

Teaching Dossier

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Note on using this document for reviewers:

I have hyperlinked and added bookmarks to the PDF file for this document. This should be useful for quickly going between sections, and I hope this makes navigating it significantly easier.

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1 Introduction

This teaching dossier summarizes my contributions to creating an exceptional learning environment at the University of British Columbia (UBC) and beyond. My focus since being hired at UBC has been teaching and learning excellence in my own classroom, collaborating with and training other educators for impact beyond my own classroom and contributing to the department, faculty, university and beyond through service to advance teaching and learning. This dossier gives a sense of my work and focus areas by selected and explaining certain significant impacts. This document does not endeavour to include all significant impacts I have made and my curriculum vitae (CV) is better suited to provide that information. I have organized this dossier into sections corresponding to my mandate around teaching, educational leadership and service. I have aimed to keep the body succinct for the reader and placed supporting materials in appendices.

For those less familiar with the expectations of UBC's educational leadership stream of faculty, these differ from the traditional research stream faculty. The formal mandate for my educational leadership appointment is 80% teaching & educational leadership and 20% service. This can be contrasted with 40% teaching, 40% research and 20% service for a faculty member in the traditional research stream. The 80% mandate can be split a variety of ways, with my position I teach roughly twice as many credits as faculty members in my department in the traditional research stream, while also being expected to contribute to educational leadership in substantive ways. I will reference UBC's Promotion and Tenure documents for the definition of educational leadership as readers may be less familiar with this concept as opposed to teaching and service. At UBC "educational leadership is activity taken at UBC and elsewhere to advance innovation in teaching and learning with impact beyond one's classroom" [1]. Evidence of educational leadership "may include, but is not limited to:"

- Innovation and enhancements to teaching, learning and assessment that has impact beyond the candidate's classroom, department, discipline and / or institution as appropriate.
- Significant contributions to curriculum development and renewal.
- Activities to advance interdisciplinary, inter-professional and inter-institutional collaborations in teaching and learning.
- Application of / engagement with the Scholarship of Teaching and Learning.
- Contributions to the practice and theory of teaching and learning literature, including publications in peer-reviewed and professional journals, conference publications, book chapters, textbooks and open education repositories/resources.
- Organization of, and contributions to conferences, programs, symposia, colloquia, workshop and other teaching and learning events, to a local, provincial, national and international audience, as appropriate.
- Securing funding / additional resources for teaching and learning innovation or enhancements, and leading the implementation of funded initiatives or activities.

- Recognition and distinction in the form of awards, fellowships and other recognition for teaching and learning related activities (internal to UBC and beyond).
- Capacity building for excellence in education, including mentoring and inspiration of colleagues, supervision of undergraduate research projects in discipline-based pedagogies.
- Activities undertaken as part of formal educational leadership responsibilities within the candidate's Department / School / Program area / Faculty / UBC [1]

UBC human resources has summarized the criteria for promotion to and tenure as an Associate Professor of Teaching at UBC citing articles in the Agreement on Conditions for Appointment for faculty [2]. I copy these criteria below to give the reader a sense of what is required in terms of teaching, educational leadership and service for promotion and tenure. In my teaching dossier and CV I aim to show the reader I have exceeded or at the very least met these criteria.

Teaching

- "Requires evidence of excellence in teaching"
- Tenure: "Granted to individuals who have maintained a high standard of performance in meeting the criteria"... (of teaching, educational leadership, and service)... "and show promise of continuing to do so" 4.01 (a)

Educational Leadership

- "Requires evidence of... demonstrated educational leadership" 3.03
- "Requires evidence of... involvement in curriculum development and innovation, and other teaching and learning initiatives" 3.03
- "Keep abreast of current development in their respective discipline and in the field of teaching and learning" 3.03

Service

- "Service to the academic profession, to the University, and to the community may be taken into account...but...it cannot compensate for deficiencies in teaching..." 4.01 (a) [2]

2 Teaching Excellence

In this section I include a teaching philosophy, summary of courses I have taught, teaching evaluations, teaching awards and a selection of significant teaching contributions to individual courses. The significant teaching contributions are organized by the three years of CHBE undergraduate programs: second-year (Y2), third-year (Y3) and fourth-year (Y4). I have organized them in this manner to first show course development I have undertaken at different year levels. They are then organized in chronological order in terms of the courses I have taught first in my career. This is done as it provides a more natural narrative in terms of my teaching development rather than by keeping them in an ascending numerical order.

Since starting at UBC, I have facilitated learning in a variety of contexts with a strong focus on engineering design. I am part of the teaching team for the first-year introduction to engineering courses, Applied Science (APSC) 100/101. These courses are taken by all first-year engineers, around 1000 students. Teaching in this context requires working with faculty from a variety of other departments and ensuring students get a holistic view of the engineering profession. After this general first year, students enter their program of specialization in Y2.

At the Y2 level I have taught courses introducing students to CHBE fundamentals such as CHBE 241: Material and Energy Balances. This course is taken by students in CHBE programs as well as integrated engineering (IGEN) program. In **section 2.3.1** of this dossier, I present my efforts to scaffold and support student learning in this course. I have also taught CHBE 243: Introduction to Chemical and Biological Engineering Process and Technology. This has now been integrated into a new course CHBE 220: Founding Principles of CHBE I. I will present design exercises I developed and introduced into CHBE 243 and how this impacted the design of CHBE 220, for which I was responsible. In Y2 I have also heavily focused on technical communications integration and I discuss this in **section 3.3.1** of this dossier focusing on pedagogical innovations.

In Y3 I have taught the first term Y3 lab course, CHBE 362. My focus in this course was broadening the ways in which students report their data and updating experimental equipment and procedures. I have also taught CHBE 376: Computer Flowsheeting, which advances student chemical plant design knowledge through the use of process simulation software. I will present how I have built on the work of my predecessors teaching the course to incorporate an active approach. I will also speak to how I have worked to better scaffold the term project drawing from my experience in other courses where I teach design.

In Y4 I have been involved in teaching our two-term capstone design courses, CHBE 453 and 454. The difference in the course code between these two courses signifies the two programs in our department, Chemical and Biological Engineering (CHBE) and Chemical Engineering (CHML). However, course outcomes, structure, and deliverables are similar and lectures are run together. Course instructors may supervise projects in either CHBE or CHML and I have supervised projects from both programs. I now coordinate the course since 2019W (2019-2020 academic year). Within this course context I discuss my efforts in helping to further clarify course expectations and develop student support resources.

The experience I have gained in these diverse teaching contexts has given me insight into student progression and development throughout their undergraduate degree. I have used this to help improve my teaching by striving to allow students to see the larger picture between these courses, and thus motivate deeper and more meaningful learning. My teaching experiences have also informed my educational leadership work, especially around curriculum enhancement, which is described in **section 3** of this dossier.

2.1 Teaching Philosophy

My actions in the classroom aim to provide a space where students can learn, experiment, ask questions, and ultimately master the knowledge, skills and attitudes required in the engineering profession. In order for students to be successful at these tasks, I focus on building a space of communication and trust with students, effective teamwork skills, and giving effective feedback in a variety of ways in courses.

In Ken Bains' book, "What the Best College Teachers do", one chapter describes the importance of trust between instructor and student and how this is an essential part of good educational practice [3]. Through openness to dialogue and feedback, I show my students that I have their best interests at heart and that I want to see them learn and succeed. I encourage students in my courses to give me feedback and offer a variety of ways to do this including through face to face conversations, midterm course surveys, online discussion boards, and anonymous surveys accessible anytime during the course. I am open to their thoughts and suggestions and will acknowledge and respond to each of them, although the response may be that I will not act on a suggestion for a certain reason. I also communicate trust in my students by encouraging them to work together on assignments and giving them materials to help with their independent study. While doing this, I encourage them to ensure they truly understand the material as they will need to demonstrate it later on in the current course, as well as in other courses, or in their professional practice. I believe this relationship of trust engages both students and myself in thinking about how we can further improve our practices.

Teamwork is essential in accomplishing many tasks, be this for engineering or any other enterprise. Much research has been done investigating team effectiveness. In many courses I teach, notably design and laboratory focused courses, students will work on a project in a team setting. I aim to improve student competencies in these settings using techniques adapted from team-based learning literature [4]. This includes ensuring students are individually prepared and accountable when coming to work in teams through the use of individual readiness quizzes. I help guide teams to establish expectations, communication methods and responsibilities using team contracts. And I help ensure accountability and feedback to students on their performance through the use of peer evaluation at regular intervals after significant team deliverables. All these elements help teams to run smoothly, but I am also available to aid students and teams if difficulties arise. I believe these steps help to build crucial teamwork skills students can use in many future settings.

Dee Fink argues that in order to create significant learning experiences, teachers must challenge students, use active forms of learning, care about students, interact well and have good systems for feedback assessment and grading [5]. There are some linkages between this and Ken Bains' observations on the importance of trust, notably in instructors showing their care for students, as well as interaction and feedback. In the courses I teach, I attempt to ensure students have sufficient practice with material and that they get feedback in a timely manner. Some of this is done in the class, through active learning techniques that I have incorporated such as with the use of response systems and worksheets. With practice outside of class, I have incorporated rapid and effective feedback tools through the development

of online homework questions and the use of instructional rubrics. I have also sought to structure course projects with intermediary deliverables such that students get feedback throughout their completion, and can improve over the course. These techniques I use help to challenge students, and give them relevant and timely feedback to improve their learning.

By creating a strong relationship built on trust between students and myself, helping students work effectively in teams, and giving student timely and effective feedback, I believe I am driving student learning forward and creating spaces where students can explore and ultimately be successful.

2.2 Courses Taught, Teaching Evaluations Summary and Teaching Awards

Below I provide relevant information and teaching evaluations on courses where I have taught a significant portion (greater than 50%) of the course. I have excluded APSC 100/101 and APSC 366: Engineering for non-engineers, because these are team taught and in many cases I do not teach the students in sections of these courses for a significant period of time (greater than 10 hours). This makes student evaluations from these courses somewhat less compelling. These team-taught courses are also the work of a number of individuals and thus it is harder to tease out my individual contribution and the impact it has had on student learning. However, relevant data on these courses can be found in **section 8** of my CV and I do not believe they present significant differences, other than those that naturally arise in different course contexts, in terms of performance and outcomes from the courses I focus on in this dossier.

2.2.1 Summary of Student Evaluations of Teaching

An average score for each question on the student evaluations of teaching for all courses for which I have taught a significant portion is provided below. I weight all course evaluations equally in this, combining those for different sections in the same course (namely CHBE 362) together. I exclude the CHBE 243 2019S2 course as this had only 8 students with 2 respondents, and did not meet the UBC recommended minimum response rate for course evaluations. All other courses included meet minimum response rates except for the CHBE 362 section 102 from 2017W1, where 37.50% of students responded and the recommended minimum was 40% for a class of this size. Nevertheless, I include this result as the numbers are combined with the other CHBE 362 class section. I also list scores for a question on overall instructor effectiveness for each of these courses below. Note that in 2018W UBC moved to a system using interpolated means in course evaluation scores and began providing scores with an extra digit from 2018W onwards. I believe the scores for courses in each year level, and particularly those within a course over multiple years, signify my improvement in teaching practice over time. I comment further on all of these courses in **section 2.3** of this dossier.

