2013 Alan Blizzard Award Feature Article

Enriching Educational Experiences through UBC's First Year Seminar in Science (SCIE113)

Joanne Fox [1,2,10], Gülnur Birol [3,10], Andrea Han [4], Alice Cassidy [10], Ashley Welsh [5,9], Joanne Nakonechny [3,10], Jim Berger [6,10], Simon Peacock [7,10] and Lacey Samuels [8,10].

[1]Michael Smith Laboratories, [2]Microbiology and Immunology, [3]Science Centre for Learning and Teaching, [4]Centre for Teaching, Learning and Technology, [5]Curriculum and Pedagogy, [6]Zoology, [7]Earth, Ocean and Atmospheric Sciences, [8]Botany, [9]Faculty of Education, and [10]Faculty of Science, University of British Columbia.

Front: Simon Peacock, Lacey Samuels, Jim Berger, and Joanne Fox
Back: Alice Cassidy, Andrea Han, Ashley Welsh, and Gülnur Birol
Missing: Joanne Nakonechny

Abstract

The First Year Seminar in Science (SCIE113) was developed during 2009/2010 academic year through an exemplary collaboration between faculty, administrators and educational support staff in the Faculty of Science at the University of British Columbia (UBC). SCIE113 reflects the vision and values of the Faculty of Science and UBC by offering an enriched educational experience to its first year students. The small class format provides students an intimate connection with faculty, an opportunity for significant engagement early in their academic careers, and helps with transitioning to the university environment.

The overall goal of SCIE113 is to introduce skills that cross disciplinary boundaries and that every scientist and student in science must master: how to constructively build an evidence-based argument and how to communicate effectively. The overarching course goals are to define and discuss the elements of a scientific approach, to think like a scientist, and to communicate science through writing. SCIE113 fosters the development of authentic scientific scholars through the construction, integration, and use of argumentation skills and through an exploration of science as a way of knowing using a collaborative class environment.

SCIE113 engages students in interactive and collaborative activities and promotes learning of scientific argumentation and writing skills.

In-class and out-of-class activities allow students to frequently discuss, debate, and defend their views of science. Specific learning activities such as case studies, targeted readings, and examinations of media and scientific articles allow students to evaluate the validity of scientific claims and to construct a scientific argument. Meanwhile, activities such as reflections, in-class writing, peer review, and discussions on the fundamentals of writing help students to improve their writing skills which are assessed by three short essays and a term project. The guided peer review process, which fosters collaboration, enables students to provide expert-like feedback to their peers. Faculty and TA feedback completes the review process.

SCIE113 is an exemplary model of collaboration and is guided by best practices in instructional design.

SCIE113 is a model of collaborative course design and instruction with a large, multi-disciplinary teaching team. The design of SCIE113 is guided by best practices and continues to evolve in response to emerging research. The teaching team consists of faculty and teaching assistants from 14 different departments, representing four Faculties, with a wide range of expertise and experience in fostering student learning. The teaching team meets bi-weekly to cultivate reflective practice and to support faculty in their professional development for teaching this writing intensive course.

SCIE113 is informed by the scholarship of teaching and learning.

SCIE113 is informed by comprehensive research that is incorporated into course design and implementation and utilizes validated assessment tools. Frequent feedback from students and faculty, and measures of perceived and actual learning gains, ensure successful course implementation and promote student learning.

Levels of Collaboration

Motivated by the need to improve science students' critical thinking and communication skills, faculty, administrators, and educational support staff began to collaborate on the design of the First Year Seminar in Science in 2009. This collaboration led to an ongoing cycle of development, delivery, and evaluation. Forty sections of the seminar have now been offered over three years and the feedback from students, faculty, administration, and TAs has been overwhelmingly positive.

Initially conceived by Lacey Samuels, Botany Department Head, and championed by Simon Peacock, Faculty of Science Dean, the course has evolved to include faculty from every department in the Faculty of Science. Early course development meetings between faculty and the Dean's Office led to the commitment of the Science Centre for Learning and Teaching to assist with on-going course development, evaluation and research. Course development and evaluation continues to be informed by evidence gathered from our research. In addition, bi-weekly meetings with the instructional team provide a venue for teaching collaborations including an exchange of ideas, rich discussions of course content and professional development opportunities. With evolving course content and a commitment to ongoing evaluation, regular engagement with administration, the instructional team and students is key to ensuring the success and sustainment of the program.

As collaborative assignments and projects have been shown to lead to increased student learning (Kuh, 2008), the development team believed it essential to extend the collaboration to students. Students engage in a number of activities that help to illustrate the importance of collaboration in the sciences and academia. Further, regular student feedback informs the ongoing course development and students are engaged to assist with the development and evaluation of course resources.

