



THE UNIVERSITY OF BRITISH COLUMBIA

Faculty of Science

SKYLIGHT Annual Report 2018/2019



SKYLIGHT: The Science Centre for Learning and Teaching



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We would like to begin by acknowledging that the land on which we gather is the traditional, ancestral, and unceded territory of the x^wməθk^wəyəm (Musqueam) People.

EXECUTIVE SUMMARY

We are pleased to present Skylight's second annual report, which highlights our key accomplishments and celebrates departmental work between May 2018 and April 2019, and provides staff updates through September 2019.

Our central staff and embedded experts continued to provide focused consultations and support on pedagogy, curriculum, learning technology, evaluation, and management and implementation of large-scale projects to UBC Science faculty. **We also supported faculty with securing funding** through the Teaching and Learning Enhancement Fund (TLEF) and its special call for Undergraduate Program Evaluation and Renewal (UPER) projects.

We are pleased to report that **our events attracted more than 1,900 participants**. Our Skylight Supper Series and Open House events were very popular, with faculty engaging and networking with our staff and with each other. We added more professional development workshops for faculty, which were also well received.

Our team members published 7 peer-reviewed journal articles, 15 conference contributions, and a handbook that offers recommendations arising from the Carl Wieman Science Education Initiatives at UBC and at the University of Colorado Boulder.

We also made steady progress in the initiatives that we support. **Teaching Startup saw an increase in participation:** 11 faculty members completed the program successfully, impacting courses in 4 disciplines. The **Student Diversity Initiative at Science (SDI@Science) began in 2019**, supported by a partnership between Skylight and the Equity & Inclusion Office. Through the initiative we offered a faculty visioning workshop and performed student interviews. Lastly, a **proposal for a UBC Science Learning Analytics Scholars Program** was developed to advance learning analytics in UBC Science.

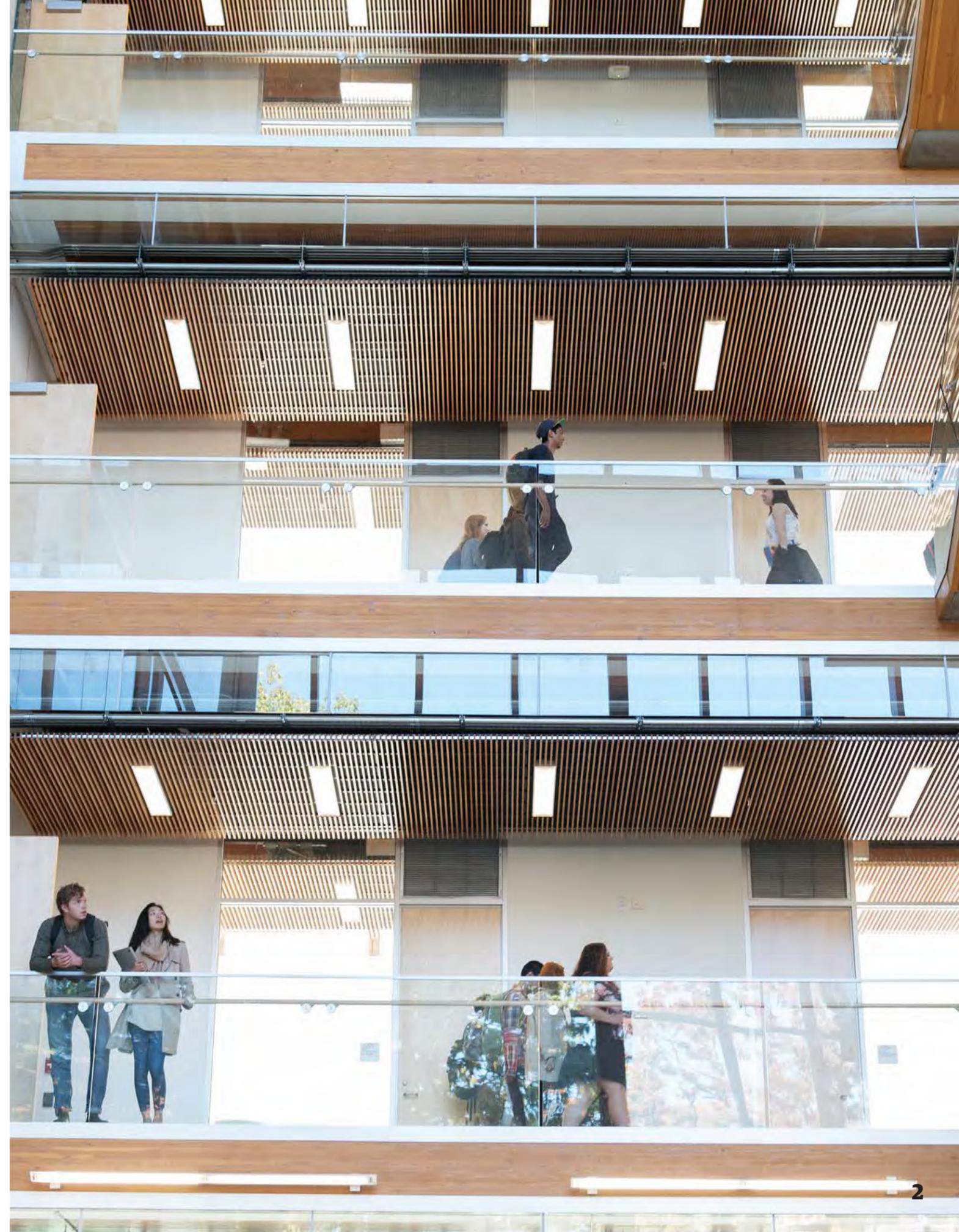
As we continue to support and make progress on our diverse set of services, we are excited about contributing to the strategic planning process that is now underway at UBC Science. We look forward to another productive year!



Dr. Gülnur Birol, Director



Dr. Warren Code, Associate Director





TEAM UPDATES

We welcomed **Naoko Hawkins** to our team as the Educational Strategist for the SDI@Science. She will be working closely with the Skylight team, UBC Science faculty and students, and the UBC Equity & Inclusion Office.

We said farewell to **Katie Foote**, Science Education Specialist in Physics and Astronomy, who moved to the United States. We welcomed **Adele Ruosi** to our team to assume this role.

Ashley Welsh, Faculty Liaison, returned from her leave of absence; we are grateful to **Eric Jandciu** and **Manuel Dias** for filling in while Ashley was away. **Erica Jeffery** went on leave, and **Jaclyn Dee** has assumed Zoology's Science Education Specialist role until Erica returns.

Manuel Dias, Educational Consultant at CTLT, supported us with faculty and student surveys on a data science project. In addition to providing many other services, Manuel continues to dedicate time to UBC Science projects, and we encourage faculty to take advantage of his great support.



Eric Jandciu
Strategist, Teaching & Learning Initiatives

Over the past year, I have supported funding proposals, managed teaching and learning projects, developed and supported program evaluation, facilitated workshops, and delivered guest classes and training workshops.

For example, I was a co-applicant on the TLEF-funded Writing Across the Curriculum+ project, which just wrapped up its third year. This project supports the teaching and learning of written, oral, multimedia, and other non-traditional forms of communication in the sciences. It has led to the development of online resources, a workshop series, and an annual best practices symposium.

Within UBC Science, I also co-lead efforts to develop a BSc Degree Outcomes Framework and support faculty and staff working on curriculum evaluation and renewal projects. I am also collaborating with a project led by Arts Studies in Research and Writing within the Faculty of Arts that will result in many new non-Arts sections of WRDS 150.

In addition, with my science and journalism background, I'm often asked to give guest classes or training workshops related to science communication and alternate careers for science graduates. Last year, this included BIOL 200, CHEM 300, CHEM 329, MICR 430, and RHSC 535.

Moving forward, I'll be supporting Teaching Startup and the proposal for the Data Science Minor, as well as continuing my involvement with Writing Across the Curriculum+, the BSc Degree Outcomes Project, and our collaboration with the Faculty of Arts.