Teaching Evaluation Questions	Average Score*
Q1. The instructor made it clear what students were expected to learn	4.38
Q2. The instructor communicated the subject matter effectively	4.31
Q3. The instructor helped inspire interest in learning the subject matter	4.17
Q4. Overall, evaluation of student learning was fair	4.27
Q5. The instructor showed concern for student learning	4.61
Q6. Overall, the instructor was an effective teacher	4.42

*1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree

Course & term	Q6 Score*
CHBE 241 2016W1	4.0
CHBE 241 2017W1	4.1
CHBE 241 2018W1	4.29
CHBE 243 2018W1	4.11
CHBE 220 2019W1	4.50
CHBE 362 2017W1	4.4
CHBE 362 2018W1	4.4
CHBE 376 2017W1	4.7
CHBE 376 2018W1	4.94
CHBE 376 2019W1	4.94
CHBE 453/454 2018W1/2	3.85
CHBE 453/454 2019W1/2	4.37

A full numerical summary of teaching evaluation results can be found in **section 8.d** of my CV. Student evaluations of teaching with numerical summaries and student comments are included in this document in **Appendix A.1**. If desired, all my students evaluations of teaching can be accessed on a password-protected UBC personal webpage. The password is UBCSEOT (all caps and all one word) and the page address is: <https://blogs.ubc.ca/jverrett/seot/>

2.2.2 Peer Evaluations of Teaching

Peer evaluations of teaching conducted by tenured faculty in each academic year I have taught can be found in Appendix A.2. These correspond to CHBE 220 (2019W), CHBE 453/454 (2019W), CHBE 376 (2019W, 2018W) and CHBE 241 (2017W, 2016W). I will draw from these evaluations in describing the impact of changes I have made to courses as well as my reflections on the courses.

2.2.3 Teaching Awards

I was the recipient of the Ron Britton Engineering Education Vanguard Award from the Canadian Engineering Education Association (CEEA) in 2020. This award is given to one early-career educator annually who has committed to the development of engineering education in Canada through practice and/or research. The award application submitted contained statements from myself, reference letters from colleagues, as well as comments from students on the impact of my teaching on their development. Receiving this national award was a great honour and I believe shows my significant impact in teaching and education. I have also received the CHBE department teaching award, as selected by the student council, on three occasions in 2016W, 2018W and 2019W.

2.3 Course Instruction

2.3.1 CHBE 241: Material and Energy Balances

Terms: 2016W1, 2017W1, 2018W1

Average class size: 187

Description

This course is taken as a core course by students in CHML, CHBE and IGEN. This course covers the fundamentals of analyzing chemical and biological process systems in terms of material and energy flows. Non-reactive and reactive processes are analyzed. Separation units are evaluated using thermodynamic principles for multiphase systems. The laws of thermodynamics are introduced and applied to characterize reactive and non-reactive systems. Students are introduced to block and process flow diagrams.

Structure and organization

The course consists of two weekly 80-minute lectures supplemented by a weekly 50-minute tutorial sessions. Course lecture time is mainly used to deliver theoretical content with breaks for practicing examples in small groups. I use small group exercises informed by literature such as those in the article outlining “teaching methods that work” by Felder, Woods, Stice and Rugarcia [6]. More in-depth problem examples are explored in the tutorials which are organized and led by myself. In the 2016W iteration tutorials were scheduled as six 110-minute tutorial sessions taking place on alternating weeks throughout the semester, however I requested to change this based on student feedback that they wanted more regular contact for practice sessions. The schedule was switched to one-hour weekly tutorials in 2017W and onwards and I have found these weekly sessions to be more effective for students. When starting to teach the course in 2016W, the previous instructor provided the presentation notes but I did not have permission to use editable PowerPoint files and as a result built new lecture slides from scratch in order to be able to customize them. I also chose to update to a newer textbook at the same time.

Reflection on student evaluations

Students appear to appreciate the efforts I have put into the course as demonstrated by the consistent high rating (~4.5/5) for instructor concern for learning. I also received the departmental Teaching Award from the CHBE Undergraduate Club for excellence in 2nd year teaching in 2016W. As shown by student comments in 2016W, the course covers a wide range of material and it can be difficult to practice this material, as well as see how the various topics are related. Over course iterations, I have worked to more clearly communicate the subject matter by organizing a variety of learning aids to scaffold student learning outside of the classroom. Evidence for this can be seen in the progression of student comments from year to year. I further describe these learning aids in the “**Scaffolding student learning**” section below. One item that I struggle with is engaging the IGEN students who may not see the relevance of this course to their future studies focusing on civil, computer, electrical or mechanical engineering. When

teaching the course, I continued to try to engage more of these students by providing examples relevant to these other disciplines they were interested in.

Reflection on peer evaluations

In a peer evaluation from 2016W1 it was noted that though the class content was logically structured, it could have been better paced when dealing with complex problems and the use of excel to solve these problems. I have worked to improve in these areas by more clearly linking course content to engineering application. I have done this by incorporating more examples from various industries into the classroom to allow students to see the relevance of the course material as well as motivate students to engage more deeply with the material. Another evaluation was conducted in 2017W and again it was recognized that the class was well organized and students were engaged. One critique from the review was that the writing on a tablet slowed the pace of the class. As a result of this, I tried using a document camera and felt pen and this sped up the pace of writing to an adequate level. This allowed more flexibility in terms of bringing back previous pages of notes to answer student questions. As a result, in this and other classes, I now regularly use this method and scan the pages I have written after class so students have access to a copy of these notes.

Scaffolding student learning

In 2017W, I was awarded a Teaching and Learning Enhancement Fund (TLEF) grant to scaffold student learning through the curation, development, and provisioning of openly available multi-media resources for CHBE 241. This project was shaped by student feedback from the first course iteration asking for further guidance and practice material. I led a team of graduate and undergraduate students, with a focus on developing four resources: supplemental course notes, WeBWorK online homework with instant feedback, supplementary study guides and a long-answer problem bank. The course syllabus and samples of some of these resources can be found in Appendix A.3 as well as online where noted. More details on each of these resources are provided below:

A. Supplemental course notes

Supplemental course notes were developed to explain key course concepts and provide sample problems and solutions. These notes are openly available on the UBC Wiki at http://wiki.ubc.ca/Documentation:CHBE_Exam_Wiki . The main page has currently been viewed over 7,700 times, and continues to be used by students in spite of me no longer teaching the course.

B. WeBWorK online homework

Regular practice and feedback can greatly enhance the learning process. In the 2016W course iteration, I introduced weekly online homework, rather than homework every two weeks, to give students more regular practice and feedback. The homework was manually graded taking roughly one week to grade and return, which turned out to be a significant delay in the context of this course. In order to offer students more rapid feedback on their learning, I have developed 50 problems

spread across ten weekly problem sets on the WeBWork online homework platform. These problems provide students with unique problem variables and solutions as well as instant feedback. Having tested the problems, I am publishing them to the WeBWork Open Problem Library (OPL), as well as as well as having them available at the following address: <https://github.com/OpenChemE/CHBE241/tree/master/WeBWork-questions>. These exercises provide good practice for students, but it is also important to prepare them to analyze open-ended problems and explain their solutions. As such, I have combined these WeBWork problems with longer form written problems in each assignment to ensure students are prepared to analyze and explain concepts. This also allowed me to focus TA time on giving feedback on these more open-ended problems.

C. Supplementary study guides

Students in CHBE 241 commented that they access a variety of video materials produced outside of UBC to supplement their learning. In order to support students wishing to access screencasts I have organized a repository of relevant online videos and listed these by course learning objective. In these guides I also include links to the online course notes and relevant textbook chapters. A sample guide is included in Appendix A.3.

D. Long-answer problems

The Math Exam Wiki at UBC collects previous exams and solutions and provides these to students in an easy to access format. I sought to replicate this approach in CHBE 241 and made available previous exams and problem sets along with sample solutions which students can use for practice. This can be found on the UBC Wiki at the following address: [http://wiki.ubc.ca/Documentation:CHBE Exam Wiki](http://wiki.ubc.ca/Documentation:CHBE_Exam_Wiki).

2.3.2 CHBE 243: Introduction to Chemical Engineering Process and Technology

Terms: 2018W1, 2019S2

Class size in 2018W1: 117

Description

The course was taken as a core course by students in CHML and CHBE. I taught the course for its last full iteration in 2018W1 as well as a summer online course for students who were still missing this credit in 2019S2. This course introduces students to the discipline of chemical and biological engineering through guest lectures and case studies in a variety of industries. In describing the course I will focus on 2018W1 as I made significant changes to course activities at that time by the introduction of design exercises in tutorials.

Structure and organization

This one-credit course consists of one weekly 50-minute lecture and one weekly 50-minute tutorial. Lectures are delivered by myself as well as a variety of guest speakers from industry and academia.

Previously iterations of the course used tutorials for two tests meaning many tutorial slots were not used. In order to introduce students to chemical and biological engineering design, I developed a variety of team-based design exercises to be run in five tutorials during the course. I also used two tutorials before and after the design exercises to measure student design knowledge using a general design assessment tool developed at Queen's University [7]. The results from this tool showed no significant change in student design methodology. I suspect the tool may be too general or the course does not introduce enough design content for a significant difference to appear. I have adapted a different tool for future measurements based on concept mapping to see if the effects are the same.

Team design exercises

A sample of one of the five design exercises developed can be found in Appendix A.4. Each team design exercise involved a pre-reading assignment consisting of 2 to 3 pages introducing a chemical and/or biological engineering design concept. This was followed by students completing a five-question multiple choice test on the course learning management system (LMS). In class, students were given a brief (5-10 minute) introduction to the exercise. They then worked in teams on these exercises to be completed by the end of the class session with the teaching assistant (TA) and myself circulating to answer questions and prompt discussion.

Reflections on student evaluations

Reading over student comments on the course, they appear to focus on two elements. The first is that it can be difficult to relate the material from guest lectures to their course of study. I believe this could be improved by having more framing around the context of why we have invited different guests into the class. Many students have also commented on the design exercises, both positively and negatively. I believe situating these design exercises in the context of a larger course may help students in seeing the relevance of these design steps and also the need to apply the natural and engineering science they are learning. As a department we have decided to revamp our second-year curriculum and have integrate material from this course into a new course, CHBE 220: Founding Principles in Chemical and Biological Engineering I. I believe this will help address these student comments and give students a better idea of how the fundamental concepts they are learning are applied.

