in industry to understand, characterize and improve process safety. These analyses can be quite complex as they encompass interactions between different process components. Both instructors and students have struggled to keep these reviews at a useful level, not being too focused as this would take too much time, but similarly not too high-level so safety issues can be teased out and improved upon. Training currently provided for this includes a one-and-a-half-hour lecture and one-and-a-half-hour tutorial as well as consultation and feedback from instructors during regular weekly meetings.

With both process control and safety we see an opportunity to significantly improve student learning. In order to do this, student input has and will continue to be critical in order to understand challenges and provide a variety of resources to support student learning in these areas. As a project team we envision these improvements may include – revamped lectures and tutorials targeting key skills, additional self-directed resources (which may include videos, readings or guided exercises), additional resources to assist students and instructors as they go through design reviews (checklists, samples, etc.).

SaP Fund Alignment (500 words max.)

Explain how this project will benefit from a partnership approach. Describe how a partnership approach will inform faculty and student collaboration, including how student partners will contribute to the intellectual direction of the work, how workload will be distributed equitably, and how the project will integrate diverse student voices and perspectives. In addition, please explain how planned work aligns with university, faculty or department strategic priorities.

A partnership approach between students and faculty is critical to the success of this project. Based on past student and instructor feedback we have a good idea of where we want to go, with this being strong student understanding and analysis of process control strategies and process safety. We have training in place to help students to achieve these competencies, but we believe this training could be significantly enhanced to ensure students are more confident in these skills. In order for this work to be successful we have built this proposal in partnership between students and course instructors.

During the summer term (May-August), capstone course instructors and TAs meet regularly every one to two weeks to discuss and prepare for the course the following year. We plan to integrate two student partners as project coordinators into this process in order to co-develop and test resources that can be implemented in the next iteration of the design course. We believe integrating students into this existing process will help ensure workload is equitably distributed with students and instructors working directly together within the existing course improvement framework. In order to obtain a variety of student perspectives we also envision having five student editors we will



consult with in order to ensure the resources we create will address the diversity of learning needs of our student population. The student coordinators would help to engage the student editors in feedback sessions as learning resources are iteratively developed over the summer.

Over the past 6 years the CHBE Department has had a sustained effort focused on curriculum renewal, which launched the largest changes to our two principal undergraduate programs in over 20 years. One major focus of this renewal was improving experiential learning activities within the curriculum including design and laboratory courses. As part of this renewal, the department has introduced more design content into the 2nd and 3rd years of the CHML and CHBE programs. This was a response to student feedback wanting more preparation for their 4th year capstone design project. These changes have been well received by students and faculty and this grant application aligns and seeks to further develop this focus on experiential learning.

The Department's efforts align with University and Faculty strategic priorities. At the University level, there is strong alignment with the strategic plan core area of Transformative Learning with a specific focus on Strategy 11 on Educational Renewal and Strategy 13 on Practical Learning. These strategies also overlap with the Applied Science (APSC) Faculty strategic plan areas of Leading Edge Teaching (#1) and Experiential Learning (#6).

Project Timeline (500 words max.)

Provide a clear plan for how you will achieve the stated goals of the project. List project milestones and dates, as well as when evaluation will occur. We expect most projects will complete within a 12-month timeframe. If you anticipate needing additional time, please explain why.

The project timeline is outlined below, with the project planned to be completed in a 12-month timeframe.

January-February 2023

- Student, faculty and staff consultation on proposal development.

April 2023

- If the SaP grant is awarded, the students indicated in the grant will be hired to support the project. We plan to hire two project coordinators, one 3rd year student and one 4th year student. In this way one student will have gone through the capstone course and another will be about to enter the course. These differing perspectives will help to enrich learning resource development. We also envision a set of five student editors, with some from 3rd year and some from 4th year who similarly will provide a variety of perspectives in order to refine course resource development.
- Student project coordinators will begin to attend SaP cohort activities.