NEW INITIATIVES

TEACHING STARTUP

In Teaching Startup, a paired teaching initiative, a new faculty member is paired with another faculty member who is experienced in implementing evidence-informed teaching practices. Together, they collaboratively teach an existing course that has already aligned learning goals, assessments, and evidence-based pedagogy, and they both receive full teaching credit. The pairs are supported by a Science Education Specialist or by someone in their department who meets regularly with the pairs to discuss various aspects of the course, including pedagogy. They also conduct classroom observations a couple of times during the term and provide pairs with feedback. For more information on Teaching Startup, please visit skylight.science.ubc.ca/projects/paired-teaching.

Between 2014 and 2018, 27 instructors taught 18 courses to over 2,500 students in the pilot program, which was held in the Earth, Ocean and Atmospheric Sciences and Physics and Astronomy departments. The program was jointly funded by a generous donation from John and Deb Harris, the Dean of Science, and the two departments, and research was disseminated through scholarly publications (Stang et al., 2017 and Holland et al., 2018). **The success of the program led to its full implementation at UBC Science, supported by the Dean and Department Heads.**

We congratulate 11 faculty members who successfully completed the program in the 2018/2019 academic year:

Fall 2018

- Marie Auger-Methe and Melissa Lee (STAT 300)
- Sean Michaletz and Mary O'Connor (BIOL 306)

Spring 2019

- Liang Song, Ljerka Kunst, and George Haughn (BIOL 433)
- Ke Zou and Marcel Franz (PHYS 158)
- Amanda Jiang and Terre Satterfield (ENVR 410)

LEARNING ANALYTICS NEEDS ANALYSIS

Learning analytics refers to the collection, analysis, and reporting of data on learners and learning environments, with the aim of better understanding and improving teaching, learning, and the student experience (learninganalytics.ubc.ca). Last year, **we explored the interests and needs around the use of learning analytics** in UBC Science's undergraduate courses. We are grateful for the feedback we received from UBC Science faculty and our Faculty Advisory Council Members.

The needs analysis committee—composed of Warren Code, Nouredine Elouazizi, Sara Harris, Manuel Dias, and Gülnur Birol—developed a proposal to pilot the **UBC Science Learning Analytics Scholars Program**. The program's goals are to advance our understanding and knowledge of how learning analytics data is used in science and mathematics education, and to build capacity among faculty and staff to tackle problems that can be addressed by learning analytics.

Last year, I provided a wide range of support services to UBC Science faculty and staff:

- I consulted with Science instructors in Chemistry, Mathematics, and Integrated Sciences who applied for small TLEF funding
- I helped develop and analyze the Data Science Faculty and Grad Student surveys as part of the engagement around the data science curriculum led by Sara Harris over the past year
- I co-facilitated two workshops on active learning techniques and assessment strategies for TRIUMF instructors
- I also helped create a Teaching Startup Canvas site for faculty and Science Education Specialists
- I am currently a member of the Learning Analytics Needs Assessment committee to promote learning analytics at the Faculty of Science.



Manuel Dias
Educational Consultant,
Learning Technologies (CTLT)
& Faculty Liaison, leave
replacement (UBC Science)

STUDENT DIVERSITY INITIATIVE AT SCIENCE

SDI@Science is a multi-year initiative created to address issues in student equity, diversity, and inclusion (EDI) at UBC Science. It is supported by a partnership between Skylight and the Equity & Inclusion Office. Please visit skylight.science.ubc.ca/projects/sdi for more information.

Congratulations to Karen Smith (Microbiology & Immunology), Jared Stang (Physics & Astronomy), Jaclyn Stewart (Chemistry), and Christine Goedhart (Botany & Skylight) for receiving funding from the Equity & Inclusion Scholars program. Their work will **enhance equity and intercultural understanding in introductory Biology, Chemistry, and Physics courses** by developing EDI measurement tools to inform teaching and conduct research; identifying the inequities and inequalities that currently exist; and determining the characteristics of learning activities that support and engage all students.

Last year, our efforts were led by a committee chaired by Karen Smith. These efforts focused on offering a faculty workshop, conducting student interviews, and researching students' sense of belonging.

SDI@Science Visioning Workshop

As part of the SDI@Science Steering Committee's work, we offered a faculty workshop in February 2019, which was **attended by ~30 UBC Science faculty and 12 Skylight staff**. The workshop gathered information from attendees on the state of EDI at UBC Science, which will inform the direction of the SDI@Science.

Student Interviews

Christine Goedhart (Botany & Skylight) and Gülnur Birol (Skylight) conducted student interviews and a focus group to learn about Science students' EDI experiences and needs. **Thirteen students participated** in the discussions, providing great insight.

Students' Sense of Belonging

Alice Campbell (Computer Science & Skylight) worked with Elisa Baniassad and Rachel Pottinger (Computer Science) to **investigate students' sense of belonging** in a second-year computer science course as part of a broader, multi-year effort studying student experiences in Computer Science.



SERVICES & SUPPORT

Through our consultations, collaborations, and engagement with faculty on teaching and learning projects, the Skylight team worked with **290 unique faculty and staff, impacting 106 undergraduate science courses** spanning all years and UBC Science programs and **accounting for 55% of Science undergraduate course enrollments (approximately 47,000 enrollments)**.

Department	Number of Courses in 2018/2019	Student Enrollments in 2018/2019
BOTA/ZOOL (BIOL)	15	8,743
CHEM	17	7,206
CS	18	9,599
EOAS	17	4,301
MATH	19	10,743
M&I	6	879
PHAS	9	3,803
STATS	5	2,480

TEACHING AND LEARNING PROJECTS

Skylight team members worked with **149 unique faculty and staff on 99 different teaching and learning projects** with varying degrees of complexity and scale, with the ultimate goal of improving student learning and experience. Some of these projects received institutional funding while some of them are grassroots faculty projects undertaken without funding.

These projects focused on:

- Improvements in pedagogy, course design, and development
- Learning and evaluation; program or course/lab learning outcomes; and resource revision and/or development
- Learning technology development
- Student diversity, equity, and inclusion
- Paired teaching and professional development workshops

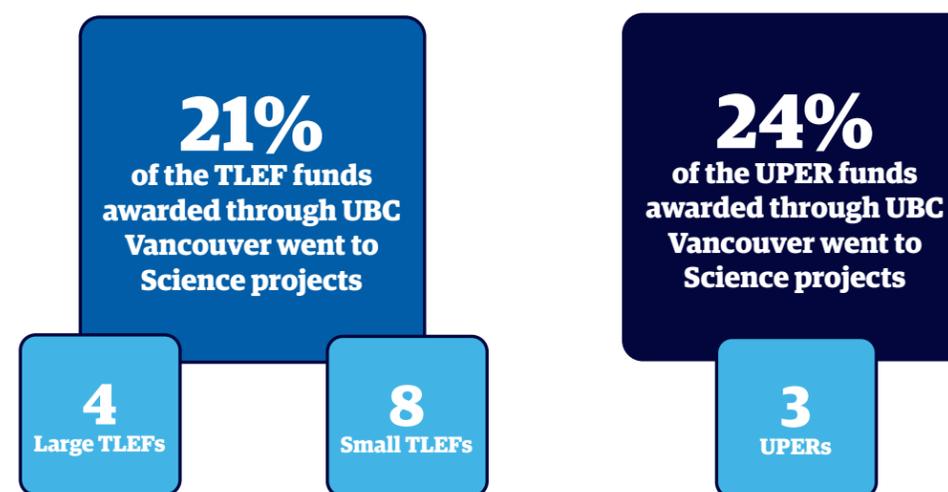
TLEF & UPER PROJECT SUPPORT

In addition to its annual call for TLEF proposals, UBC issued a special call for Undergraduate Program Evaluation and Renewal (UPER) proposals. **We were pleased to provide faculty with project development and implementation support for both of these funding opportunities.** In partnership with CTLT, we also connected faculty with resources to facilitate the adoption of best practices and to build capacity for change within UBC Science.