2.3.3 CHBE 220: Founding Principles in Chemical and Biological Engineering I

Terms: 2019W1

Class size: 114

Description

The course is taken as a core course by students in CHML and CHBE. It was run for the first time in 2019W1 as part of a redesign of the Y2 curriculum. When it was put in place, CHBE 243 was removed from the curriculum as well as a physical chemistry for engineers course (CHEM 251). CHBE 220 introduces the

fundamental physical science principles that underlie CHBE and applies them in the context of chemical process design. It also aims to give students an appreciation for the theory they will learn in future courses and how this will enable them to analyze chemical processes.

Structure and organization

The course uses a chemical engineering design framework as an overarching course plan. This framework, along with the other sample documents I refer to for this course is provided in Appendix A.5. The course consists of two weekly 80-minute lectures and one weekly 110-minute tutorial. Lectures are delivered by myself and include theory interspersed with more active elements such as polling (using clickers) and discussion or guided example problems. The tutorials were mainly dedicated to students working in teams on a set of design exercises that I further describe below. A schedule of the course containing weekly topics for lectures and tutorials is provided in the syllabus in Appendix A.5. Individual course deliverables including assignments followed a similar format to CHBE 241 with a mix of automatically graded online homework exercises along with TA graded open-ended problems.

Team design exercises

During tutorial sessions I would give a brief (10 minute) introduction to the design exercise and then the TAs and I would circulate and check in with teams as they work through the problem. The basic structure for this I took from CHBE 243 but I expanded it significantly to include a broader number of topics that go much more in-depth into chemical process design. My comments focused on technical details as well as some basic feedback on communication issues (particularly if passages were unclear). These assignments were also integrated with the technical communications course (CHBE 201). Compilations of assignments (usually two) were submitted to CHBE 201 for detailed feedback to students on their communication. Students submitted a final report at the end of the term consisting of a compilation of all assignments with revisions, which was evaluated by both CHBE 220 and CHBE 201. Students could pick from five design project topics they would work on over the term which were: hydrogen production, carbon capture from a coal power plant, ammonia production, diesel desulphurization and acetaldehyde production. I selected these topics as they are relatively well-known processes meaning students could easily find sufficient literature information on these processes. Because of this, there was also multiple process routes or catalysts that could be used in these processes, allowing submissions to be relatively unique. Overall this design project worked quite well, I will continue to use this format including integration with CHBE 201.

Reflections on student evaluations

There are a variety of comments from students on the course. Some commented on the course being well structured overall and others commented that certain portions could be made clearer. Many students stated they enjoyed the project with some stating the design exercises were unclear. Overall considering this is the first time through the course, I think the comments are quite good, and I'm hoping to continue to build material and resources to support student learning (see Open Textbook section below). Students commented that more examples of testable material, or a sample exam to get a sense of the formatting

would have been appreciated. Having gone through the course once now, I will provide the midterm and final from the previous year to students. I did provide study guides to students (similar to what I created for CHBE 241), but can continue to add to these to give students a better sense of what to study in the course.

Open Textbook

CHBE 220 relies on a variety of textbooks as it covers a range of materials from physical chemistry to chemical process design. Because of this varied nature of the course it can be difficult for students to find the resources they need to support their independent study. In fall 2019 a call went out for a new fund at UBC called the Open Educational Resources Fund, I submitted a proposal to create an open textbook that would compile theory and practice examples. I was successful in the grant (roughly half of the projects were funded), and worked with two undergraduate students to build an online textbook using the Pressbooks platform supported by BC Campus. The result can be found at: <https://pressbooks.bccampus.ca/chbe220/>. The timing of this is quite fortunate with the course moving online due to COVID as I think this will help support student learning in an online environment. After using the text in the course this coming year and refining it, I intend to disseminate and publicize it more widely as OER in order to have impact outside my own classroom.

2.3.4 CHBE 362: Process and Environmental Engineering Laboratory

Terms: 2017W1, 2018W1

Average class size (sections combined): 124

Description

The course is taken as a core course by students in CHML and CHBE. The course introduces experiments relating to theory students learn in Y2 and Y3 courses. This includes experiments on heat transfer, particle technologies and biological wastewater treatment. Students also take a field trip to various industrial sites as part of the course. This field trip is mainly organized by the department in conjunction with the Y3 student representatives.

Structure and organization

The course is split into two sections, one on Tuesday and another on Friday. Course meeting times are four-hour timeslots and it will depend on the week as to whether the students are in the lab. The course consists of three two-hour workshops and three four-hour labs. A sample lab schedule for the 32 lab groups in a course is shown in Appendix A.6. Students also partake in industrial field trips during the fourth week of classes. In 2017W1 I co-taught the course with Dhanesh Kannangara and then in 2018W1 I was the sole instructor. In both cases I was present in the lab during most experiments assisting the TAs and students, particularly the first time in a term an experiment was run. Students are responsible to complete a pre-lab assignment before coming to the lab, they then work in the lab to collect necessary data and

finally complete an assignment, submit a report or do a presentation. For workshops students generally submit an assignment. Reports and presentations are for the four-hour labs.

Modifications in 2018W1

My work on this course between 2017W1 and 2018W1 was focused on updating lab manuals, equipment and ensuring our data collection and analysis system was running smoothly. This data collection system uses excel templates, and students report their data (D file), answers (A file) and this is compared again a correction file (C file) that calculates expected answers based on the data students measured. I include a sample of these files for the particle size workshop from the course in Appendix A.6 so the reader can get a sense of them. I believe the updates helped ensure clarity and thus reduced student workload as there were fewer comments on this from students in 2018W1. One major change I introduced was an oral report rather than a written one for the wastewater experiment in order to give students a chance to formally practice and get feedback on communication in forms other than written reports.

Reflections on student evaluations

A challenge with lab courses is ensuring consistent marking between the instructor and TAs, and students commented on this. I had worked with TAs to set expectations around marking using rubrics, but could further develop this to ensure consistency and clarity in the course. Another point students brought up is making the labs more engaging, and this is something that should be focused on in the future, perhaps trying to make data collection less tedious or repetitive. Though I was aware of this after 2017W1, I was not able to focus on it in preparation for 2018W1 given my heavy teaching load that term, with this being five courses (APSC 100, CHBE 241, CHBE 243, CHBE 362 and CHBE 453/454). Students also commented on lab timing compared to the related theory component introduced in other courses. I was aware of this disconnect and spoke with relevant course instructors but constraints around lab timing, and natural progression of theory courses, can make changes to fully address this disconnect quite difficult. Nevertheless, this should continue to be worked on and a part of the solution could be attempting to better support students by introducing some key theory into the lab courses. Our curriculum renewal is aiming to give the labs a 1-hour lecture per week that could be partially used to support such a system. The major items I point out here I have passed on as comments to future instructors as I did not teach the course after 2018W1.

2.3.5 CHBE 376: Computer Flowsheeting

Terms: 2017W2, 2018W2, 2019W2

Average class size: 117

Description

The course is taken as a core course by students in CHML and CHBE, it is also taken by a few IGEN students as an elective course. The course introduces students to computer flowsheeting, using computers for chemical property estimation and how these tools are used in chemical process design. I audited this course in 2016W2 and taught it in subsequent years.

Structure and organization

This three-credit course consists of two weekly 80-minute lectures and one 110-minute tutorial every two weeks. Lectures consist of theoretical background on a given topic, followed by a guided example where students are encouraged to work along in real time on their own laptops. This is then followed by students working through a worksheet example on their own or in small teams while I circulate to answer questions. Tutorials are problem-based with students working on a problem set due at the end of the tutorial period. Myself and the TAs circulate and answer questions during the tutorials. I have included the syllabus from 2019W in Appendix A.7 to give an idea of the course deliverables and timeline. Note this also has changes implemented in evaluation due to COVID-19. These were mainly being more flexible about which test grades were used in the grade calculation mainly to reduce student stress about online testing. In spite of these changes, the average course grade did not significantly change from previous course iterations.

Expansion of worksheets approach

The previous course iteration in 2016W2 used worksheets in roughly half of the classes. With these worksheets, students would work independently on a problem to further their learning. Since beginning to teach the course in 2017W I have expanded this approach to be used in each class. Students are asked to submit the completed worksheet before the next class. This is then given a mark out of 1, mainly based on completion rather than for being entirely correct. Solution summaries for worksheets are made available following the submission deadline. A sample of a worksheet and solution can be found in Appendix A.7. The goal with this approach is to have students work independently on problems with accountability for completion without requiring the time for full grading and feedback. I encourage students to self-evaluate and come to see me if they have questions and I believe it is important to build these self-evaluation skills in students.

Course Project Support and Structure

Another element of the course that I have continued from previous instructors is a term project. This involves completing a chemical process simulation or the development of a tutorial on a novel element of the process simulator. Initially I had students submit a proposal roughly one month into the course. I would then give students feedback on this idea, and they would work towards their final deliverable and come to me for assistance as required. Many students would put the project off to the end of the term closer to when it was due, leading to a concentrated workload for both them and myself. In 2019W I decided to incorporate additional deliverables for students that would build up to their final deliverable. These intermediary deliverables and their weighting can be seen in the course syllabus in Appendix A.7. This allowed students to get feedback on sub-components of their final deliverable. This also provided useful feedback to me in terms of whether students understood how to independently perform components of what they were learning (eg. setting up reactors, separators, etc.). This approach was quite successful, albeit more work spread over a longer time, and I will continue it in future years.

Reflections on student and peer evaluations

Student comments mention that they see the applicability of the course, which I believe is critical for student engagement. From the comments, I believe the applied nature of the course and integrated student practice in class sessions aid students in understanding course content. Students in 2017W commented that the feedback could be clearer for assignments. In order to improve this, the assignment marking was all done in canvas in 2018W, using rubrics that students could see following grading. I believe this helped in communicating feedback to students in 2018W as I did not receive many comments on assignment marking. In 2018W I received a peer review in this course that was very favourable in terms of my organization, enthusiasm and engagement of students through in-class exercises. During these exercises I would circulate to help students with any problems they had with their simulations. One critique is that for 120 students, it can be a challenge to get to many of them to answer questions. I do encourage students to work in groups so that they can turn to their peers for help if I am not available initially, but this is nevertheless a challenge. Having the TAs in class may be helpful, but would mean cutting back hours on dedicated to student feedback on assignments. In 2019W due to COVID-19 and teaching online I had to adapt the exam to more of a theoretical exam rather than one using the process simulator as some students did not have access to computers with sufficient computing power to run the simulator. Previously students would write the exam using a process simulator, either on their own system or in the computer lab, which is a much more authentic assessment. Some students commented on this, and I agree with them that this was unfortunate. In preparation for 2020W I have worked with departmental IT and other instructors to set up remote access to lab computers. I believe this will allow students to write exams in an authentic manner again, although I will need to test this with students to ensure accessibility issues (eg. internet reliability) are not significant barriers.