Project Description

Institutional Context

The University of British Columbia's vision, values, and strategic plan commitments are founded on the goal of creating an exceptional learning environment where student engagement is critical (Pascarella & Terenzini, 2005). Consequently, UBC is committed to provide all undergraduate students with at least two enriched educational experiences during their studies (UBC, 2012). With approximately 6,800 undergraduate science majors and an enrollment in first year course sections approaching 300, the Faculty of Science has committed to provide all first year students with "at least one small-group class where they meet regularly with a faculty member" (UBC Faculty of Science, 2011). This commitment to a small class experience offers students a more intimate connection with faculty, an opportunity for significant engagement early in their academic careers, and enables a scaffolded transition to the university environment.

Discussion of Faculty-specific needs for a small first year seminar began in 2009 with small committee led by Lacey Samuels. One of the key components of this committee was the collaboration of science instructors, such as Samuels and Joanne Fox, with experts from the Science Centre for Teaching and Learning, Gulnur Birol and Joanne Nakonechny, who guided the process. A series of consultations with Science faculty resulted in agreement that first year students lack sufficient opportunities to practice synthesis of scientific ideas, specifically science epistemology and the rhetoric of science. That is, how a scientist thinks and communicates. In parallel, feedback from students revealed a compelling need for opportunities to develop scientific writing skills: between 40-50% of first and second year students felt their courses had "very little/little" emphasis on writing (Birol & Yurk, 2009).

These findings mirrored research indicating novices' distorted conceptions of science are not dispelled by teaching that focuses on the laws, concepts, and theories of science. Hence, the American Association for the Advancement of Science recommends that science as a way of knowing needs to be made explicit in the curriculum (Rutherford & Ahlgren, 1990). Additional research illustrates that, despite the importance of strong scientific writing skills for both scientists and students, opportunities for students to develop and improve their scientific writing and argumentation skills are rare (Stout, 2011). Engaging students with scientific writing early in their degree helps them learn the writing genre of the discipline and enhances their scientific literacy, reasoning, conceptual understanding, and scientific argumentation (Libarkin & Ording, 2012).

The development of SCIE113 forms a key part of the Faculty of Science's efforts to address both the communication skills and enriched educational experiences initiatives outlined in UBC's strategic plan. Although not required, the course can be used towards the communication requirement for a Bachelors of Science degree. The first year seminar format presents a unique opportunity to incorporate three of the ten high impact educational practices identified by Kuh (2008): first year seminars, writing intensive courses, and collaborative assignments. SCIE113 encourages the development of authentic scientific scholars who engage in deep structure learning facilitated by a discipline based process, notably the construction, integration and use of argument as a factor in a scientific way of knowing.

Support from the Dean's office has helped to guarantee the success of SCIE113. An advisory committee, including the Dean and Associate Deans, was formed to ensure the course met the diverse needs of first year students and lobbied for accreditation of SCIE113 in professional programs and specializations. The Dean's Office asked each department to contribute one faculty member per year to teach the course and offers funding for departments contributing additional faculty and TAs. The Dean's Office also covers the cost of up to four professor emeriti to teach the course per academic year; funds the Science Centre for Teaching and Learning, which provides development, evaluation and research support; and funds a half-time Course Coordinator position.

Goals of Project

Regardless of specialization, there are skills every scientist and student in science must master. The overarching goal of SCIE113 is to establish the importance of these skills early in students' studies to provide context to their undergraduate course work and to encourage students to identify themselves as scientists. SCIE113 centers on a framework that provides students with an understanding of what it means to be a scientist and an expert in their field (Wieman, 2012). As such, the three overarching course goals of SCIE113 are:

Goal 1: Define and discuss the elements of a scientific approach.

To promote scientific literacy and to assist students in becoming more aware of the role of science in their lives, SCIE113 encourages students to explore the nature of science and the elements of a scientific approach through close engagement with Science faculty and graduate students. These interactions challenge students' preconceived notions of science as black and white and help them to explore science and scientific knowledge as "empirically-based; subject to change; theory-laden; creative; subjective; and, as a human endeavor, influenced by society and culture" (p. 45, Miller et al., 2010). Through classroom activities and discussions, SCIE113 encourages students to consider when a scientific approach is appropriate or inappropriate, how a scientific approach can be used in their daily lives, and how science contributes to society at large.

Goal 2: Think like a scientist.