In 2019, UBC Science faculty submitted large TLEF proposals aimed at redesigning upper-division Physics labs; developing apprenticeship learning opportunities for Engineering Physics; and developing data-enabled pedagogies and technology for critical thinking and decision making. They also submitted proposals for program review and revision in Mathematics, Computer Science, and Biology as part of the special call for UPER proposals.

Small TLEF projects centered on providing experiential, multi-disciplinary, and self-regulated learning opportunities to students, as well as developing open-source textbooks and technology for online grading.

2019 Funding Competitions



Ashley Welsh
Faculty Liaison

As the Faculty Liaison in Skylight, I am involved with several strategic teaching and learning projects and professional development activities within UBC Science and the Centre for Teaching, Learning and Technology at UBC.

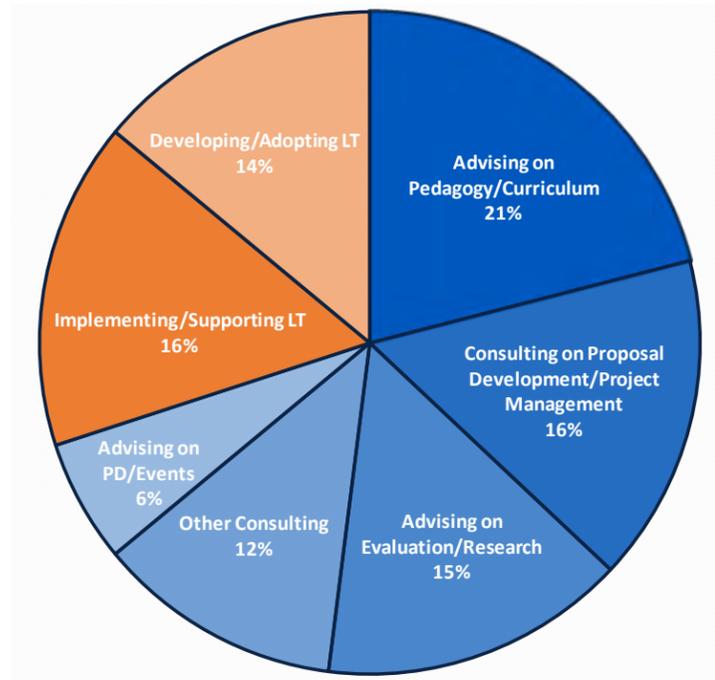
One of my main responsibilities is to support faculty, staff, and students with the design and evaluation of their TLEF proposals and projects, and to oversee the adjudication of proposals within UBC Science. This year, I met with over 10 TLEF project teams to discuss their project goals and timelines, to provide feedback on their evaluation processes, and to connect them with UBC colleagues and resources related to their projects.

Over the past two years, I have been co-leading the BSc Degree Outcomes Framework project and have created a guiding framework that outlines the knowledge, skills, and competencies that undergraduates could achieve at the completion of their UBC degree. More specifically to the past year, I co-facilitated a Degree Outcomes Working Group for Science Education Specialists engaged with program learning outcomes projects within their own departments. This group is an opportunity for them to share practices, resources, and challenges, and for me to gain a better understanding of the design processes occurring within different departmental contexts.

In the upcoming year, I will be co-facilitating the Skylight self-study, developing a curriculum and communications plan for Skylight events and professional development, and engaging in activities and scholarship related to evaluating the services and impact of discipline-specific centres for teaching and learning.

CONSULTATIONS

We provided teaching, learning, and learning technology (LT) consultations for **189 unique faculty members (~30% of UBC Science faculty)** in the past year, **impacting 88 courses representing ~39,000 student enrollments.**



Our consultations with faculty between May 2018 and April 2019 covered a wide range of matters requiring a diverse set of expertise. Almost 60% of our consultations were on the broad areas of pedagogy; curriculum for courses and programs; evaluation and discipline-based education research; development and management of educational improvement projects; and providing advice on professional development workshops and events. Approximately 30% of our consultations were on the development, implementation, and/or adoption of learning technologies.

LEARNING TECHNOLOGIES ECOSYSTEM SUPPORT & CONSULTATIONS

We offer learning technology support in partnership with CTLT and in collaboration with department-based IT/LT groups in UBC Science departments. This support continued to be an important service last year. With the Canvas transition now complete, our work mainly focused on **supporting large and small TLEF projects involving learning technology**, in addition to addressing **nearly 6,000 learning technology tickets**. The multi-year and multi-faculty endeavours to develop two content repositories (StatSpace and BioSpace) are now complete. Both repositories are being used by UBC Science faculty.

5,964

Learning technology support requests serviced

1,700

Active course sites created

82

Learning technologies supported

2

Content repositories created

Some of my own specific contributions included:

- Delivering StatSpace and BioSpace to enable faculty members to use and share discipline-specific teaching and learning content
- Facilitating and leading the learning technology efforts for at-scale piloting WebWork for online exams in a large enrollment math course
- In collaboration with faculty members, leading the software development efforts to create AI-informed, innovative learning technologies to support learning assessment in Chemistry (Alchemy system) and Mathematics (Orchard system)

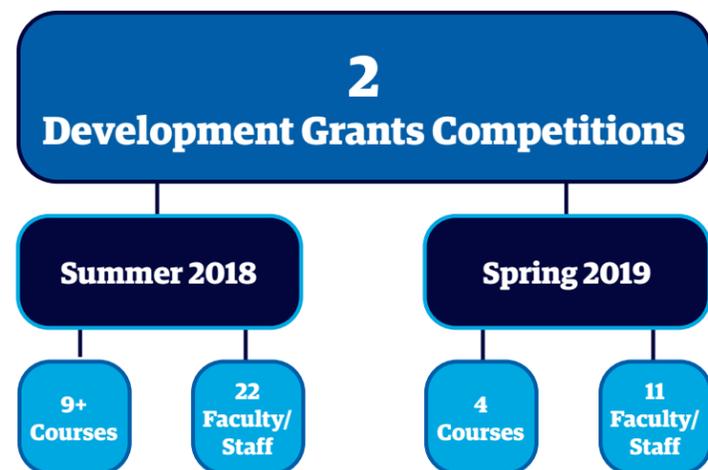


Noureddine Elouazizi
Strategist, Learning Technology

My current activities include:

- Continuing to innovate in the assessment technologies space
- Completing and delivering the Alchemy system (for scalable use) and the Orchard system (for piloting use)
- Managing the learning technology ecosystem and its related support operations

SKYLIGHT DEVELOPMENT GRANTS



Skylight received 18 proposals requesting a total of nearly \$55,000 in the [2018 Summer](#) and [2019 Spring](#) competitions. **We awarded nearly \$36,000 in total to 13 proposals.**

The majority of the funded projects centered on introducing active learning techniques or improving existing ones in courses, while other projects focused on curriculum development and skill or knowledge assessment.

Summer 2018

Department/Program	Grant Holder
CHEM	Robin Stoodley
CS	Cinda Heeren
CS	Meghan Allen
EOAS	Sarah Bean Sherman (1)
EOAS	Sarah Bean Sherman (2)
IRES	Amanda Giang
MATH	Andrew Rechnitzer
M&I	Kimberly Dill-McFarland
PHAS	Kathleen (Katie) Foote

Spring 2019

Department/Program	Grant Holder
CHEM	Jay Wickenden
CS	Tamara Munzer
COGS	Christopher Mole
ZOOL	Stella Lee

EVENTS

Skylight hosted and facilitated a wide range of events between May 2018 and April 2019, including professional development and networking opportunities for faculty and staff. Our events were attended by more than 1,900 participants.



Last year's [Supper Series](#) hosted **11 speakers**, with presentations on the following topics:

- Using Canvas templates to improve the student and instructor experience
- Embedding self-reflection and personal development into a lab course
- Lessons learned on building a degree program from scratch
- Blended teaching model for making large classrooms smaller
- Development and use of a content repository for Statistics
- Developing a software prototype and pedagogy for expert-like thinking in Chemistry

In April 2019, our annual [Open House](#) on science education featured talks by:

- Elisa Baniassad (Computer Science): Mastery Learning at Scale
- Kayli Johnson (Chemistry & Vantage): Interactive Videos to Support Active Learning Beyond the Classroom
- Carl Wieman (Stanford & CWSEI): Teaching Expert Decision-making

Our Open House also offered an **interactive session to explore practical strategies for addressing common teaching issues** in realistic teaching scenarios, such as problems with group work and low student engagement. The poster session featured **23 posters showcasing the excellent work and activities carried out by the UBC Science teaching and learning community**, and it provided a venue for fruitful conversations.