2.3.6 CHBE 453/454: Biological/Chemical Process and Product Design

Terms: 2018W1/2, 2019W1/2

Average class size: 114, Average number of students I advised: 23

Description

The course is taken as a core course by students in either CHML and CHBE. Students work on a biological or chemical process over 2 terms developing a process design including initial project scoping, process synthesis, process flow diagrams (PFDs), process and instrumentation diagrams (P&IDs), control strategies, economics, plant layout, environmental and safety analyses. I shadowed instructors in this course in 2016W1/2 and 2017W1/2, assisting with guiding student groups and performing some assessment through individual interviews with students at the end of terms. I was added to the instructional team in 2018W once I had my Professional Engineer (P.Eng.) designation. Since 2019W I coordinate the course consisting of myself, three other instructors and one industrial adjunct.

Structure and organization

This 3-credit per term course consists of one 50-minute lecture and two 110-minute tutorial sessions per week. Lectures are generally given by guest speakers who are experts from industry introducing a certain process design component. Students work in groups of 6 to 8 on their design project. Instructors are assigned groups for which they become an advisor, and tutorial sessions are used for instructors to meet with the students groups they advise. Major student deliverables are presentations followed by reports due at three points in the course: one month in (proposal), end of term 1 (progress) and at the end of the course (final). Further information on the course can be found in the syllabus in Appendix A.8.

Reflection on student evaluations and changes to course organization

In 2018W many students commented on unclear course deliverables and the desire for clearer standards, this can be challenging in an open-ended course that is also team taught. In 2019W I coordinated the instructional team and sought to help address these issues. This included developing a comprehensive schedule (shown in Appendix A.8), and clarifying existing rubrics for key deliverables including oral presentations and reports. We also developed sample standards for flowsheets and equipment design and the main person leading the creation of these was Mr. Sergio Beretta (our industrial adjunct) with feedback from other instructors. Comparing student comments from 2018W to 2019W, organization seemed to improve. However, students in 2019W commented on a number of areas for further development, specifically to improve clarity around deliverables and evaluation.

In order to tackle this, I have coordinated meetings every two weeks with the instructional team over the course of the summer of 2020. This also allowed us to prepare for teaching the course entirely virtually. Over the summer we reviewed course rubrics and came up with clearer guidelines on course expectations while not taking away from the open-ended nature of the course. For example, in terms of equipment

design, we are now specifying to students the types of units and number of such units they should do detailed equipment design on (eg. 1 reactor, 1 separator, 1 pump/compressor, etc.). We believe this standardization will remove some variability from project expectations allowing students to instead focus on ensuring their design is well supported and clearly explained. We have also compiled a library of exceptional sections of previous reports to showcase excellent design work to students.

Students in the biological option (CHBE 453) also comment on the lack of biological process examples in the lectures. Dr. Sue Baldwin, Mr. Sergio Beretta and myself are working on this for 2020W. Some students also comment on the large group sizes and difficulty with accountability and we noticed as instructors this was particularly challenging for a few groups. We have come up with a portfolio system we will implement in 2020W. This will have each student copy items they worked on and briefly describe how they contributed into one large document. Along with the peer evaluations we currently use, we will also be able to use this to look back on student contributions for each individual more clearly to help support peer evaluation scores and see if these are merited. We believe this will help solve the problem of certain students contributing very little, although it should be noted the vast majority of groups split work relatively evenly.

3 Educational Leadership

In this section I discuss my educational leadership philosophy and highlights of my educational leadership contributions. For a complete list of contributions please refer to **section 9** of my CV. I have organized the contributions I discuss in this document into three categories:

1. Curriculum renewal, development and assessment within the CHBE department.
2. Partnerships with other faculty to develop and deploy impactful pedagogical innovations.
3. Developing educational capacity in the department, university and beyond through creating and facilitating a number of training opportunities.

3.1 Education Leadership Philosophy

Reflecting on my experiences around educational leadership, I believe the role of educational leaders is to ensure programs deliver effective learning experiences to students. Students should be engaged in these programs, and graduate having developed and enhanced their knowledge base, critical thinking, communication and teamwork skills [8]. This should also include the capacity for continued learning and skill development such that students can identify their educational needs and continue to grow these important skills.

In order to be effective, educational leaders must seek out the views of a variety of stakeholders and continually engage with them to ensure program quality enhancement [9]. Notable stakeholders include students first and foremost, as well as faculty, alumni and in the case of engineering, industry and co-operative learning employers. Students must feel that they are partners in both the learning process

within the classroom and more broadly in program improvement. This requires space and time for students and faculty to interact and exchange ideas in a respectful and constructive manner. I have sought to include a strong student voice or active participation in many educational leadership initiatives I have undertaken.

Programs can move towards successfully incorporating these elements by promoting a faculty culture of evidence-based program and course design [10]. It is important to recognize broad goals around graduate attributes are not likely to be impacted by changes made solely by one faculty member. Multiple faculty must ensure they are using up to date research to inform strategic methods of teaching and program design in order to succeed in delivering academic programs of a high quality. Support for this must be aligned at the department, faculty and institutional levels [11]. I have worked on a number of educational leadership initiatives engaging different levels of the university, as well as disseminating ideas and practices beyond the university.

The principles that I have described above in terms of quality in educational leadership are also reflected in a number of sources that highlight principles of good practice in this domain. This includes Felton's "Principles of Good Practice in SoTL" whose five principles of good practice focus on inquiry into student learning, being grounded in context, engaging students as partners, being methodologically sound and appropriately public [12]. My role as an educational leader is to ensure I am engaging department stakeholders to bring the best to the programs we offer at all educational levels. In many instances I work with colleagues to ensure this work has a broad impact.

3.2 Curriculum Renewal and Development

Part of my mandate when I was hired was the further integration of design education into the curriculum of the CHBE Department's two programs with these being Chemical Engineering (CHML) and Chemical and Biological Engineering (CHBE). Accomplishing this has required engaging other faculty to discuss and support design integration into their courses. Since my initial appointment I have also begun to take on a larger role in curriculum development for the department's two programs. This notably includes improving our program outcome assessment and continual improvement process.

3.2.1 Design integration (Faculty Associates)

I was selected to be part of the Faculty Associates Program run by the Centre for Teaching, Learning and Technology (CTLT) at UBC. This program appoints faculty for two years and provides funding of \$10,000 annually to work on a project of importance to the faculty member and their department or faculty. The focus of my project was on design education in the 2nd and 3rd year of CHBE departmental programs.

The project focused on first identifying best practices in integrating design into the CHBE curriculum. This was done by reviewing practices in other departments at UBC, at other institutions as well as in industry.

This process also involved reviewing the current CHBE curriculum. During the time of the project the department was also reviewing and changing the curriculum of its two programs and the project was complementary to this. Methods of measuring the effect of these design experiences on student learning was tested in the second year of the project in CHBE 243. My involvement in the program ended in summer 2019, but work to improve the undergraduate curriculum by integrating design continues. Notably there is a new second-year course (CHBE 220) focusing on design, and I am testing out a new tool to measure design learning through concept mapping. Data analysis has been completed and I will be submitting a manuscript for publication with results from this study to an educational journal such as Journal of Engineering Education in the fall of 2020.

3.2.2 Undergraduate Program Evaluation and Renewal TLEF

Working with Dr. Louise Creagh, I co-developed a successful application for the UBC Provost's call for Undergraduate Program Evaluation and Renewal (UPER) TLEF projects. Members of the curriculum and accreditation committee also gave input for the application including Dr. Peter Englezos (dept. head at the time of application), Dr. Charles Haynes (current dept. head), Dr. Dusko Posarac, Dr. Gabriel Potvin and Dr. Bhushan Gopaluni. We have also partnered with Mr. Jim Sibley and the Applied Science Centre for Instructional Support, the teaching support unit in the Faculty of Applied Science (APSC), to support the project. The project received funding of roughly \$200,000 over 3 years to re-evaluate our continuous improvement process and develop procedures that can be scaled to other units in order to improve academic programs. Within CHBE, as with all engineering programs in Canada, we report on program outcomes known as Graduate Attributes (GAs). Our continuous improvement process aims to take quantitative and qualitative data from students, faculty, co-op employers, and industry to improve our undergraduate academic programs.

Dr. Creagh and I are responsible for the implementation of this project, which started in April 2019. We worked with department staff and a summer co-op student in the summer of 2019 to implement the initial stages of our plan. This included individually consulting each faculty member on GA indicators that they report on through the courses they taught over the past year. Over the summer we also developed surveys to collect self-assessment data from alumni and students. These surveys have been deployed in the 2019W academic year, and will continue to be used. Furthermore, in order to better engage students in the curriculum process we have created an interactive curriculum map. A static version of the curriculum map developed from this project can be seen in Appendix A.9. In the fall, we followed up on interviews with faculty by organizing a faculty retreat. The retreat was well attended with 26 out of 33 faculty in attendance, and all faculty were engaged before the retreat in order to contribute to agenda items. We discussed curriculum renewal for each year level of our undergraduate programs. We also revised our graduate attribute indicators to ensure these were targeted and more effective, moving from 60 indicators to 40. In 2019W, we implemented these new indicators in courses, which meant assigning indicators to each course. At the end of 2019 and in the summer of 2020 we worked with TAs to begin developing an annual ungraded assessment for students entering Y2 and Y3, to assist in evaluating the learning of key program concepts. We are currently working to refine questions for the assessments and

will begin working on a similar assessment for students entering Y4 in the coming year. Summer of 2020 was largely spent working on efficient data analysis and visualization methods in order to be able to rapidly present the data we collect to the department on a rolling basis to inform continuous curriculum renewal. We intend to finalize the setup of all data collection and analysis methods by April 2022.

3.3 Pedagogical Innovation

3.3.1 Communication Integration

I have worked closely with communication instructors in our department in order to better integrate technical communication into the CHBE undergraduate curriculums. Initially we integrated topics from assignments and lectures in CHBE 241 (Material and Energy Balances) with CHBE 201 (Technical Communications). This eventually developed to synchronized assignments for the term project in CHBE 220, and I elaborate on this in **section 2.3.3** of this dossier on CHBE 220. This collaboration has also led to three conference proceedings papers on technical communication integration. A future focus of these efforts is ensuring the communication content from Y2 is supported by curriculum activities in Y3 and Y4. One example of an area where this is currently done is laboratories where there is a common style guide for the department. Further integration could occur with design courses such as CHBE 453/454 or with the term reports in CHBE 376 and we are looking to act on these opportunities in future years.