Being an expert involves more than just obtaining content knowledge. It involves the ability to organize, interpret, and utilize information in various environments. As novices within the field of science, many students bring with them misconceptions about their field of interest (Bransford et al., 2000). To improve opportunities for success within science, faculty need to help students understand how an expert thinks and develop tasks to help support this type of thinking (Wieman, 2012). SCIE113 accomplishes this goal by providing a structure for students to learn how to construct pertinent questions at different levels of Bloom's taxonomy, develop critical analysis skills, and formulate ideas or hypothesis based on their findings. In addition, SCIE113 offers a speaker series where all sections of the course join together to listen to and engage with scientists who demonstrate science as a personal, collaborative, dynamic, and creative endeavor.

Goal 3: Communicate science through writing.

The ability to read, critique, and understand scientific writing is an important skill for both scientists and students studying science (Libarkin & Ording, 2012). Through SCIE113, students learn to analyze the structure of an argument in a scientific context, which includes identifying the assertion and its evidence and critiquing its validity. While there is a whole field of philosophy on argumentation and rhetoric, SCIE113 emphasizes the pragmatic use of logic and argumentation in scientific discourse. Students are asked to elucidate, using frequent short writing assignments, how "justified knowledge" in science is based on empirical and analytical evidence.

These goals are integrated across the six units and 23 learning objectives below:

Defining the nature of science
- Provide an opinion on what defines the nature of science
- Identify, and restate in your own words, the thesis statement in a piece of writing
- Create a thesis statement in your own writing

Science as a way of knowing
- Discuss how science as a way of knowing is used to understand the world (e.g. when is a scientific approach appropriate?)
- Give examples from personal experience of scientific and non-scientific approaches

- Put science as a way of knowing in context, alongside, and interacting with other ways of knowing
- Organize your writing into paragraphs
- Describe peer review, give and receive feedback from peers, and discuss the role of peer review in science

Presenting scientific arguments
- Identify the elements of an argument: claim and the interpretation of evidence that supports the claim
- Recognize when it is appropriate to use the different types of scientific literature such as primary literature, reviews and textbooks and cite it appropriately
- Defend the validity of an argument by evaluating evidence in a variety of genres, including popular media, websites and scientific journals
- Use an outline to organize a scientific argument with a claim and supporting evidence

Evidence in a scientific world view
- Explain what constitutes scientific evidence and identify it in different contexts
- Give an example of how several lines of evidence come together to build a scientific model and how the acceptance of the most well supported models creates a scientific paradigm
- Recognize the strengths and shortcomings of scientific evidence derived from observations and experiments, and from models and mathematical relationships
- Gather evidence, and restate it in your own words, for use in your writing

Scientific community
- Explain the different roles of people involved in scientific research
- Compare and contrast applied and basic research
- Use a variety of sources of information and write an abstract

Science and the global citizen
- Outline your opinion on where science can contribute positively to society in the future
- Identify where you are using a scientific approach in your daily life and where you see yourself using science in the future
- Identify opportunities to do research in your area of interest
- Write an evidence-based report, on a topic that relates to your life, that demonstrates mastery of the course writing goals.

Achieving these goals has not been without challenges. Fortunately, an integrated evaluation plan and commitment to an evidence-based approach has helped us quickly identify and address these challenges. For example, during the pilot, concerns emerged from faculty about the order of the learning objectives. This was echoed in feedback from students who found it challenging to understand what made evidence scientific before they were presented with the framework that established the importance of evidence to support a claim in scientific argumentation. Based on the evidence we collected from faculty and students, we were able to revise the order of the course units to be more conducive to student learning.

Challenges also emerged in communicating the specific structure and expectations of scientific writing to first year students, who have limited experience with anything other than narrative writing. The instructional team also felt challenged to provide effective, targeted, and timely feedback to students. To help address these challenges, we developed a detailed rubric for instructor marking with a simplified version used for student peer review (Fox et al.; manuscript in preparation). We also integrated the use of Calibrated Peer Review (Russell, 2005) to both expose students to other examples of writing and to provide formative feedback. This led to the addition of classroom activities highlighting the importance of peer review in the sciences with faculty and TAs sharing examples of their own work and peer feedback.

In addition to course goals, the collaborative team set program goals for SCIE113. Among those was to develop a model of collaborative course design and instruction that incorporates reflective practice with a large, multi-disciplinary instructional team and to develop a support structure for faculty teaching a writing intensive course, an area outside their research agenda. We strive to teach students that science is a collaborative, dynamic, and creative endeavor. Thus, this is the approach we've employed in the development and support of SCIE113. We have been able to accomplish this goal with remarkably few roadblocks because of our commitment to engaging faculty, TAs, and students and responding to their feedback. Collaborative measures are central to SCIE113 and support the continued development and success of the course.