We were delighted to host a **weeklong professional development series for education researchers**, facilitated by Eleanor Sayre (Kansas State University), Scott Franklin (Rochester Institute of Technology), and Linda Strubbe (Kansas State University; previous: UBC Physics & Astronomy). The workshop specifically focused on engaging with research design and implementation. This intense workshop series was **attended by 25 staff and faculty**.



RESEARCH & DISSEMINATION



Last year, we continued sharing our work with the broader science education community. We were **invited to give 7 talks and 10 workshops**, and we generated **16 UBC-internal reports and 1 external report** to inform strategic decisions involving teaching and learning.

Our **peer-reviewed journal contributions**, often written in collaboration with UBC Science faculty and other colleagues, covered a wide range of topics, including (but not limited to):

- Faculty adoption of active learning strategies via paired teaching
- Methodology development for scholarship of teaching and learning
- Embedded expertise approach for enriching teaching and learning
- Navigating the divide between scientific practice and science studies to support teaching of epistemic knowledge
- Timing and perseverance in higher education reform
- Sustainable change in teacher preparation programs
- Longitudinal study on improving students' generic problem-solving skills

PEER-REVIEWED CONTRIBUTIONS

The following works were published between May 2018 and April 2019. Please visit skylight.science.ubc.ca/resources/publications for a full list of our scholarly publications.

Proceedings

- Coles, M. (2018). Professional Development for Graduate Student and Postdoc Instructors. In J. Holm & S. Mathieu-Soucy (Eds.), Proceedings of the 2018 Annual Meeting of the Canadian Mathematics Education Study Group/Groupe Canadien d'Étude en Didactique des Mathématiques, (pp.235-236).

Journal Articles

- Klegeris, A., Dubois, P. J., Code, W. J., & Bradshaw, H. D. (2019). Non-linear improvement in generic problem-solving skills of university students: a longitudinal study. *Higher Education Research & Development*, 38(7), 1432-1444. doi: 10.1080/07294360.2019.1659758
- Strubbe, L., Stang, J., Holland, T., Sherman, S. B., & Code, W. (2019). Faculty Adoption of Active Learning Strategies via Paired Teaching: Conclusions From Two Science Departments. *Journal of College Science Teaching*, 49(1), 31-39. doi: 10.2505/4/jcst19_049_01_31
- Webb, A., & Welsh, A. J. (2019). Phenomenology as a methodology for Scholarship of Teaching and Learning research. *Teaching & Learning Inquiry: The ISSOTL Journal*, 7(1), 168-181. doi: 10.20343/teachlearningqu.7.1.11
- Sharif, A., Welsh, A., Myers, J., Wilson, B., Chan, J., Cho, S., & Miller, J. (2019). Faculty Liaisons: an embedded approach for enriching teaching and learning in higher education. *International Journal for Academic Development*, 24(3), 260-271. doi: 10.1080/1360144x.2019.1584898
- Öberg, G., & Campbell, A. (2018). Navigating the divide between scientific practice and science studies to support undergraduate teaching of epistemic knowledge. *International Journal of Science Education*, 41(2), 230-247. doi: 10.1080/09500693.2018.1548044
- Foote, K., Henderson, C., Knaub, A., Dancy, M., & Beichner, R. (2019). Try, Try Again: The Power of Timing and Perseverance in Higher Education Reform. *Change: The Magazine of Higher Learning*, 51(1), 50-57. doi: 10.1080/00091383.2019.1547082
- Foote, K. T., & Knaub, A. V. (2018). Seeding long-term, sustainable change in teacher preparation programs: the case of PhysTEC. *International Journal of STEM Education*, 5(1). doi: 10.1186/s40594-018-0134-3

Conference Talks

- Algar, R., Elouazizi, N., Stewart, J., Maxwell, J., Tan, T. (2019). A Choose-Your-Adventure Style Learning Platform. CSSE.
- Foote, K. (2019). Leveraging Disruption to Catalyze Change: The Case of SCALE-UP. Foundations and Frontiers in Physics Education Research Conference, Puget Sound, United States.
- Dee, Jaclyn. (2019). Semi-Pro: Novices learn to read papers more like experts and understand papers better with 'Figure Facts'. University Biology Educators of Alberta Conference.
- Chasteen, S., & Code, W. (2019). Leading departmentally-based change initiatives: The Science Education Initiative Handbook. Accelerating Change in STEM Education Network.
- Birol, G., Smith, K., Campbell, A., Goedhart, C., Sherman, S. B., Harris, S., & Wideman, T. (2019). Equity, Diversity and Inclusion in First Year Experience. UBC First Year Educators Symposium, Vancouver, Canada.
- Smith, K., Birol, G., Micallef, J., Clarke, S., Welsh, A., Hambler, P., Jung, D., & Li, D. (2019). Piloting an Academic Scholars Program in a First Year Biology Course. UBC First Year Educators Symposium, Vancouver, Canada.
- Welsh, A., & Jandciu, E. (2018). One size does not fit all: Sharing practices for developing and assessing degree program learning outcomes at a research-intensive university. International Society for the Scholarship of Teaching and Learning, Bergen, Norway.
- Briseño-Garzón, A., Han, A., & Birol, G. (2018). Researching Institutional Change: A Longitudinal Study on Faculty Teaching Practices. ISSOTL, Bergen.
- Webb, A., & Welsh, A. (2018). "This might be uncomfortable": Learning to support SoTL scholars. International Society for the Scholarship of Teaching and Learning Conference, Bergen, Norway.
- Smith, K., Li, D., Birol, G., Welsh, A., Hambler, P., & Jung, D. (2018). Piloting an academic scholars program to foster student engagement and sense of belonging in a first year science course. Presentation at the International Conference on Educational Sciences, Antalya, Turkey.
- Algar, R., Elouazizi, N., et al. (2018). Expert-Like Feedback and Decision Making Evolving Toward Learning Analytics. 101st Canadian Chemistry Conference.
- Dawson, J.Q., Allen, M., Campbell, A., & Valair, A. (2018). Designing an Introductory Programming Course to Improve Non-Majors' Experiences. Western Canadian Conference on Computing Education, Victoria, BC.
- Coles, M. (2018). Professional development of novice math instructors: Encouraging the adoption of authentic teaching. Canadian Mathematical Society (CMS) Session on Authentic Teaching.
- Stewart, J., Aube, M., & Jandciu E. (2018). A Cross-Disciplinary Collaborative Approach to Undergraduate Communication Instruction. International Society for the Scholarship of Teaching and Learning Conference, Bergen, Norway.

CARL WIEMAN SCIENCE EDUCATION INITIATIVE

Wrap-up activities for the Carl Wieman Science Education Initiative (CWSEI) continued this year. **The Life Sciences SEI group published a large study¹** across Biology courses relating observed teaching practices to concept inventory performance. **Earth, Ocean & Atmospheric Sciences and Physics & Astronomy individually published two papers about the benefits of paired teaching^{2,3}** based on studies of several teaching pairs who are completing their extension of SEI efforts (co-funded by a donation from John and Deb Harris). **A fourth publication was the The Science Education Initiative Handbook⁴**, which provides detailed recommendations and resources to complement Carl Wieman's book, which was published in 2017.

The CWSEI sponsored both the annual Open House on science education and the [Professional development for Emerging Education Researchers](#) workshop in Spring 2019.

As part of our stewardship of the many outputs of the CWSEI, an SEI Materials Archive was previously created to store materials from SEI efforts. This archive is now being migrated to a new platform (DSpace) that will be more sustainable in the long term. Efforts also began this year to **migrate the popular CWSEI website (cwsei.ubc.ca) to a more permanent home** while changing the site's focus to be more about reflecting back on the initiative. Summary reports of each department's activities during the CWSEI have also been drafted to capture the initiative's activity record, which will be shared on the new website.