3.3.2 WeBWork Development

Collaborating with Dr. Agnes d'Entremont from Mechanical Engineering (MECH) and Dr. Negar Harandi from Electrical and Computer Engineering (ECE) I have co-led the expansion of the WeBWork open-source online homework system to many second-year engineering topics. This system is commonly used in many math departments (including the one at UBC) for delivering practice problems with unique values to each student. This allows students to get instant feedback, collaborate on solving problems and focus on understanding key course concepts through practice. Previously this software was being used in isolated courses in CHBE, MECH and ECE. We came together to expand the use of this tool across many second-year engineering courses as there are many overlapping topics in second-year engineering taught by different disciplines. One example of such a topic is fluid mechanics, taught by CHBE, MECH and Civil Engineering (CIVL), where many concepts, and corresponding practice problems, overlap. In the first year of the project in 2018W1 we implemented WeBWork in sixteen second-year courses taught in five departments. Many of these common courses are required in more than one program, as such these changes have impacted roughly 800 students per year in all engineering programs at the UBC Vancouver Campus.

Our goal was to create WeBWork problems and then share them to the Open Problem Library (OPL), which is an online openly licensed repository for WeBWork questions. The OPL contains over 35,000 questions, but these are almost entirely in math subjects. When we began our work, there were only

about 260 engineering questions on the OPL in three subjects. Since beginning the project we have created or coded over 1500 problems and created taxonomies to organize problems in ten new subject areas in the OPL. Many of the questions created are now available on the OPL through the WeBWork interface with the source code stored in the OPL GitHub under the UBC folders: <https://github.com/openwebwork/webwork-open-problem-library>. This work received funding from multiple sources including \$50,000 from the UBC TLEF as well as \$7,500 from BC Campus.

3.3.3 CHBE 355/CHBE 356 TLEF

Working with Dr. Bhushan Gopaluni, Dr. Vikramaditya Yadav, Dr. Yankai Cao as well as a number of graduate and undergraduate students we were successful in applying for a TLEF grant to begin April 2018. The project has integrated problem-based design exercises into Kinetics and Reactor Design (CHBE 355) and Process Dynamics and Control (CHBE 356). Both these courses are taken by students in their third year second term in both programs offered by the department. My role was organizing group meetings, managing the overall TLEF plan, including hiring and supervision of students working on the project, and providing feedback on the resources developed. Through this grant we were able to develop, deploy and assess a number of innovative educational resources in the grant's first year. These include the development of Jupyter notebooks for introducing the use of python for the analysis of reactor modelling and process control. The resources developed are openly licensed and those developed to date can be found under our GitHub repository at <https://github.com/OpenChemE>. The TLEF grant has been renewed for a second year and third year for a cumulative total awarded of \$50,000 and we continue to refine these resources. As a result of this and other pedagogical development projects, I was one of 20 young faculty from the United States and Canada invited to present on educational innovation at the 50th Anniversary Computer Aids in Chemical Engineering. As a follow up, I have published a collaborative paper in Chemical Engineering Education with four other faculty members from various institutions on the use of computational notebooks in the classroom.

3.3.4 Second-Year Undergraduate Lab Development

I collaborated with Dr. Dhanesh Kannangara to redevelop two second-year labs implemented in CHBE 262 in 2017W. These labs focused on fluid mechanics. I was responsible for designing and overseeing the construction of two experimental setups. I also redeveloped lab manuals, student assignments and trained teaching assistants on use of the setups. One setup focused on pump and system curves including analysis of multi-pump arrangements in series and parallel. The second setup focused on valves types and pressure losses associated with these systems. This unit improved on a previous setup by using clear piping and more straightforward pipe paths, allowing students to more easily operate and understand the implications of the setup. It was also designed to be modular on a moveable table such that it can be re-arranged in the lab.

3.4 Impacts in Training other Educators

I have undertaken a number of initiatives to facilitate spaces where students and faculty from a variety of backgrounds can exchange ideas, learn and collaborate to promote excellence in teaching, learning and educational leadership. I present a selection of these initiatives below.

3.4.1 Vancouver Summer Program and Student Educational Training

In the summer of 2017 the CHBE department was launching our first iteration of our Vancouver Summer Program (VSP) offering. Dr. Gabriel Potvin, Ms. Marlene Chow (CHBE Director of Programs) and myself were leading the development of our VSP package. We had heard from a number of graduate students and postdoctoral fellows in the department they wanted to get some teaching experience, but had limited options for doing this during the winter academic terms. In order to address this, we developed a program for training graduate students and postdoctoral fellows to teach as part of the VSP program. The students were paid a stipend to teach 3 three-hour classes in the program. We spaced this teaching out such that students were teaching once per week. Either Dr. Potvin or I were in the class when the students were teaching and we would meet with them to give them feedback each week. In order to prepare students for this experience, I offered a four-hour training workshop followed by an optional 24-hour instructional skills workshop (ISW). The ISW is an intensive teaching workshop which incorporates theory and practice and us run at many institutions within BC as well as internationally. Dr. Potvin and I then followed up with students as they prepared lessons plans and materials for the program. The program has been a success and is ongoing. To date, we have had 22 individuals teach in the program. Some of these students have gone on to teach two-week mini-courses for high school students as part of the UBC Future Global Leaders Program, or teach full VSP courses. This program provides a method for students and fellows in our department to gain teaching experience, which is becoming increasingly important when applying for academic positions. In addition to this I have also supervised five graduate students and eight undergraduate students working on educational research projects, with these supervisions listed in **section 8c** of my CV.

During the summer of 2020 I sought to support students and TAs in the transition to online teaching. I ran summer drop-in office hours roughly every 2 weeks to answer students' questions. I then compiled an FAQ based on these and distributed this to students through our learning management system (LMS). I also oversaw the development of online learning tool guides for TAs by adapting guides we had created for faculty (described in **section 3.4.2** of this dossier), again making this available for TAs on our LMS.

3.4.2 Faculty Educational Training

When I joined UBC in August 2016, I participated in an ISW that month. I found it a very helpful introduction to teaching at UBC as well as a chance to meet colleagues from across the institution. Based on my experience I wanted to ensure others had a similar opportunity to hone their teaching skills. I have led Faculty ISWs with CTLT for the past 4 summers, training 20 faculty members. I have also co-facilitated

four workshops as part of CTLT institutes that are run three times a year. A list of these workshops can be found in **section 8e** of my CV.

Over the summer of 2020, I focused my activities on supporting faculty in the transition to online learning. I met individually with 25 out of 30 faculty teaching in 2020W1 in 30-minute meetings to hear their plans and concerns for online teaching. I then developed a plan coordinating with Drs. Gabriel Potvin, Louise Creagh, Alireza Bagherzadeh and Charles Haynes (Dept. Head). We received funding for these activities and I supervised two undergraduate co-op students with whom I developed five workshops for faculty on a variety of online teaching tools. We generally ran each workshop twice and also produced written guides and session recordings. Details on these including number of participants can be found in **section 8e** of my CV. We also created guides for two online teaching rooms in the department, which had been converted from meeting rooms. In addition, we met one-on-one with 7 course instructors to provide individual support in getting their courses ready. Overall, we interacted with 27 out of 30 faculty teaching in 2020W1. I have hired and am managing a co-op student from September to April to continue this support.

Since joining UBC I have also been active in leading the Educational Leadership Network, for the first two years as Communications and Membership Coordinator and for the two following years as co-chair with Dr. Silvia Bartolic. This is a grassroots network of faculty in the educational leadership stream that offers events and workshops in order to bring together faculty to promote and share educational leadership. As a part of this I helped organize annual CV and teaching dossier workshops as well as networking events twice per term. In the summer of 2020 I completed my term as co-chair.

3.4.3 Open Education

One area of educational leadership that I have been particularly engaged in is open education. Open education seeks to make education and associated resources open for use, sharing and editing. As one example, this can facilitate the creation of more effective learning materials that can be adapted to a classroom context. My engagement in this area is shown by the TLEF projects I have been involved in, most of which aim to build upon or produce open resources. I have also sought to engage colleagues in these endeavours, both at UBC and beyond. At UBC I have given a variety of workshops on open education, and a list of these can be found in **section 8e** of my CV. Within a broader context I am active in a special interest group (SIG) focusing on open educational resources (OERs) as part of the Canadian Engineering Education Association (CEEA). With this group of faculty from across the country, I have developed and delivered four workshops to faculty and students at the CEEA annual conference. I became chair of the SIG in June 2020. I have since led the group in putting on two workshops over the summer of 2020 and as well as a guide on finding and licensing OER which is hosted on the Engineering Collaboration for Online Remote Education (ECORE). Ecore is a collaboration between multiple groups led by Engineering Deans Canada to disseminate resources to support faculty in the move to remote teaching. Based on my work in open education, I was selected as one of the BC Campus Open Education Advocacy and Research Fellows in 2018. This has allowed me to showcase the initiatives I have helped lead at UBC

to a broader audience, and supported dissemination of the work I had done on the WeBWoRk online homework system.

4 Service Within and Beyond UBC

I have served in a number of roles, and in this section I highlight service of special relevance to teaching and educational leadership. A full list of service contributions are available in **sections 11 and 12** of my CV.

4.1 Service within UBC

Within the CHBE department I am an active member on the curriculum and accreditation committee. I have significantly contributed to curriculum re-design which has re-shaped Y2 and Y3 curriculum and is moving on to major Y4 curriculum changes in both our undergraduate programs. These are the most significant changes to our programs since the introduction of the CHBE program in 2003.

I have supported co-curricular student initiatives that seek to apply engineering knowledge through my role as a Faculty Advisor to various student teams. This include ChemEcar, Thunderbikes (electric bike/motorcycle), Engineers for a Sustainable World and the Biological Internet of Things (Big data and biological systems). Getting students to apply their knowledge to problems they are passionate about outside of a course context can deepen their learning and give them a greater appreciation of curricular content. I now further support students by my role as a member of the APSC Professional Activities Fund (PAF) Funding and Governance Committees. This fund disburses around \$500,000 in engineering student fees to a variety of design teams and professional training activities on campus.

Outside of the above initiatives, I have done a number of outreach events listed in **section 11c** of my CV including participating in the APSC open house leading lab tours for the past four years. I have also served on four adjudication committees for educational grants at UBC listed in **sections 11b/c** of my CV. Furthermore I have served on student admission and scholarship committees. This including the APSC broad-based admissions committee, reading and ranking 270 student applications in the 2016W and 2017W academic years, as well as the UBC Premier Wesbrook Scholar's Selection Committee in 2018W and 2019W ranking 100 applicants each year for the most prestigious scholarships that UBC awards.

4.2 Service to the Community

I am actively involved in the American Institute of Chemical Engineering (AIChE). Much of this involvement centres around undergraduate student programs offered by AIChE. I advise the AIChE Chapter at UBC known as Envision. I also actively encourage and facilitate students to attend regional and national AIChE conferences. This includes soliciting undergraduate students to present their research. Each year I also nominate students for AIChE awards and two of our students have received awards each year for the past

four years that I have been advisor. I also serve on the Engineers and Geoscientists British Columbia (EGBC) Scholarship committee since 2018 having ranked 57 nominations over 4 scholarship competitions.