May- June 2023

- This will be the main time for course resource development. We focus on this time in the summer because course instructors for CHBE 453/454 meet over the summer, typically once per week, and tend to be most available for these two months, as opposed to July and August when instructors are more likely to be away. The courses are also fresh in the minds of students and instructors and this provides an ideal time to reflect and make changes.
- The student project coordinators will be onboarded (provided workspaces, timesheet procedures, etc.).
- Student project coordinators will attend the instructional team planning meetings over the summer. In these meetings potential resources to be created will be discussed and prioritized for development. Instructors and student coordinators will also work outside of these meetings to build resources and then bring these to the meetings for consultation.
- The resources created will go to student editors for feedback. Resources will be sent to these editors in advance and group consultation sessions will be held. We envision four of these sessions taking place over the summer, roughly once every 2 weeks. We anticipate each session to take four hours between reviewing resources individually in advance followed by a group meeting with all student editors, project coordinators and potentially members of the instructional team.



- Throughout this time, consultations with external partners take place as needed. This includes library consultation around existing resources and copyright, OER consultation around project outcome dissemination, accessibility consultation to ensure resources created are as accessible as possible and follow UBC best practice guidelines and consultation with a learning design consultant to ensure impactful course resource design.

MILESTONE

- Resources are created, have had student and instructor feedback, and are ready to be implemented in the course in 2023W.

September 2023-April 2024

- Course resources are implemented.
- Further feedback is received from students through evaluation methods outlined in the “Evaluation Plan” section.
- Suggested updates to resources are noted, prioritized and, if time allows, further development is undertaken.

May 2024

- Project is complete and project outcomes are incorporated into future course iterations. The resources continue to be updated as with other course resources.

Formation of Student-Faculty Partnership (500 words max.)

Describe how your student-faculty partnership was formed or how you plan to approach this. Include information about how this process was or will be inclusive and equitable for students who come from historically marginalized backgrounds and how you will integrate equity and inclusion into the partnership. Please note, the CTLT does not recruit nor match faculty and student partners.

The student partnership was formed following a recognition of a need for more support around control strategies and process safety reviews in capstone design projects. The student council and department regularly host course feedback sessions with students and instructors twice per term. In 2021W, students expressed concern with implementing control strategies and process safety reviews in their designs. The same concerns are also being expressed by students this year (2022W). Instructors were also observing the same challenges play out in the course and the difficulty in supporting students in learning and applying this material. Given this significant recurring challenge it was decided that it would be best to have a focused project to develop educational resources in order to provide greater support to students.

A general call to students was sent out through the student council seeking student partners to assist in developing the project. In forming the partnership, considerations were made around historically disadvantaged groups in engineering, notably women and racial minorities. The students involved include representation from different genders and backgrounds. A mix of students in their third and fourth year were selected in order to have perspectives from students having taken the course as well as those about to take the course.

Our department has a history of valuing and responding to student feedback on program curriculum. Recent curricular reforms in the department were undertaken with significant student engagement. Through this project we look to build on this relationship. We want to have students engage in the existing course preparation process, where instructors meet over the summer. This will help to have students more fully engaged as partners.

Student Involvement in Proposal Development (250 words max.)

Explain how students were involved in the conceptualization, development, and writing of this proposal.



When sending the call out for student partners for this project a draft project summary was shared with students which provided context for the project. Students were then able to comment on the draft summary and provide feedback. Students also provided comments to shape the other sections in the proposal. A few distinct areas that benefitted significantly from student feedback in proposal development include student role structuring and evaluation feedback.

When defining student roles on the project, students wanted to ensure a variety of them could be engaged. This led to the idea of having two different types of paid student engagement in the project, the coordinators and editors. These two roles ensure that students who may already have a job lined up for the summer could still contribute to the project and provide feedback, while also ensuring in-depth engagement from certain students (the coordinators) throughout the project. This allowed for participation from a more diverse group of students than may otherwise have been possible.

For evaluation, students suggested having informal channels to reach out to the project coordinator in addition to the more formal student feedback sessions and surveys. This feedback approach may also provide richer data as the coordinator can discuss and clarify when engaging with students without time limitations that are present in the feedback sessions or the textual response format in the survey.

Support Requested (250 words max.)

What support would be helpful for you to achieve the stated goals of the project? This information will help us identify needs, but does not guarantee this support will be available.