These efforts and further publishing activity are expected to continue through 2019, and in 2019/2020 we will see the final two Science Teaching and Learning Fellows (STLFs) finish their positions.

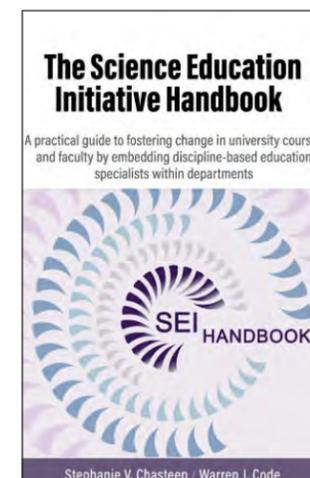
¹Weir, L. K., Barker, M. K., McDonnell, L. M., Schimpf, N. G., Rodela, T. M., & Schulte, P. M. (2019). Small changes, big gains: A curriculum-wide study of teaching practices and student learning in undergraduate biology. *PLOS ONE*, 14(8), e0220900. <https://doi.org/10.1371/journal.pone.0220900>

²Strubbe, L. E., Stang, J., Holland, T., Sherman, S. B., & Code, W. J. (2019). Faculty Adoption of Active Learning Strategies via Paired Teaching: Conclusions From Two Science Departments. *Journal of College Science Teaching*, 49(1), 31-39.

³Holland, T., Sherman, S. B., & Harris, S. (2018). Paired Teaching: A Professional Development Model for Adopting Evidence-Based Practices. *College Teaching*, 66(3), 148-157. <https://doi.org/10.1080/87567555.2018.1463505>

⁴Chasteen, S. V. & Code, W. J. (2018). *The Science Education Initiative Handbook*. Accessed at <https://pressbooks.bccampus.ca/seihandbook/>.

THE SEI HANDBOOK



The Science Education Initiative Handbook, released in early 2019, is intended as "a practical guide to fostering change in university courses and faculty by embedding discipline-based education specialists within departments." The handbook provides advice for people in all roles in a department-based teaching initiative; resources, including downloadable, sample planning documents; and case studies of SEI-like initiatives at other institutions. It was co-authored by Stephanie Chasteen (University of Colorado Boulder) and Warren Code (Skylight), with Erika Borys (Skylight) copy editing it and assisting with its design.

The handbook is openly licensed and available for free download at pressbooks.bccampus.ca/seihandbook. It can also be purchased in print through Amazon at amazon.com/Science-Education-Initiative-Handbook-discipline-based-ebook/dp/B07MJNKSHQ.

Last year was an exciting year for Skylight! I was thrilled to work on many projects in support of the team and our strategic goals. I edited The Science Education Initiative Handbook, co-authored by Warren Code, and learned a lot about the CWSEI in the process. I contributed editing and graphic design work for the creation of Skylight's first annual report and prospectus. I facilitated a workshop on developing communication plans and strategies at our Skylight retreat. I also supported the hiring of new team members, interacting with candidates on behalf of various search committees and then helping onboard our new hires.

Erika Borys, Administrative Coordinator

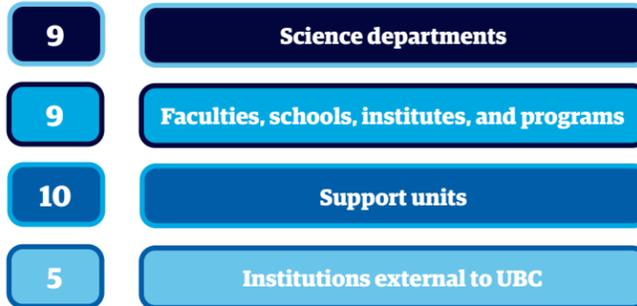
PARTNERSHIPS

STUDENT PARTNERSHIPS

We worked with:

- 1 Co-op Student and 1 Staff Student
- 1 Work-Learn Student
- 7 Learning Technology Rovers (Co-op Students)
- 2 Canvas Technology Rovers (Co-op Students)

PARTNERSHIPS



COMMITTEES & ORGANIZATIONS



Our team members collectively held **10 professional memberships** to participate in and support the following organizations:

- Canadian Society for the Study of Higher Education (CSSHE)
- National Science Teachers Association
- International Society for the Scholarship of Teaching and Learning (ISSOTL)
- Mixed Methods International Research Association
- EDUCAUSE
- Society for Learning Analytics Research (SoLAR)
- Society for the Advancement of Biology Education Research (SABER)
- Undergraduate Biology Educators of Alberta
- Science Writers and Communicators of Canada
- National Association of Geoscience Teachers

We served on 22 committees, including the Data Science Curriculum Group and the Vantage College Science Curriculum Committee.

We also co-hosted Eleanor Sayre from Kansas State University, Andreas Moeller and Diane Komala from University of Kansas, and Nienke van Houten from Simon Fraser University.

Further, **we peer-reviewed work submitted to:**

- Canadian Journal of Scholarship of Teaching and Learning
- First Year Experience Conference
- International Journal of Science Education
- Journal of Geoscience Education
- Multidisciplinary Undergraduate Research Conference
- Society for the Advancement of Biology Education Research
- Western Conference on Science Education

FACULTY ADVISORY COUNCIL

SKYLIGHT FACULTY ADVISORY COUNCIL

2018/2019 Skylight Faculty Advisory Council Members



Bridgette Clarkston
Instructor (BOTA)



Bruce Dunham
Senior Instructor (STATS)



Costanza Piccolo
Senior Instructor (MATH)



Gregory Dake
Associate Professor (CHEM)



Joss Ives
Senior Instructor (PHAS)



Marcia Graves
Instructor (M&I)



Pam Kalas
Senior Instructor (BOTA/ZOOL)



Rachel Pottinger
Associate Professor (CS)



Stuart Sutherland
Professor of Teaching (EOAS)



Gülnur Birol
Director (Skylight)



Warren Code
Associate Director (Skylight)



Sara Harris
Associate Dean, Academic (ex-officio)

Faculty Advisory Council Members continued to play an important role last year in liaising with their departments and advising us on matters of strategic importance, including: SDI@Science; identifying needs for teaching and learning data, and its use; updates on departmental strategic priorities for teaching and learning; input on wrap-up reports for the CWSEI's departmental work; and input on the revision of processes for Skylight's events and grants. In addition, **many of the faculty members continued to supervise the work of the Science Education Specialists** in their departments.

We were able to support one council member in attending a teaching and learning conference using funds earmarked by the Dean of Science for the council.

DEPARTMENT REPORTS

GENERAL OVERVIEW

We asked our Faculty Advisory Council Members to share teaching and learning highlights from their departments that were undertaken with Skylight support over the past year. The following section is organized around these highlights and the work performed by our Science Education Specialists. We acknowledge that there is an extraordinary amount of teaching and learning work underway in all Science departments, however for the purposes of our report we are focusing on activities we had the opportunity to support last year.

We invite you to celebrate with us the great work that has been carried out by UBC Science faculty, staff, and students last year, noting the diversity of these activities and the significant impact on student learning and experience.



BIOLOGY: BOTANY & ZOOLOGY

Faculty Supervisor and Faculty Advisory Council Members: Pamela Kalas and Bridgette Clarkston (2018/2019); Sunita Chowrira (current)
Science Education Specialist (Botany): Christine Goedhart
Science Education Specialist (Zoology): Erica Jeffery (on leave); Jaclyn Dee (current)

Three major teaching and learning activities in Biology last year included soft-launching BioSpace, conducting student experience interviews, and developing a program renewal project proposal.

BioSpace

BioSpace is a searchable online repository that gathers teaching and learning resources for UBC Biology courses, and it was part of a larger, multi-year project with TLEF funding. Learning technology support for developing BioSpace was coordinated by Nouredine Elouazizi and Rachel Petrynko, with contributions from Maki Sumitani. **The repository was soft-launched in June 2019**, and Biology faculty have started contributing to it.