I am active in the Canadian Engineering Education Association (CEEA) and served as logistics chair for the CEEA 2018 conference at UBC. This involved organizing conference accommodation, venue and food for the roughly 300 delegates attending the conference. I also contribute to the American Society for Engineering Education (ASEE) and am co-chair of the 2022 Zone IV conference with Dr. Agnes d'Entremont. Over the past four years I have reviewed 9 abstract and 8 article submissions in total between both of these conferences.

5 Conclusion

Over the past four years since my initial appointment, I have contributed to UBC through teaching, educational leadership and service. I have sought to capture highlights of this activity in this dossier. This includes demonstrating exceptional teaching and grounding my practices in scholarly literature. I have advanced education beyond my own classroom by thoughtfully engaging in curriculum renewal, developing pedagogical innovations that have been recognized internationally and learning from, as well as training peers. I have also served UBC through activities within and outside of the university.

I look forward to continuing my work, bringing the best in teaching and learning to UBC. In order to do this, I will continue to collaborate with students, colleagues, and external partners.

Thank you for your time and consideration.

6 Acknowledgements

None of the work in this dossier would be possible without the support of many colleagues, peers and students. "Collegial" is one word used to describe CHBE and this resonates strongly with my experience. I owe much to the many faculty before me who have worked to shape the department into what it is today. Many colleagues have offered encouragement and constructive feedback and each day I find myself always looking forward to going to UBC. This becomes especially apparent when I haven't seen many colleagues in person for the past 6 months due to the COVID-19 pandemic. Though there are many people who I am grateful for I would like to highlight a few in particular. I would like to thank Agnes d'Entremont and Gabriel Potvin, two people who I have worked extremely closely with, and learned a great deal from, and who I very much look forward to continuing to work with. I would also like to thank Peter Englezos and Charles Haynes, two exceptional, and self-less leaders for our department, who have provided their support, time and energy in assisting me in a myriad of ways. I would also like to thank Marlene Chow for her tireless coordination of a number of items within the department and particularly her support for student extra- and co-curricular activities. I would like to thank the department's technical staff,

particularly Ken Wong and Doug Yuen for being patient and creative in finding solutions to everyday problems in the laboratory. I would also like to thank the department's office staff, in particular Lori Tanaka who keeps many things on track and Amber Lee who does a great deal of paperwork to hire students and ensure finances are in order. I would also like to thank the many students who I have had the pleasure of interacting with. Without them, none of what we do would be possible. Their creativity, drive and energy inspire me every day. Last but not least I would like to thank those who support me in my personal life, without whose understanding I would not be able to undertake what I do at UBC. This includes my partner Selina Liu and my parents Robert and June Verrett.

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Appendices: Supplementary Materials

A.1. Select Student Evaluations of Teaching

As discussed in the Summary of Student Evaluations of Teaching section of this dossier below are select student evaluations of teaching ordered by course year (Y2, Y3, Y4) and then chronologically. This follows the order in the course instruction section of this dossier, namely:

Y2 - CHBE 241 (2016W1, 2017W1, 2018W1), CHBE 243 (2018W1), CHBE 220 (2019W1)

Y3 – CHBE 362 (2017W1, 2018W1), CHBE 376 (2017W2, 2018W2, 2019W2)

Y4 – CHBE 453/454 (2018W1/2, 2019W1/2)

A.1.1 CHBE 241 2016W1 Student Evaluations

Course:	CHBE 241 101 - Material and Energy Balances	Department:	CHBE
Responsible Faculty:	Jonathan Verrett	Responses / Expected:	120 / 193 (62.18%)

Course	CHBE 241 - 101										
	Responses					Course					
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev	
Q1	The assigned workload for the course was heavy.	1	14	54	36	15	120	3.4	3	3	.88
Q2	The course material is rather advanced.	1	8	39	51	21	120	3.7	4	4	.86
Q3	The material is relevant to my professional needs.	7	10	17	40	46	120	3.9	4	5	1.17
Q4	The course material is interesting.	8	13	37	50	12	120	3.4	4	4	1.03

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:

University Module	Verrett, Jonathan										
	Responses					Individual					
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev	
Q5	The instructor made it clear what students were expected to learn.	1	4	13	57	45	120	4.2	4	4	.81
Q6	The instructor communicated the subject matter effectively.	1	11	25	61	22	120	3.8	4	4	.88
Q7	The instructor helped inspire interest in learning the subject matter.	4	12	25	50	29	120	3.7	4	4	1.04
Q8	Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	4	17	23	46	30	120	3.7	4	4	1.10
Q9	The instructor showed concern for student learning.	1	1	2	32	84	120	4.6	5	5	.64
Q10	Overall, the instructor was an effective teacher.	1	4	22	65	28	120	4.0	4	4	.79

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

Question:	Comment on the things you appreciated about the course and provide suggestions for improvement.
Response Rate:	62.50% (75 of 120)

1	useful course
2	this course has too many thing need to learn
3	the in-class notes is a little bit hard to understand.
4	the course has been a challenge, especially the amount of material we have to study. It requires a lot of work to be mastered. I fee that some sections must be deleted to reduce the pressure.
5	homework is well related to midterms.
6	good
7	exam questions do not effectively summarize the majority of course contentn
8	You learn a lot of chemical exercises in this course that seem to have practical uses. It applies knowledge of chemistry to solve simple engineering problems.
9	Way too much information to keep track of, and we only seem to practice each concept once and it is not enough to understand any topic in depth
10	Too many overly complicated questions/examples. Doing simple and easy questions would help provide a base understanding to then move on the the more complicated questions.
11	There was all lot of content. Like a lot. And it was a really big lecture.
12	There are many challenging concepts in this course, and they were not always presented in a way that students could understand easily. This course could use a list of relevant textbook questions to do for practice. With the sometimes overwhelming amount of material being taught, it is very difficult to get lost or confused and fall behind very easily.
13	The tutorials are too long. 2 hours of material and energy balances drives me insane.
14	The professor is very concerned with his students and makes immense effort to make sure everyone is comfortable in the course. However the course materials are difficult to teach and his methods are not the most effective.
15	The professor is extremely helpful!!1
16	The prof was very aware of our learning habits and did his best to cater the course to the needs of the class.
17	The office hours were good, also the example problems were also good. Maybe different TA's would be good? (Not I didnt like the current TA's, also I didn't even know there were three in this course, only two)
18	The more visuals you can give, the better. Most of my classmates and I learn the same as we did when we were 5. Visuals (especially videos) are imperative to understanding what is happening to the materials. No matter how many times you explain what enthalpy is, I will not understand until I can visualize what is happening inside the materials. For the most part there were effective descriptions. The issues of understanding for me came when energy was involved.
19	The material is difficult to understand, and the textbook is not very helpful when trying to gain traction on a concept. Dr. Verrett has done everything he can to create additional resources for us - using OneNote to post lecture examples and even making a few videos where he solves practice problems. I would have liked even more of the videos by Dr. Verrett, if possible. I would also like if we could do more practice of small questions that build to the complicated problems. This would cultivate familiarity with the concepts and help develop confidence in problem solving. Audio recording to compliment the OneNote would make it easier to follow along, as sometimes it's hard to remember all the details after class. While the course material can be difficult to understand, and the solving problems can be frustrating, this course is essentially about overcoming obstacles and solving puzzles - which is the very nature of Engineering. The students who entered this program likely love a challenge and solving puzzles. I think if the material was framed inside the context of solving puzzles and overcoming challenges, more enthusiasm could be garnered from the students. It could feel like a game, rather than a chore - I think that such a shift would dramatically increase student performance and understanding.
20	The course makes me learn about topic that will be very practical in process industry. The amount information is extremely diverse and difficult to place together.

21	The course would have been more effective having 1 hour classes instead of 1.5 hour classes
22	The course included a lot of useful information but unfortunately can be terribly dry. I find many people zone out for much of the class and it is difficult to stay engaged. I think this could be improved by providing more concrete examples and I don't only mean questions related to things in our real lives professional or otherwise but also by showing example or discussing the deeper principles behind things instead of just showing a mathematical relationship then working a question.
23	The course tried to relate topics learned in class to real life applications.
24	The course is too hard and tough for people that have no interest on the subject and that it has no relations to one's professional field.
25	The course focuses heavily on calculations, I just hoped that it focuses a bit more on conceptual understanding first.
26	The course was very enjoyable. Everything was interesting and relevant to the field of chemical engineering. The tutorials were somewhat pointless. The sessions just consisted of Professor Verrett or a TA solving one or two difficult questions on the projector. It was hard to learn how to them in such a short period of time, and it was much more efficient to study them on my own. The classroom (CHBE 101) had terrible acoustics, and with a section size of 200 students, it often got very loud. It would be best to have this class in a different classroom.
27	The course has a lot of material. It is difficult to study when the questions require so much time to finish, and especially when there are very limited practice problems with full solutions. The practice problems in the textbook are not helpful without having a full solution for the answer. I don't like how a lot of the questions require you to look up values in tables, it would be much more effective and easier to study if data were given in the question. Since there is so much material in the course, a suggestion might be to make the exams non-cumulative.
28	The course started off very basic, with dimensions and unit conversions, which is general knowledge for engineering students. It very suddenly changed into material balances, which I found surprising. My only problem was in that area; there should have been more focus on material balances at the very beginning, as opposed to spending time working on unit conversions, so that the material is understood more easily later on.
29	The assignments were quite frustrating, for the same reason listed below. They were also extremely time consuming, even when working in groups with lots of peer help.
30	Teaching methods were effective Course presentation on connect was very good
31	Prof tried very hard, but a very hard class to teach. Did well on all midterms but always felt very unprepared.
32	One thing I think would have helped in this course is dedicating one lecture to showing students how to look up data on NIST or any other source. This had to be done frequently for assignments and it was sometimes difficult to navigate the websites without knowing exactly what to do.
33	More questions with full solutions.
34	Midterm exams (especially the second one) were very difficult, and lectures/given problems did not adequately prepare me for either midterm. A better source of practice questions and solutions would be helpful
35	Loved the way you walked around the class and interacted with students.
36	Learning something new is always fun but need to find a better and more interactive regime of presenting course material to the students for better understanding. The course material is very dense and the scope of assignments was vast. Many concepts had to be figured out how to be incorporated instead of actually understanding why something works the way it does.
37	Learning how to use certain tables and where to look for them.
38	Jonathan really stressed that his main goal is for us to succeed and went the extra effort to provide additional office hours and commanding the tutorials himself when he heard the TA's were not conducting them well.
39	Jonathan had taught the class the way that I would've thought of teaching a class of material balances with the flipped classroom environment. To do well in the course you must do as many problems as possible to get a feel of the flow charts as well as the processes. All and all, a good way of teaching as I couldn't think of a better way to teach a hard course like material balances. Although I feel that this be more assignment, having a heavier percentage on our mark within the assignments; since the assignments take a while to do and are nearly applicable to the course content.
40	Its neat content.
41	It was a very good overview on what is needed in professional life, but there was a lot of content crammed into a very short amount of time. It might be more helpful to split the course so that we deal with material balances for a longer period of time and go into energy balances separately and in more detail. It is also suggested that instead of one tutorial every other week that's two hours long, tutorials take place every week for one hour. It is difficult to sit in a tutorial that's longer than the actual class, and a lot of time I can't hold my concentration that long.
42	It teaches us skills we will actually use in the industry
43	IDK
44	I think the course is very relevant for the Chemical and Biological Engineering department. I think the material should be taught in a way that is less dry and boring, therefore, making it easier to understand and spark interest in learning the material.
45	I think the course would benefit from more group work i.e. group midterms.
46	I think the course heavily relies on having equations at hand and using them, rather than understanding why we use the equation and how it is derived. It makes it difficult for me to really understand why we are using this equation. For more understanding I think more theory is necessary for the student to properly be able to apply these concepts.
47	I think the course contents of this course are very important. But I often had difficulties understanding what the questions are asking for which made it challenging for me to answer.
48	I think there should be more time for this course since this is the basis for our careers as chemical engineers, I think there should be more time for this course. This allows us more time to practice and be more efficient.
49	I think having the course in a 1.5 hr slot is very long for the material. Overall the course was interesting and relevant.
50	I think everything is going pretty good!
51	I really like examples because it's easier to understand by doing a problem. It would be nice to have more examples for midterms.
52	I realize why I have to take this course and I think it is somewhat beneficial, but its so far from what I want to be doing that its near impossible to stay engaged.
53	I liked the abundance of exercises provided in class, as well as the use of pre class quizzes to review for the week. I think simpler weekly assignments would have been more beneficial to me over a larger, more difficult assignment every two weeks.
54	I like how the course had relevant material for application in my engineering career. The material wasn't too difficult but it was a lot at once and it would have been nice to have more time to work through and understand the concepts. I did not like how tutorials were 2 hours long biweekly. I wouldn't have minded attending the tutorials in full if they had been every week. It was difficult to stay attentive at the end of a Wednesday with a classroom full of equally as tired peers.
55	I found the assignments very difficult and took a lot of time. Often, we did not have similar questions in class which forced me to learn things on my own, which is fine, but the amount of questions made the assignments time pits.
56	I appreciated how passionate and encouraging the instructor was. As a student taking this course for the second time, it was much more enjoyable this time around.