> *I have found it valuable to connect with fellow instructors, share tips, and co-read papers that are challenging.*
>
> *-SCIE113 Faculty*

Course Overview

Close collaboration between Science faculty and educational researchers with expertise in life sciences research, science teaching and learning, writing in the sciences, and the scholarship of teaching and learning led to the development of a pilot course delivered in 2010. The pilot involved a teaching collaboration between eight faculty members from five departments (Computer Science, Microbiology and Immunology, Earth Ocean and Atmospheric Sciences, Botany, and Zoology) and included a speaker series with high profile speakers such as Stephen Toope (UBC President and Vice Chancellor) as well as recent science alumni. In addition, the Dean of Science taught a section in the pilot, displaying his personal commitment to the success of the course.

Limited to 27 students per section, SCIE113 is open to first-year students in the Faculty of Science. In comparison to most large first-year science courses, SCIE113 engages students in ongoing conversations with their instructor, TA, peers, and research scientists and focuses on active learning about the elements of a scientific approach, what it means to think like a scientist, and how to communicate science through writing. Over the past three years, SCIE113 has more than doubled in size with 14 departments across 4 Faculties involved in the teaching or development of SCIE113.

> *The course is a great chance to talk to 1st year students, in a small academic setting. I found I learnt a lot from them.*
>
> *- SCIE113 Faculty*

Table 1: *Number of the sections, students, faculty, and TAs involved with SCIE113 per academic year*

	Sections	Students	Faculty	TAs
2010 Winter*	8	191	8	3
2011 Winter*	14	323	13	6
2012 Winter*	18	438	16	7

* data from both Winter terms is combined

At the beginning of every term, each member of the instructional team (faculty and TAs) is provided with access to a blog, a learning management system (LMS) site pre-populated with content, and an instructional resource package. These resources contain the course learning goals, a timeline with important due dates, instructional support documents, course readings, and daily lesson plans which outline the class activities and provide advice regarding how to facilitate the activities. Course activities have been carefully developed around research on best practices in teaching and learning in the sciences. Articles used to inform course activities are available to the instructional team via the course blog. These resources have proven particularly useful given the number of new faculty and TAs joining the course each year.

> *The blog, binder and [the LMS] are really helpful…. I felt really well-supported.*
> *- SCIE113 TA*

The instructional team also meets every other week to share ideas about grading, classroom environment, student ability, and enhancing the course content. Time is also devoted to professional development, such as a calibration activity to help ensure consistent marking of student essays across sections.

SCIE113 engages students in interactive classroom activities that allow them to frequently discuss, debate, and defend their views of science. Learning activities such as case studies, targeted readings, debates, and examinations of media and scientific articles allow students to identify, evaluate, and discuss the validity of scientific claims and to develop their ability to construct a scientific argument (Booth et al., 2008). Meanwhile, activities such as reflections, in-class writing, peer review, and discussions on the fundamentals of writing help students to build upon their ability to write scientifically, a skill that is targeted and assessed via three short essays and a term project. In-class writing prompts reflect the current unit focus and progress through Bloom's Taxonomy from knowledge to application to analysis.

Students engage in a peer review process using the web-based Calibrated Peer Review (CPR). This tool provides a formative component to help students provide more expert-like feedback to their peers (Russell, 2005). Students evaluate the work of three peers and perform a self-evaluation, using a modified version of the rubric their instructor will use to mark their essay. Once the CPR process is complete, students revise their essay and submit a final draft to the instructor for assessment and additional feedback. In addition to the CPR process, students receive guidance through one-on-one interactions with the instructional team. Students are also provided with additional writing resources such as the Writing Centre and the Academic English Support Program at UBC.

In addition to developing their writing and argumentation skills, SCIE113 compels students to engage with research scientists and explore the scientific research process and community. Each year, over 100 researchers at UBC volunteer to be interviewed by SCIE113 students interested in their area of research. Students present to and discuss with their peers what they learned from their interview and how it has enhanced their view of scientific research, responsibility, and community. Students also engage with research scientists through the speaker series which closes with a 30 minute period for students to probe more deeply into the issues brought forward by the speaker. The impact of these interactions with leaders in the field is evident through the comments in course surveys, such as the one below:

> *I understand now that science isn't just about coming up with discoveries as an individual but it occurs within a diverse community in which scientists from all over the world come and collaborate together.*
>
> *- SCIE113 Student*

Research Plan

A research plan (Figure 1) was established during the initial course development to evaluate the effectiveness of teaching and to assess impact on student learning. Active every term, this research plan has been an integral part of the iterative course revision process. Data has been collected to measure student performances and attitudes following the guidelines of the UBC Behavioural Research Ethics Board. The results are used to inform pedagogical practices and improve the teaching and learning within the course.