Student Experience Interviews

As part of the growing SDI@Science, Christine Goedhart and Gülnur Birol conducted a series of **student interviews to understand the challenges students in underrepresented groups face** during their undergraduate education at UBC, which culminated in a report on students' insights and perceptions.

Defining and Mapping Program Learning Outcomes for the Biology Curriculum: Empowering Students and Faculty in the Development of Core Knowledge and Competencies

Erica Jeffery, Christine Goedhart, and Jaclyn Dee supported Sunita Chowrira, Shona Ellis, Patricia Schulte, and Angie O'Neill in the development of a successful Undergraduate Program Evaluation & Renewal Project (UPER) proposal. This project aims to make it easier for faculty and students to understand and appreciate **connections between courses and the progression of program-level outcomes across the curriculum**, as well as to highlight how existing course experiences help students develop key transferable skills. The project has the potential to impact thousands of students yearly.



Christine Goedhart
Science Education Specialist
(Botany)

As a Science Education Specialist in the Botany department, I help faculty develop teaching practices that are student-centered, inclusive, and evidence-based. I also advise and support faculty on teaching and learning project proposal development, implementation, and evaluation, and provide formative, expert feedback to instructors on their teaching.

One of the major projects I've been involved with this past year is SDI@Science. In this project I worked with others to organize and host a faculty workshop and to conduct a needs analysis within the Biology program. The results of this needs analysis will inform the approach, direction, and methodology of the initiative within the Biology program to improve conditions around equity, diversity, and inclusion for all students.

I'm also working with faculty on an Equity & Inclusion Scholars project, titled "Enhancing equity across active-learning introductory science courses". An outcome of this project is the development of tools that will help us identify best practices for educators when implementing activities in an active learning environment.

I'm excited to continue working with others on these efforts in the next year!

It has been my great pleasure to create spaces that bring faculty, staff, and students together in order to learn from each other the myriad ways that we can enhance student learning. While planning and facilitating discussions during the Skylight-sponsored Science Education Open House, our annual Biology Teaching Retreat, and student focus groups, I have witnessed people laughing, engaging in meaningful conversations about learning, and sharing both their academic expertise and their lived experience. After each of these events, participants have expressed how much they have enjoyed connecting with peers and receiving practical advice for dealing with present challenges. Our student participants have expressed their sincere appreciation for having these opportunities to be heard, to learn, and to contribute to current teaching and learning initiatives. I look forward to continuing to draw our students into the process of shaping their own learning environment.

Jaclyn Dee, Science Education Specialist (Zoology)

MICROBIOLOGY & IMMUNOLOGY

Faculty Advisory Council Member: Marcia Graves

Teaching and learning activities in Microbiology & Immunology last year included work on an upper-level lab revision project and on the implementation of the Academic Scholars Program (ASP) in BIOL 112.

In addition to this Skylight-supported work, David Oliver and Marcia Graves received UBC PURE funding to address the need for quality undergraduate research experiences using course-based undergraduate research experiences (CUREs), which are scalable pedagogical approaches.

Steven Hallam and Stephan Koenig have made significant progress in developing and implementing data science modules through [EDUCE](#), which received TLEF funding. Steven has also made substantial contributions to the Data Science Working Group through direct meeting participation and development of the UBC Science Data Science Minor proposal and the 2019 Data Science Curriculum Group's report and recommendations.

Lab Curriculum Mapping and Course Renewal

Microbiology & Immunology is looking towards renewing courses within the lab curriculum of the MBIM undergraduate program. To this end, Jennifer Sibley, Marcia Graves, Wade Bingle and Dave Oliver, as well as Linda Horianopoulos (GTA), are engaged in **mapping how learning objectives within their lab curriculum align with the goals of their program**, and to identify how objectives are being met and assessed. The documentation has provided a framework to begin course renewal efforts in the introductory lab course, MICB 322, led by Jennifer Sibley.

Students taking this course learn the fundamental core concepts and skills required to move forward through the lab program. The redesign of this course included defining overall course goals, learning objectives, and lab/lecture activities. New assessment tools that align with the course's learning objectives were also developed for the September 2019 offering of the course. This project was initially supported by Eric Jandciu, Warren Code, and Andrea Han (CTLT) using CWSEI funds.

Academic Scholars Program

As part of the TLEF-funded project entitled Building Academic Tenacity, Karen Smith piloted an ASP in a first-year cell biology course (BIOL 112), supported in part by Gülnur Birol and Ashley Welsh. The ASP was designed to engage students with a wide range of activities shown elsewhere to promote academic success. The initial findings showed that **ASP students overall performed 5% better on exams than students who did not participate**. Further, students responded positively to the benefits of participating and appreciated being directed towards key campus events.

CHEMISTRY

Faculty Supervisor and Faculty Advisory Council Member:

Gregory Dake

Science Education Specialist: Jeanette Leeuwner

Chemistry concentrated on a few major projects, notably Alchemy, a Basic Skills Test, and CHEM 100.

Alchemy

Alchemy is a prototype online tool that Chemistry developed in partnership with Skylight. This tool provides a pedagogical method for students to practice and receive feedback on their critical thinking, decision making, and processing skills, helping them learn and practice expert-like thinking. The project was led by Russ Algar and Robin Stoodley, who also presented on Alchemy at our March 2019 Skylight Supper Series event.

Basic Skills Test

In Summer 2018, a new **Basic Skills Test for incoming Chemistry students was developed and offered for the first time**. Analysis of this test is ongoing but may point to some challenges concerning the quantitative skills of incoming students.

CHEM 100

Jeanette Leeuwner developed and instructed the first offering of CHEM 100, delivering the course to 67 students in Fall 2018.

This course was designed for students who do not have sufficient high school chemistry credit. It covers atomic and molecular properties; chemical reactions; bonding; nomenclature; kinetics; equilibrium processes; acids and bases; oxidation; and reduction. A comprehensive new course evaluation was an integral part of her work in developing the course.



Jeanette Leeuwner

Science Education Specialist
(Chemistry)

As a Science Education Specialist within the Chemistry Department, I support faculty in undertaking education projects and in improving their teaching and learning approaches. This involves advising on best teaching practices; the design and implementation of evaluation tools; and the development of course material and assessments. For example, some projects I'm involved in include improving students' critical thinking and collecting feedback on students' experiences in the Chemistry degree program. Last year, I also designed and taught a new Chemistry course called CHEM 100. The course is an introductory catch-up course covering BC Grade 11 & 12 Chemistry, and intended to give students an improved chance of success in subsequent Chemistry courses.

COMPUTER SCIENCE

Faculty Supervisor and Faculty Advisory Council Member: Rachel Pottinger

Science Education Specialist: Alice Campbell

Teaching and learning activities in CS last year featured the development of an undergraduate program evaluation and renewal proposal, small TLEF and Skylight Development Grant proposals, and community building efforts.

Computer Science Undergraduate Program Evaluation and Renewal

Chen Greif, Rachel Pottinger, and Alice Campbell co-developed an Undergraduate Program Evaluation and Renewal (UPER) proposal, which received funding and may impact up to ~2,000 students. The funding will be used for **developing program-level learning outcomes (PLOs) to help ensure the quality and relevance of the program**, which has witnessed significant growth in the past several years. The first year of the project will focus on curriculum mapping to articulate what students currently learn and to identify implied PLOs, including both technical and non-technical skills.

Community Building Efforts

The department has successfully engaged faculty from different ranks and disciplinary groups with conversations on teaching and learning. Half a day was allocated to discussing teaching-related topics during the department's annual retreat this year, which featured a 90-minute session on its curriculum revision project. This successful session had a high level of engagement from faculty, staff, postdocs, and graduate students in drafting learning outcomes.



Alice Campbell

Science Education Specialist
(Computer Science)

As a Science Education Specialist, I enjoy having the opportunity to help department members improve their teaching practices, support their educational research, and to help further the undergraduate program's strategic goals.