The project has obtained a variety of consultation support to ensure its success including:

- Library support by Erin Fields to assist in literature review and copyright.
- Open Educational Resources (OER) support from Will Engle to assist in finding relevant OER that can be adapted and ensuring works created can be shared as OER such that they can be disseminated and used by other organizations.
- Accessibility support from AC Deger to ensure project resources are built in a form so as to make them as accessible as possible. We aim to follow guides such as the OER Accessibility Toolkit (<https://open.ubc.ca/oer-accessibility-toolkit/>) and University Design for Learning Principles (<https://isit.arts.ubc.ca/designing-for-accessibility-an-introduction-to-universal-design-for-learning/>)

In addition we understand a learning design consultant will be assigned from CTLT. Ideally we would like a consultant who can help us to ensure the resources created are engaging and provide support for students as they study both individually and in their teams. Resources may also be geared towards assisting student-instructor interactions and review of the student design work.

Evaluation Plan (500 words max.)

Describe how you will determine if the project achieved the stated goals. Outline any key indicators that will be used to determine the project's success. Please also indicate if and how you will share your work with colleagues within and beyond your department.

We anticipate evaluating the impact of the project in a variety of ways. These include:

- Our existing student feedback sessions are held twice per term and coordinated by the student council and the department. These are known as "beef and pizza", with students bringing the "beef" and the department supplying pizza. Despite the name, these are productive and respectful feedback sessions where the goal is to improve courses. These sessions helped to shape this current application, and we will ask students to comment specifically on the resources created at these sessions and record feedback.
- We will also encourage students to share their feedback with our student project coordinator from year 3 who will be taking the course in the coming year. Sharing feedback individually with a peer may be more



comfortable for some students and this different format for feedback may elicit different ideas.

- Instructors will collect feedback on the resources and observe how students use them. We will assess changes in student work and student confidence. Instructors meet with each student team twice per week in the course for roughly 30 minutes each meeting. This allows instructors to have a good understanding of student development and areas of confusion or concern. We also evaluate student work throughout the term as well as their final work products (presentations and reports). We will use these observations to understand the impact of the project and help improve the effectiveness of the resources.
- We have students self-assess on graduate attributes required by our accreditation body each year. Some of these attributes touch on skills we are looking to improve through this project. We will use the data collected in the survey, including open ended comments, to characterize the impact of the changes to the capstone design course.

We anticipate sharing this work and believe the most appropriate venue outside of the department would be presenting a paper at a disciplinary conference such as the Canadian Chemical Engineering Conference or American Institute of Chemical Engineering Conference. Students in our program already regularly attend these conferences to present their research and engage in undergraduate-focused programming and competitions. We envision supporting students involved in the project to present at the conference. Funding for students would also be available from the Department, the Professional Activities Fund in Applied Science as well as the SaP Dissemination Fund.

Project Budget

Provide an itemized list for how the requested funds will be spent.

- **For each student** you anticipate hiring, please:
 - describe the work they will do
 - list the hourly rate they will receive (**include an added 8% for benefits**)
 - estimate the number of hours required
 - include 5-10 hours for SaP cohort activities
- repeat for additional students, if applicable
- indicate other project costs (max \$100)
- list the **total project cost**

For example: Student #1 - facilitate student focus groups and work with instructors to use feedback to inform redesign of assessments - \$22/hour (\$23.78 with benefits) x 40 hours = \$951.

Please refer to the SaP website for eligible expenses and recommended student salaries.

Student Project Coordinators - two total

These students, as coordinators, will work with instructors to redesign resources and facilitate student editor feedback. We estimate these students will work part-time (10 hours/week) for 9 weeks over the summer, with additional time for the year 3 student (Dhruv) to support the roll out and refinement of resources during the term (20 hours per term for 2 terms) and 10 hours each to attend SaP cohort activities - \$20/hr (\$21.60 with benefits) x 240 hours = \$5,184

Student Editors – five total

These students will provide feedback on resources created. This would involve reviewing resources individually in advance of an editors meeting held with other student editors and project coordinators. We envision 4 of these editors meeting occurring over the summer to ensure we get feedback and refine resources over time as they are developed – 5 students at 16 hours per student over the summer - \$20/hr (\$21.60 with benefits) x 80 hours = \$1,728