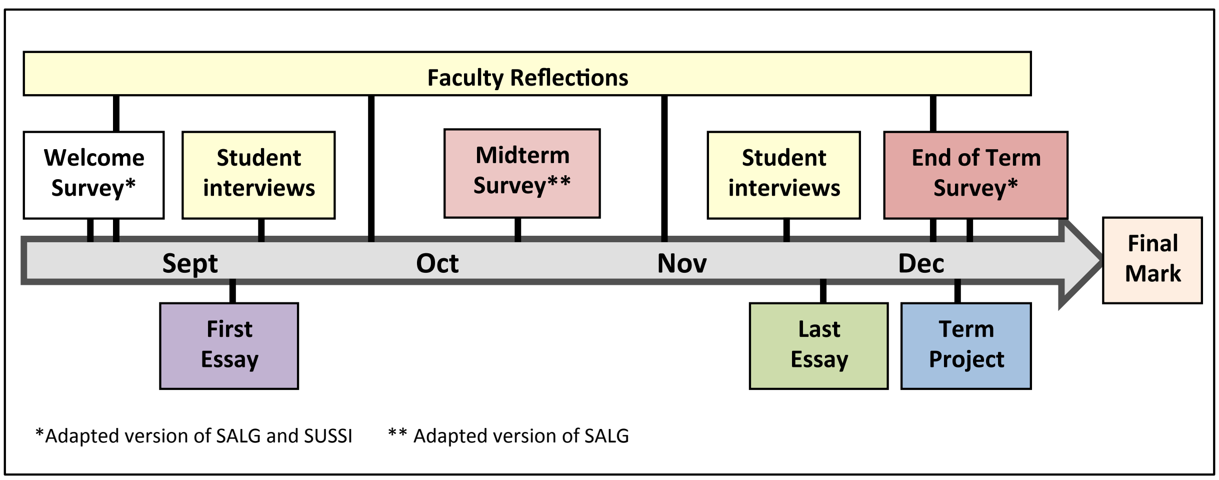

Figure 1: An outline of the research plan for evaluating SCIE113 teaching and learning outcomes.

We continue to use a mixed qualitative and quantitative methodology to collect data. This includes an evaluation of student work, semi-structured one-on-one student interviews, introductory and midterm course evaluation surveys, and an adapted version of the validated Student Assessment of Leaning Gains (SALG) from the University of Colorado (Seymour et al., 2000). Student feedback is captured on a wide range of course components: readings, class discussions, group work, CPR, faculty and TA feedback, and the speaker series. These data are used to investigate both student perceptions and actual learning gains. In addition, faculty and TA feedback is collected through one-on-one interviews and team meetings to explore their expectations, use of the prepared materials, and their overall impressions of teaching the course. This information is used to update course materials and lesson plans and provide tips to future members of the instructional team.

The triangulation of data helps to verify findings, prioritize emerging issues and inform decisions. For example, the midterm student survey revealed that students felt rushed during class discussions, a component they value immensely. Concurrently, faculty members indicated that they were finding it hard to balance class discussions with the content they needed to cover to ensure all sections were synchronized in a given week. Hearing this from both parties alerted the course design team to address the issue immediately and avoid related complications in the second half of the term. Overwhelmingly positive responses in later terms provided evidence of successful course design.

Evidence of Impact on Student Learning

Perceived Learning Gains

SCIE113 students' understanding of science, their expectations and experiences, and how these changed during the course were captured using the adapted version of the SALG survey administered at the beginning and at the end of term. In addition, we collected feedback on how students perceived various course components as contributing to their learning.

The following quotes represent typical student feedback about how their understanding of science changed as a result of the course:

> *I think I see it in a more complex light. I am more aware of the controversies surrounding it and I definitely think more critically when presented with new knowledge.*

> *Prior to taking this course, science was just another subject filled with information that was interesting but not particularly relevant to my life. Now I have a greater sense of how science affects me, how science affects the world and society as a whole.*

We were particularly interested in understanding the role SCIE113 plays in students' transition to university. A majority of students (approximately 70%) agreed with the statement "Taking this course has made my transition to university easier." Student interviews that were run at the beginning of the term and at the end of term provided further insights into how students perceived this course impacted their transition to university:

> *[H]igh school doesn't prepare you for university at all. Rather than being just thrown into your classes and told just figure it out yourself, [SCIE113] sets your sights on the expectations now. This is how things are done, this is how research*

is done and this is what it is going to be like from now on if you go on with your science education.

Among the various course components, the students identified speaker series, peer review, and interaction with their professors and TAs in the top three things that they found most useful for their learning in the course.

I saw how material in class was applied to life, gave different perspectives to science, gave me more career options to think about.

What my peers thought helped me look at my writing from a different perspective.