In the past year, I've worked closely with Rachel Pottinger and many other CS faculty members to advance our Computer Science curriculum renewal project. With our large number of majors (~2,000) and anticipated growth, we aim to take stock of what our students are currently learning in our programs and define what we want them to learn in order to drive potential changes to our programs. So far, we've engaged dozens of faculty members, staff, students, and industry representatives to identify what our students are currently learning and what they need to learn to succeed in their future careers. We are grateful for the generous support from UBC's Undergraduate Program Experience Renewal fund, including time from Carrie Hunter, a Curriculum Consultant at CTLT.

Together with Elisa Baniassad, I've also begun investigating students' sense of intellectual belonging in CS, particularly in some of our core courses. We've been especially interested in analyzing gendered differences in student belonging, since women are underrepresented in CS. Going forward, we hope to better understand the experiences and sense of belonging of other underrepresented groups in CS, and will draw on Naoko Hawkins's (Skylight/Equity & Inclusion Office) expertise to gather and interpret this data. Our preliminary data has already led to some changes in one of our second-year core courses to better support all students' sense of belonging.

As co-organizer of the Skylight Supper Series, together with Matthew Coles (Math), I also enjoy programming a series that showcases the diversity of teaching and learning initiatives in Science that address the needs and interests of a broad audience of science educators. It's heartening to see department members come out to support their colleagues, and to see the community of educators that the Supper Series has nurtured over the years.

PHYSICS AND ASTRONOMY

Faculty Supervisor and Faculty Advisory Council Member: Joss Ives

Science Education Specialist: Kathleen (Katie) Foote (past); Adele Ruosi (current)

Science Teaching and Learning Fellow: Electra Eleftheriadou

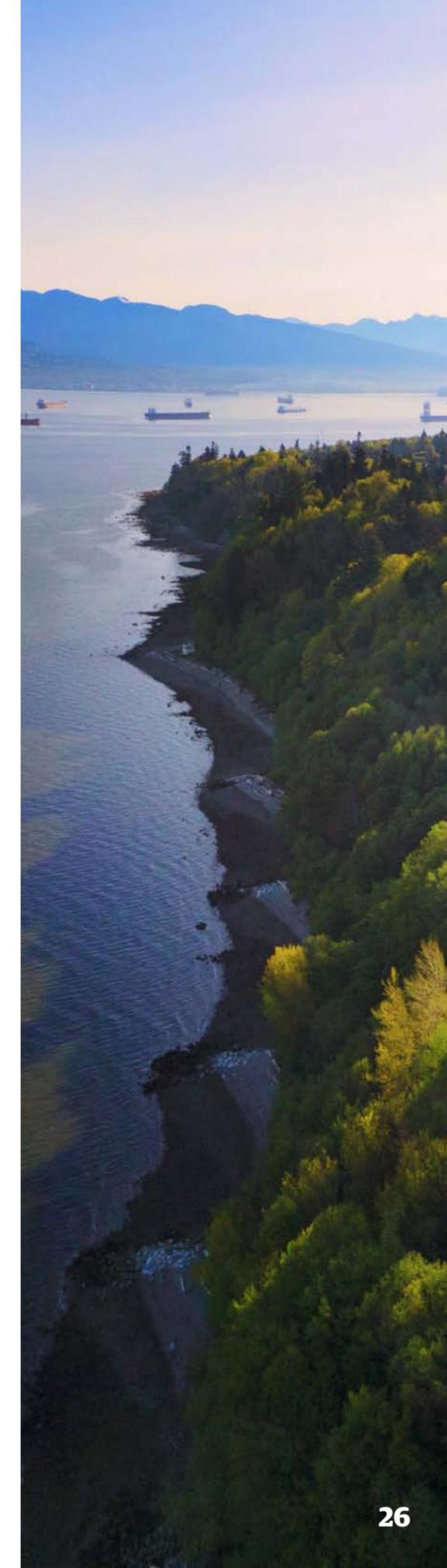
PHAS has been working on two major projects: a TLEF-funded, undergraduate program renewal project and a course transformation project.

Re-designing Upper Division Physics Labs to Target 21st Century Competencies

Douglas (Doug) Bonn, Carl Michal, David Jones, Joss Ives, Josh Folk, and Katie Foote co-developed a TLEF proposal, which received funding and has the potential of impacting ~650 students. The funding will be used to **develop project-based labs with skills modules** to improve the authenticity and coherence of the upper division lab experience; to articulate and implement skill-based degree outcomes; and to increase students' confidence, scholarly communication skills, and autonomy in design. The work also includes **redesigning the lab curriculum and pedagogy** to align with the new learning space in the Hebb Building.

PHYS 301 Course Transformation

Katie Foote and Joerg Rottler made **significant efforts in the transformation of PHYS 301**. In Fall 2018, PHYS 301 had ~150 student enrollments and was held in the recently refurbished Hennings 200 classroom. The transformation incorporated many of the group structures used in Student-Centered Active Learning Environment for Undergraduate Programs ([SCALE-UP](#)), building on Katie's prior work. In PHYS 301, students sat in groups during their lectures and tutorials, and were given group whiteboard activities as part of their regular coursework. To evaluate the course transformation, Katie worked on understanding the performance differences observed in the course based on students' specializations. She also developed resources for use in future sessions to learn more about how different groups of students interact with the course.





EARTH, OCEAN AND ATMOSPHERIC SCIENCES

Faculty Supervisor and Faculty Advisory Council Member:

Stuart Sutherland

Science Education Specialist: Sarah Bean Sherman

Science Teaching and Learning Fellow: Alison Jolley

Highlights from EOAS's teaching and learning activities over the past year included the development of a process for assessing faculty candidates' teaching, a field course transformation, and a survey of departmental specializations.

Teaching Assessments of Faculty Candidates

Sarah Bean Sherman and Alison Jolley were key members in a faculty hiring team that **developed, coordinated, and deployed teaching assessments in EOAS's hiring process**. Following the hiring round, Bean, Alison, and Stuart Sutherland, chair of the EOAS Teaching Initiatives Committee, reviewed the process and wrote a recommendation document on teaching assessments for future hires.

Field Course Transformation

The second year geology field school is often over capacity and cannot accommodate more students in its week-long field site away from Vancouver. To support and make space for more diverse students, **the course is being transformed to involve multiple instructors with varied expertise, added laboratory exercises, and single day trips**. Stuart Sutherland, Sarah Bean Sherman, and Alison Jolley are supporting James Scoates and Nichole Moerhuis, who are leading the curriculum development of the project. Stuart, Bean and Alison (with consultation from others in EOAS) have compiled a selection of field sites, which will be scouted in the upcoming year.

Survey of Departmental Specializations

Stuart Sutherland, Sarah Bean Sherman, and Alison Jolley **gathered data on student experiences in all eight specializations in EOAS**. The data are now being analyzed by Alison, and the results will form an important part of the upcoming departmental external review.

I am delighted that I can share what I learn at UBC with other institutions. For the past three years, I have gone to the University of Hawai'i to give workshops, conduct class observations, and meet with faculty and students to discuss evidence-based active learning techniques and assessments.

I am thrilled that the paired teaching pilot project that started in the Physics & Astronomy and Earth, Ocean & Atmospheric Sciences departments is now being offered throughout UBC Science under a new name, Teaching Start-Up. It is really exciting that the university feels that it is worthwhile to put resources to helping faculty improve the teaching and learning experiences for all involved.

This past year I nominated two instructors for our departmental teaching awards, and both were selected. This is especially pleasing as it is the first time in the history of our department where two women received this award the same year.

I, along with Dominique Weis, submitted a large Learning Space Improvement Project proposal that, if funded, would transform the way learning happens in labs that rely heavily on microscope work. I have dreamed of the setup I've proposed for more than a decade now. I started with receiving funding for a teaching microscope from a Skylight Development Grant and then convinced the department to buy microscopes with embedded cameras for all of the students. So I have been slowly working towards my dream of creating a better microscope lab. If we receive the funding to bring it all together, I will be ecstatic, but if we don't, I have already started thinking about other ways to make it happen. I am so amazed that UBC offers so many ways of improving learning and teaching.