57	I appreciated the prof, but the written assignments were sometimes tedious and did not seem representative of midterm questions. I wouldn't suggest adding more direction to the assignment questions (breaking then into smaller parts like midterm questions)
58	I appreciate professor Verrett's efforts to always try to do better over the course, I think the course could be improved by having the textbook as mandatory material. I found it to be very helpful.
59	I appreciated the clarity (or attempt at clarity) of the provided lecture materials. Jonathan always asked us for feedback, and how he could help us learn the material. I liked how the quizzes would test my knowledge without penalizing me for getting questions wrong (marks for participation only) This way we could attempt the problems without worrying too much about the marks.
60	I appreciated the teacher actually considered us to be humans and provided so much help with our needs. Its great he understood our needs and that he tried to provide extensive resources for us to use.
61	I appreciated the worked out solutions towards the end of the course that i could go through on my own time. They complimented my learning very well.
62	Hi Jonathan, i appreciate your efforts and care in the students in your course. Though I didnt particularly enjoy the course in general, your efforts and ability to convey a difficult topic was worth noting. For the future i would like that you make your notes more concise, go a bit slower in your lectures and to be consistent in notation (ie defining variables and staying consistent). Thanks
63	He cares for the students involvement in class, but often, him moving around gets distracting
64	Given formula sheet
65	Gave a preview to the appliccations of the concepts in the real world.
66	Flipped classroom may be a better alternative for this course. Most of the time we get in all the information and theory about the subjects in class right before applying the concepts to some examples. It would be helpful to learn these concepts in advance on our own through possible screencasts so we have time to think about and digest the information before using the concepts to work on examples. I find it very difficult to follow through class examples right now as I dont fully understand concepts before applying them so it makes it hard to learn in class.
67	Fair course but should give more time for assignments
68	Dr. Verrett showed caring towards his teachings. He would respond relatively quickly to emails and piazza. He would listen to what students say; however, sometimes it was hard to understand the lecture materials. It would be better if he could explain some of the hard concepts more thoroughly with examples.
69	Course was good, would have appreciated more study material directly related to what we were going to be tested on.
70	Course should bring in real life applications. Verret has done a good job of that by having us look up values on pur own
71	Course has very difficult and new content. It's a lot to learn in such a short period of time. Perhaps another tutorial could be added with smaller sections for students with specific questions. Our tutorial section was basically just another lecture.
72	Assignments should be more clear and straightforward. They're not worth much but we spent about 8 hours on the tough ones.
73	Assignments were sometimes long. I liked that the quizzes were for completion only.
74	Appreciated the very structured way of lectures; however, since this is my second time taking the course, I felt like the professor has included way more material than the previous instructor. Cutting the material down a bit would be better for students.
75	After the second midterm , everything suddenly became too much and in depth. I wouldn't know if there's a way to space it out , or it's just how the syllabus was designed. But I'm sure a lot of the stuff in energy balance will be taught in 3rd year.

Faculty:	Verrett, Jonathan
Question:	Comment on what the instructor has done especially well in teaching the course and what he\she might do to improve it.
Response Rate:	68.33% (82 of 120)
1	very nice instructor
2	more practice problems with detail solutions
3	he genuinely cared about the success of the students and did his best efforts to present the material in an engaging manner, however more practice material that reflects the kind of questions asked in exams should be released
4	he always tries and puts effort in the things he teaches and tries to be fair with the students which is good. maybe give pre readings or pre lecture material before class because sometimes its hard to follow the examples in class when we've just learned the material 10 min. ago
5	good
6	flip classroom with video about general idea for the classes and more examples on different types of question might or might not be asked on tests/exam. Test students more on material learned in class.
7	explain lectures in details.
8	You were very clear in communicating material but went too fast at times and didn't explain key concepts and equations in depth. A lot of the times I found myself lost I a problem because I don't know what to look for in a question and what equations to use because I don't know what they mean. Perhaps verbalize your thought process more and clearly write down steps when solving equations in class.
9	You could tell this was Johnny V's first year doing the course, as he was a little rough around the edges. He could probably be a little more thorough in explaining what things were conceptually so we understood what we were trying to apply. However, you could also tell that Mr. Verrett legitimately cared about our learning and how he could make this a great semester for us. His genuine attitude inspired me to try as hard as he did. Also Johnny boy is a super cool dude in general. I'm sure we'd be bros if there was no age/profession gap.
10	You are very approachable and encouraging. The way you presented examples by showing them, letting us work through them and then going over the answer, was very effective! Piazza was also a good addition and I found it very useful.
11	Very engaging professor. Provides everything a student would need.
12	Very communicable!
13	Very clear and concise
14	Verret is a king and balances are his thing.
15	Verret has got to be one of the most dedicated profs I've ever had! He is interested in the course, wants the students to succeed and is always available for help when needed. Verret could improve on going faster in class but there are so many great qualites in his teaching style. Hands down the best prof
16	The surveys quizzes every week were effective and the assignments were relevant. The instructor was monotone and hard to stay focused for 1.5 hours.