[My professor's feedback] gave me insights into how to improve not only the one piece of writing but future writing too.

I think my critical thinking skills are improved by taking this course. By writing essays and receiving feedback from my peers and professor, I know how to think in a more logical way.

Furthermore, we investigated perceived learning gains through the open ended-question "What skills you have gained as a result of this course?" Responses were collected, coded, and grouped into four emerging themes as specific writing skills, teamwork, argumentation, and academic writing skills (Figure 2). Argumentation and academic writing skills were the top two skills mentioned by the majority students, both of which were in alignment with the course learning objectives. Examples of student comments are as follows:

Finding accurate and reliable evidence and including it in writing helped me strengthen arguments and to know how to properly research a topic.

I gained valuable scientific writing skills and learned how to be precise and clear in my writing.

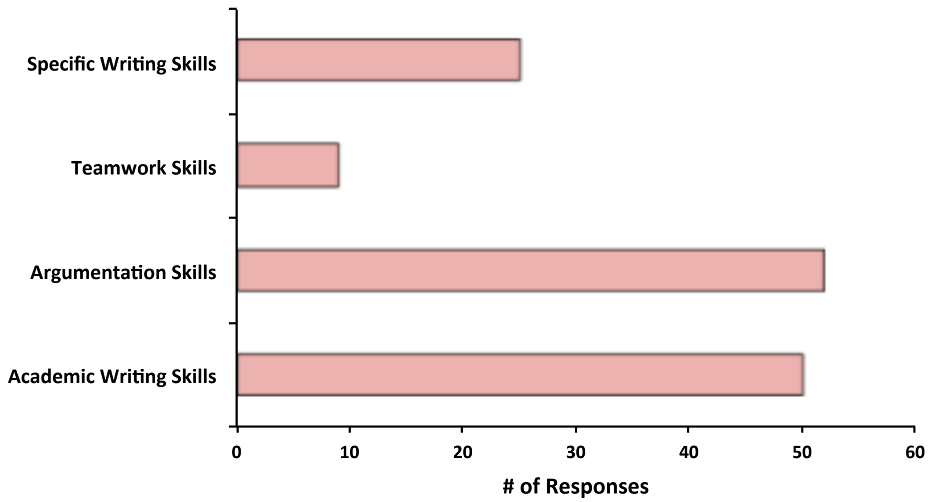

Figure 2: The SCIE113 student responses to an open-ended question "What skills you have gained as a result of this course?" coded and categorized into themes from 2009. N= 90.

Actual Learning Gains

Aside from the perceived learning gains, the actual learning gains were investigated through a carefully designed study (Birol et al., 2013; manuscript under review) where an independent marker coded a subset of writing samples using a customized rubric. We found strong evidence of improved student writing through a comparison of average student marks on the first essay with both average marks on the last essay and the term project (Figure 3). Students showed a significant increase from C+ to B between both their first and last essay ($p = 0.03$) and the first essay and the term project ($p = 0.02$). While we saw significant gains overall, we found the most substantial gains in the bottom group of students as summarized in Figure 3. Our analysis of SCIE113 writing samples demonstrates that increased exposure to writing (multiple opportunities to write and receive feedback) in a science specific context results in consistently better writing skills for the majority of students.