Sarah Bean Sherman, Science Education Specialist (Earth, Ocean, and Atmospheric Sciences)



MATHEMATICS

Faculty Supervisor and Skylight Faculty Advisory Council Member: Costanza Piccolo
Science Education Specialist: Matthew (Matt) Coles

Mathematics' teaching and learning enhancement activities focused on the development of a TLEF funded, undergraduate program renewal proposal; a lab revision project; small TLEF proposals involving learning technology; and professional development for graduate students and postdocs.

Review and Evaluation of Baccalaureate Programs in Mathematics at UBCV

Philip Loewen, Young-Heon Kim, Elyse Yeager, Eric Cytrynbaum, Joel Feldman, Costanza Piccolo, Andrew Rechnitzer, Patrick Walls, Mark Mac Lean, and Matt Coles received an UPER in 2019. The funding will be used to articulate a **shared core of learning outcomes for the Mathematics program**; identify a set of competencies shared by all of our undergraduates completing the Mathematics program; and examine how well the department's course learning experiences prepare students to use their knowledge of mathematics in new contexts. This project will potentially impact all students in Science and beyond (there are more than 20,000 course enrollments each year).

MATH 221 Lab Revision

Changes to the computer lab component of MATH 221, a linear algebra course, included the **introduction of computational activities, improved grading, and allowing students to drop in to the lab.**

Small TLEFs Involving Learning Technology

Matt Coles supported Andrew Rechnitzer and Fok-Shuen Leung in developing a successful small TLEF proposal. This project will create an **open source marking application to facilitate online grading.** Nouredine Elouazizi and Matt Coles also supported Elyse Yeager, Andrew Rechnitzer, and Patrick Walls in the development of an **adaptive recommendation and personalized feedback system** to support student engagement with student materials in Mathematics courses. Nouredine is currently coordinating support learning technology for both of these projects.

Professional Development

Matt Coles offered **professional development workshops** to improve the instructional skills of graduate students and postdocs, who are an important part of the department's undergraduate teaching.



Matthew (Matt) Coles
Science Education Specialist
(Mathematics)

Each year, I run an orientation on teaching for new Mathematics postdocs. We had about 15 new postdocs this year, many of whom were teaching for the first time. Once September hit, I made sure to follow up with all of them—doing class visits, helping solicit feedback from students, and providing community to talk about teaching.

This September was the first time the big calculus courses were using Canvas. I ended up providing a lot of support to instructors. I had a few faculty tell me, "I wouldn't have tried Canvas this year if I didn't know you were in the building to come talk to."

I've been working on a few TLEF-funded projects this year. The first is a project called Orchard, which is an adaptive system designed to serve students math problems and to foster a growth mindset. The second is a project called PaperLess Open Marking (PLOM), for digital exam grading and providing improved feedback to students. The prototype has been run in a number of classes. The third is the UPER; we're starting to look at our program—which has grown substantially!—and interact with alumni.

A faculty member, myself, and three other former Math graduate students went to STLHE this year and presented some work we've been doing on the landscape of pedagogical training for Mathematics graduate students. We each wrote reflections on our experiences and identified key moments in our development. We also looking through paths of more typical graduate students and then make some suggestions for future training. It was a lot of fun.

It's just getting started, but I'm really excited about a SoTL Seed project we have. We're starting conversations with our undergraduate students in our honours courses surrounding belonging and inclusion.

STATISTICS

Faculty Advisory Council Member: Bruce Dunham (on leave);
Eugenia Yu (current)

Last year, Statistics launched an online repository (StatSpace), co-developed a proposal for a Data Science Minor, and continued work on the Improving Students' Study Skills project.

StatSpace

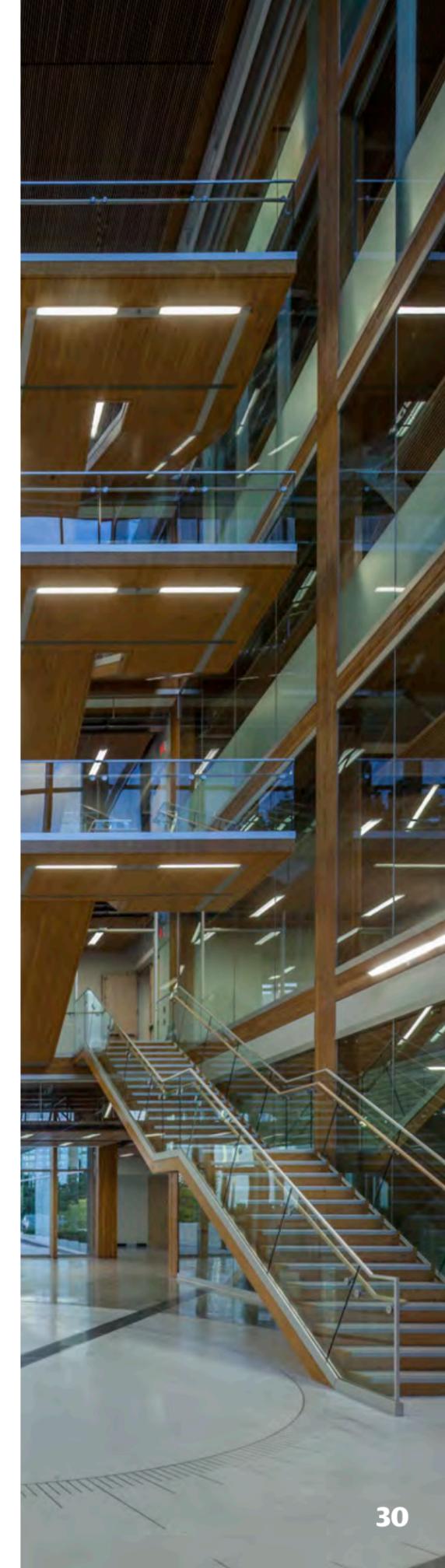
StatSpace is an **online platform for introductory statistics resources** developed by instructors from UBC Science, Arts, and Medicine. StatSpace was created to provide instructors with teaching and learning materials that can be used across any discipline. Nouredine Elouazizi coordinated our learning technology efforts in support of this project. In January 2019, Melissa Lee and Caitlin Donnelly provided a presentation to guests at one of our Skylight Supper Series events.

Data Science Minor

Offering a minor in Data Science is a strategic priority for UBC Science. Phil Austin, Gaby Cohen-Freue, Kim Dill-MacFarland, Steven Hallam, Sara Harris, Rachel Pottinger, Tiffany Timbers, Patrick Walls, and Gülnur Birol provided major contributions to the Data Science Working Group. This working group **developed a report that offers a plan for providing all UBC Vancouver undergraduate students with opportunities for developing data skills.** The activities of the Data Science Working Group also led to the submission of a large TLEF proposal this year.

Improving Students' Study Skills

The project, led by Bruce Dunham and supported by CWSEI funds, aims to **address deficiencies in student knowledge** that are reported by instructors of upper-level courses.



MESSAGE FROM OUR ASSOCIATE DEAN, ACADEMIC

The Skylight team provides consistently outstanding teaching and learning support and leadership across the Faculty of Science. In so many ways, Skylight's work enables faculty members and departments to pursue their priorities in curriculum and pedagogical improvements, and supports Faculty-wide initiatives. I am increasingly impressed at how Skylight's embedded expert model facilitates collaboration and knowledge exchange across unit boundaries. The Science Education Specialists and those embedded in the Centre for Teaching, Learning & Technology and the Equity and Inclusion Office are critical connectors and skillful liaisons. I am excited about current projects that have the potential to impact teaching and learning across Science, such as the Student Diversity Initiative and the Data Science Education Initiative. Much is happening in teaching and learning, and Skylight continues to be there, at the forefront of "the next big thing".



Sara Harris

Associate Dean, Academic &
Professor of Teaching, Earth, Ocean
and Atmospheric Sciences



Annual Report Enquiries

Gülnur Birol, Director
604.827.3414

birol@science.ubc.ca

General Enquiries

Skylight: The Science Centre for Learning and Teaching
UBC Science
The University of British Columbia
2178-2207 Main Mall
Vancouver, BC, Canada
V6T 1Z4

skylight@science.ubc.ca

General Information

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