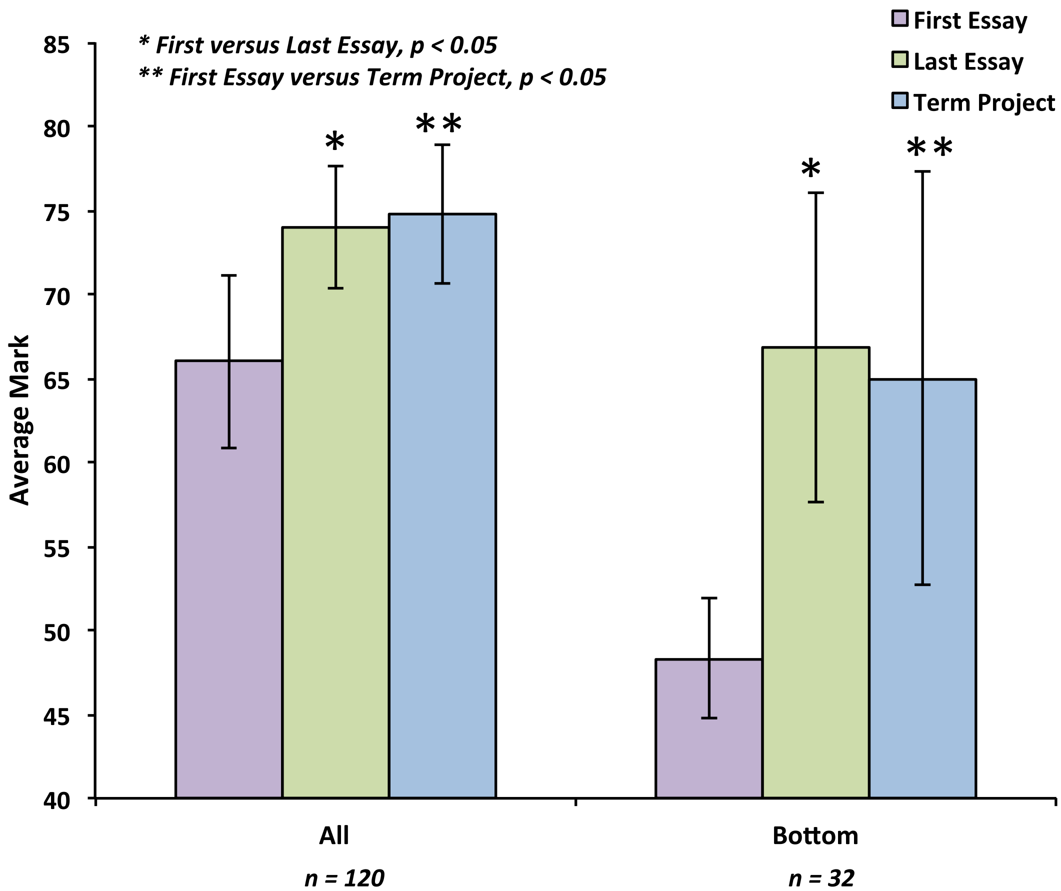

Figure 3: Comparison of average marks for first and last essays and final term project from SCIE113, 2011, term I. *, ** indicate statistical significance ($p<0.05$, Student's t-test).

The change in students' views on science and scientific inquiry was also measured using the validated survey Students Understanding of Science and Scientific Inquiry, SUSSI (Liang et al., 2008). The survey results indicated significant improvements in students' overall understanding of science and scientific inquiry (Figure 4). Students made significant gains in their understanding of laws versus theories, social and cultural influences, and methodology while maintaining a solid understanding about the role observations and inferences, and change of scientific theories.

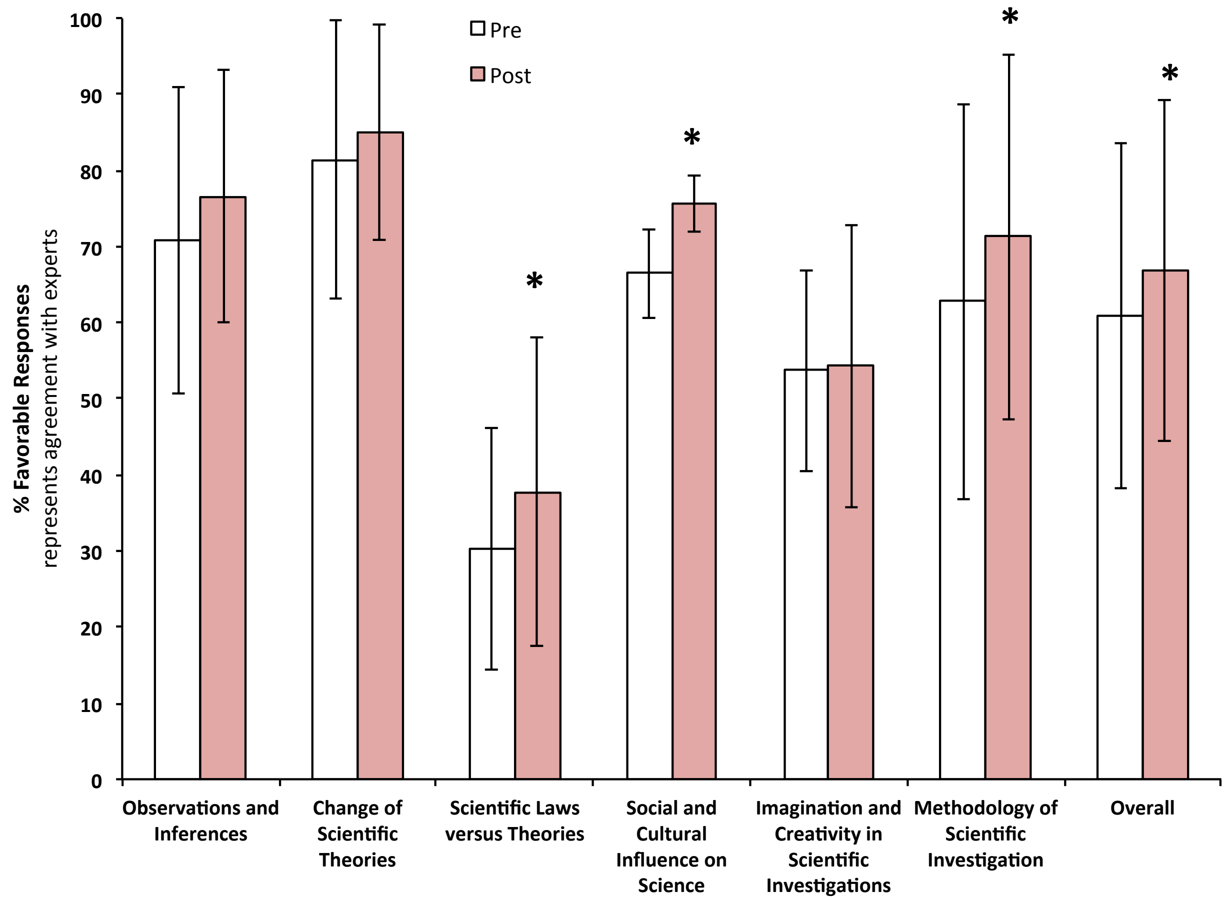

Figure 4: Representative SCIE113 Student Responses to Student Understanding of Science and Scientific Inquiry (SUSSI) Questionnaire from 2011; 47 paired responses; * indicates statistical significance ($p<0.05$, Student's t-test).

In 2012 Term 1, we collected qualitative data to gain further insights into how students' understanding of science and scientific inquiry changed over the term. We are currently analyzing these data to inform our design of targeted activities. Moving ahead, collection of evidence on student impact and learning remains to be a top priority to ensure continued success of the course.

Future developments

Teach SCIE113, it will change the way you think about science.
- *Simon Peacock, Dean, UBC Faculty of Science*

The impact of the SCIE113 experience extends through our collaborative teaching team, influencing the teaching practices of faculty and TAs. Many faculty and TAs return in subsequent terms and/or present at both local and international conferences on how their experiences in SCIE113 have shaped their teaching and careers. Participating in SCIE113 also allows faculty and TAs to reflect on their own experiences and views of science. A TA expressed that:

> *The whole course reminded me of what it's like to be in first year, and that also helped me to think about how far I have gone (gave me a fresh perspective for that).*

We continue to share and disseminate our teaching model, tools, and findings to a variety of audiences. We were invited to share within the Faculty of Science through workshops at the popular 'Science Supper Series', across the University through both the Centre for Teaching, Learning and Technology (CTLT) Summer Institute, and Course Design Community of Practice. To date, a total of 15 authors (including 5 faculty members, 5 graduate students, 4 staff members and 1 undergraduate student) have presented at local, provincial, national, and international peer-reviewed conferences. These include the Society for Teaching and Learning in Higher Education; the International Society for the Scholarship of Teaching and Learning; Investing our Practices, Faculty of Education, UBC; Conference on the First-Year Experience; and International Improving University Teaching Conference.

Because the SCIE113 curriculum was developed with input from a diverse instructional team, the teaching resources that resulted have been equally relevant across disciplines. Presentations at local, national, and international conferences have elicited interest from diverse groups on adapting our resources. For example, faculty in multiple departments are currently using components of the Calibrated Peer Review template developed for SCIE113 and several Science faculty have also used the writing rubric in their courses. Even the instructional resource package has been adapted for a fourth year Microbiology course and workshops for practitioners. In addition, copies of the rubric and syllabus have been shared with institutions in British Columbia, Ontario, and Australia.

Since we strongly believe in the importance of teaching science students to communicate within the context of the discipline, we have initiated further collaborations with the UBC's Centre for Teaching, Learning & Technology, the Writing Centre, the English Language Institute, and the instructional team of the third year communicating science course (SCIE 300). These collaborations led to a successful grant in 2012 from UBC's Teaching and Learning Enhancement Fund (TLEF) to develop science specific writing resources. An application for second year of funding was recently submitted to allow us to develop rigorous diagnostic tools to identify students who require language and communication intervention, and to create instructional resources with high-quality learning activities for educators wishing to integrate writing into courses and programs that are traditionally not writing intensive.

We are also beginning conversations with the UBC Faculty of Land and Food Systems, which has expressed interest in developing a course based on SCIE113. We are working with them now on feasibility and details. At the same time, in collaboration with the Science Centre for Learning and Teaching, a longitudinal study is currently being developed to track SCIE113 students in select upper level courses. We aim to identify if and how these students are similar or different from their peers in relation to their attitudes towards science, their writing and argumentation skills and how well they transitioned to university.

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