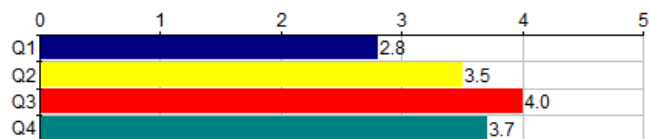
17	The instructor clearly cares about students well-being and wants his students to do well. He tries to engage people by asking questions but doesn't try to frame the class in a more interesting way. I understand this is his first run but if things are related back to larger principles like when introducing an equation explain a little of where it came from, or the history of a discovery or knowledge. Show a video of the reaction or show a video captioning what is going on and why. Even showing water condensing on a window with explanations about the gas phase becoming saturated or the equilibrium changing would help me pay attention and remember what is taught.
18	The instructor has done really well in explaining methods of doing the problems.
19	The dedicated last weeks for review is good. Could improve on vagueness of questions and unpredictable midterm questions.
20	Sometimes you skip over small details that make the world of a difference in class examples, so maybe try to figure out what to include and what not to include
21	Showing examples and doing them for the class is probably the only way to teach this course so that is fine. I think the problem is that the atmosphere of the class promotes distractions, there are too many people. So I think splitting the people up into two classes with the same tutorial time will really help. Also more practice problems from somewhere other than the textbook, and some handouts roughly detailing what steps to take and when would help a lot (maybe also a vocabulary list because in one midterm I didn't know what miscible meant).
22	Showed an incredible amount of concern for student learning. Easy to talk to.
23	Responding questions through piazza.
24	Professor Verrett is really keen on improving his teaching methods, although I don't think the weekly quizzes being for participating is a good reflection on what students don't know. As a lot of people just put random answers in to get the marks.
25	Professor Verrett is a good teacher. He shows concern for his students' learning. He takes breaks in his classes to make sure that we feel energized. Professor Verrett also is slow when he teaches how to solve the chemistry exercises.
26	Professor Verrett did a good job for his first time teaching the course at UBC. Perhaps for the future, he could create his slides and examples so they are not word-for-word from the textbook, or he can do examples in the textbook that don't already have the steps written out in the book. It was difficult to find examples with step by step solutions outside of class because all of the ones already in the textbook had been used in class. (i.e. do the examples in class that don't already have solutions provided in the textbook)
27	Prof. Verrett is patient, helpful, and an effective instructor. His class slides are detailed and helpful, and he's always willing to meet up with you if you have problems with the material. He's eager to improve as an instructor, and constantly welcomes feedback. I appreciate the extra effort he made to relate class material to real world applications, which makes everything more interesting. I do wish that he provided more practice problems. The class assignments were extremely difficult and were much harder than the class examples. He sometimes has problems controlling the class, but this is understandable since this is his first year teaching and there are 200+ students in the section.
28	Prof Verrett is fantastic. I think he is trying really hard to make sure the students do well. He is very transparent about what is going on in the course and is constantly available through piazza for questions. I'm not doing well in the course at all but it's because I can't connect to the content, not because of the Prof.
29	Please provide questions where all needed constants are given. The questions in the textbook are great, but not knowing how much more information we need to look up gets very frustrating, especially when we know the exam questions will not be structured the same way.
30	NP
31	Making resources available and constantly asking for feedback from the class to incorporate into lectures.
32	Keep the structured way of lecture, but cut down on the materials covered. It is a bit too much materials.
33	Jonathan was a really good prof, he was enthusiastic about student learning and was always willing to go above and beyond to help students. It's nice how he gave breaks during classes. He did well for his first year teaching. The first midterm was very fair, the second was too hard (but it's good that he realized that and scaled accordingly.)
34	Jonathan tries really hard and it is clear that he has his student's best interest in mind. I appreciate his efforts in trying to help us through a course that I find very difficult. As a new teacher it is understandable that not everything will run smoothly right away, but I still think Jonathan is a great teacher and he will only get better with experience.
35	Jonathan tried his best to explain course materials and to raise our interest in this course. He is a great prof that cares about this student and put a lot of effort try to help us achieve academically. However, the material of this course cover is rather tough and complex, and with the fact that this course has no relations to my professional field, thus I found this course hard to understand and hard to relate.
36	Jonathan really cared about us doing well in the course, he asked for a lot of feedback and acted on it. Very impressed for first year teacher. The TAs were very poor though.
37	Jonathan had taught the class the way that I would've thought of teaching a class of material balances with the flipped classroom environment. To do well in the course you must do as many problems as possible to get a feel of the flow charts as well as the processes. All and all, a good way of teaching as I couldn't think of a better way to teach a hard course like material balances. Although I feel that this be more assignment, having a heavier percentage on our mark within the assignments; since the assignments take a while to do and are nearly applicable to the course content.
38	Jonathan did well working out the problems on the projector screen, but at times the reasoning for his steps was unclear. The content was covered very quickly without enough practice problems to do.
39	Jonathan did a good job on providing multiple levels of support for students through piazza, ta office hours and his own office hours. His marking was fair. The only complaint I would have about the course was the difficulty of assignments. As this was my second time taking the course, I found Jonathan was easy to listen to because he was passionate about teaching and making sure the students knew what to do.
40	It's very clear that Jonathan really cares about us actually learning the content and that he tries very hard to help us. I love that he is so open to criticism and actually applies suggestions right away. However, Jonathan still can use a lot of improvement in the way he teaches. He tends to start new concepts with an example and explains what he's doing in them. I find this very confusing as the process only applies to the specific type of question. I think Jonathan's teaching quality could be greatly improved if he started each new topic with an overview of the general procedure and a description on why it is the general procedure, then dove into a specific example. This would make what he's doing in the example much clearer and easier to understand. For example, recently we learned that there is two different methods to solve a reactive energy balance problem through examples, but I didn't know why and how the methods were different until he reviewed the methods the next class. It would have been much clearer if he had started the topic with the overview of the 2 methods before doing the examples. Overall Jonathan is doing awesome for his first time teaching, but he still has a lot of improving to do
41	It is rare in my experience to find a prof who shows genuine care for his students, as well as genuine interest in the material that he teaches. It is for these two reasons that despite the complexity and difficulty of the material in this course, I can say that it was well taught and I genuinely enjoyed coming to lectures.
42	Instructor did a good job of covering all the material, could have improved by presenting it in different ways to fully engage students
43	In order to improve the course in the future, more worked out examples are needed. The course is problem solving based and without those worked out examples, it is very difficult to be confident with the material.
44	I'm struggling in this course, and I'm not totally sure why. I find it hard to follow the lectures and make sense of the OneNotes after class, but I can't think of how Dr. Verrett could be any more clear in his lectures. Maybe if Dr. Verrett could place more emphasis on why he takes the approach that he does in solving, how to know what equation to use, and really talk about what the symbols in the equations represent, that would be helpful. Also, I really think more repetition would be useful - that way, if the material was presented in a way that I didn't understand initially, I have an opportunity to grasp the concept on the second pass. It would also allow me to develop strength and comfort in using key concepts. I would also appreciate if Dr. Verrett could present information in more than one way, or have different ways of explaining an example. Sometimes, when questions are asked, instead of finding a new way to try to explain the answer, he will essentially just repeat what was originally said. Also, I think that when the class gets loud, it's because the students aren't able to follow - perhaps that could be treated as a sign to slow down and explain things more thoroughly. Overall, though, Dr. Verrett is exceptionally great at listening to us and addressing our comments. He also goes out of his way to be available to us, and takes time to ask us how we are doing. I'm giving lots of feedback on improvement because I know that Dr. Verrett wants to develop his skills in teaching - and I really support this ambition. Please do not take this information as an indication of weakness. Dr. Verrett is a strong, fair teacher who does a lot for us. He's one of my best teachers this semester.
45	I thought he was a great professor and I liked how all of the notes, even those written in class, were available on line. Only think to improve would be minor errors on some of the slides and it is sometimes hard to read the hand written notes in class.

46	I think was really comforting to know you had a teacher who cared so much for the class's learning and development. I think he's one of the few teachers I've met that is so interested in seeing his students succeed and at the same time improve himself with the students as the course develops. I feel he was constantly trying to provide us with resources for us to use, he was always there to answer questions whether in office hours or piazza and even took into account students comments. It was great having him as a teacher because he made the material (which can sometimes be dense and complicated) less difficult to learn. Lastly, I really appreciated he always listened to each and all of his student's questions. I appreciated he tried his best to understand my question regardless of how trivial they were. If I could recommend something to keep doing in the future, I'd definitely encourage the use of professor Verrett's videos working out problems in OneNote, since that helped me most.
47	I think that Jonathan has done a great job considering it was his first time teaching a university course. He really cares about all of his students and tries harder than any of my other professors in helping you to understand the course material. He was always prepared for lectures and was always and was always willing to help students if they were struggling. I think Jonathan was a great professor and I enjoyed being in his class. My only suggestion for improvement would be to put a bit more information in the class power point slides that explains the topic more clearly. The shorter slides work for when we're in class listening to him explain, but when going home and reviewing the slides to study they sometimes are unhelpful.
48	I think he is a pretty good instructor, but maybe he can make the problems and solutions a little bit clearer.
49	I think Jonathan put a lot of effort into this course and making sure the students understood and were happy. That was something that was really great about him. I personally did not enjoy the way the class was run. In my opinion I would suggest possible screencasts to watch before the week that talk about the theory related to the concept that is to be gone over in lecture. It is challenging to go over examples that are fairly new and be able to complete them without watching Jonathan solve them. I think it would be a better learning experience and the students would be more attentive and at least attempt to solve the problem.
50	I really like how engaging he is and how concerned he is about his students. I would prefer have more examples that target specific skills.
51	I really liked his patience towards the subject and how he was really thorough on each example given, However I wished for the notes he made in class during each example he would've been a little more detail so once I went back to look at them I would understand how each number was obtained.
52	I really like the fact that he takes the opinions and suggestions of the students into consideration. I did not do well on the second midterm and he gave us an option where I could possibly do well in the course despite not doing well on my midterm. He does go fast while doing problems. Next time could he put pre-done parts of the question on one projector while continuing the question on the other projector? This is way I can follow the solution better because I can see the whole solution and draw back on previous information and assumptions.
53	I really enjoyed your enthusiasm for the topic and for teaching. Every explanations to questions asked in class was clear and concise, no matter how many times it was repeated. I also really liked watching those videos you did on how to do questions. However, I would suggest more of a flipped teaching style for this course in particular, as concepts can be explained through videos and online things, but learning how to apply concepts in different conditions is sometimes more difficult for us students.
54	I liked how the class was mostly about solving problems rather than spending a lot of time on explaining the details of the material. This made the course interesting, challenging and a signal to know the parts I am weak in. Overall, this class was probably the most condensed with ideas throughout my college experience, but I feel that I understand it the most compared to my other courses.
55	I like how Dr. Verrett gives us extra resources and shows that he cares about our understanding of the course. What Dr. Verrett could improve on is organizing information for example with the formula sheets. It would be nice if he named the powerpoint slides put up on connect by the date of the class. It is difficult to figure out which is which when you have several opened up while studying. Examples in class were relevant and lengthy but I would have liked if there were more exam-style questions available for studying. I also think Dr. Verrett could improve on his ability to capture the class' attention. Much of the time there is a lingering chatter in the lecture hall and it is difficult to pay attention when this persists. Over all I didn't dislike this course and I learned a lot. Thank you for a good semester and happy holidays!
56	I found the overall teaching method for this course to be very difficult. I wish (as I had previously mentioned in the in class prof reviews) that the questions in class were collected into a document that I could print before class since I wasted a lot of time copying down information for questions yet my notes are still pretty much useless since I could not copy the paragraphs of questions word for word. My biggest comment is the lack of studying material to prepare for exams. There is virtually no way for the students to know what kinds of questions will be asked or the way they will be phrased since the exam questions are so different from both assignment questions and textbook problems. I really would have appreciated a list of exam-style questions to help me prepare for exams.
57	I appreciate how the instructor catered the course material to our interests based on a survey done at the beginning of the year. I also appreciate him actively walking around the room and being engaging rather than standing behind the desk at the front.
58	I am a fourth year engineer and you are in my to 3 professors. Your drive to teach and help everyone to understand is unparalleled. The way you have set up your classes to involve communication has helped me learn these concepts. I usually don't give suggestions but because I think you actually want students to learn I will let you know what would help me. I think if you called on people for in class answers, more people will pay attention in class (which will help them), those that do have answers will be able to feel good about themselves (which is an incredible motivator), and if the person doesn't have the answer you can find out where the breakdown is. To the latter point, the reason when you ask a full room of students a question no one answers is: the people who think they have it right don't need to embarrass themselves in front of others if they are wrong, and those that know they have it right don't feel the need to answer your question. The other suggestion I have is that you continue to have 2 midterms. I understand it is literally double the amount of work for you and your TA's but I can tell you from experience that people learn better and remember what they learned more often when there are 2 midterms. I cannot express how many times I have done better on finals that have 2 midterms than those that do not. I know the things I have said are more work for you and I wouldn't have suggested them if I didn't feel that this may help you in understanding your students a bit more. I cannot thank you enough for the hard work you have put into this course and I am hopeful that as you teach more you will become even better. Thank you! From the guy wearing a hat in the back of class with problems that Trump was elected. All the best!
59	His teaching style is great and he puts just a lot of effort However I would prefer if he could also have some review sessions
60	He's a good prof. I feel his examples are a little too basic in class, probably because of time, but maybe extra problems for us to look at with solutions would be good
61	He showed genuine care for student learning and tried his best to improve every week!! :)
62	He showed great concern for how well we learnt the material.
63	He really cares about making sure we learn and understand course material.
64	He puts a lot of effort into making the class the best it can be for students.
65	He made himself available for students to ask questions and provided several learning resources.
66	He is well prepared and organized most of the time. The slides can be revised to minimize errors and confusion.
67	He is a very responsible instructor but the class is a little boring
68	He has done well at explaining things very thoroughly. Sometimes he took too much time on some questions. Since he talked very fast it was hard for me to follow and know which parts are important.
69	He has made himself available both on piazza and through office hours. He has tried to provide us with as many problems with worked solutions as possible. He's asked us for feedback on the material, and uses online quizzes to assess our level of understanding.
70	He has done a good job of trying to make sure that the students understand the concepts and material. but he could do a better job of figuring out how to present it and teach the material that makes it easier for the students to understand and apply.

	He cares so much about us and how we are doing in the course. He constantly asks for feedback and actually takes it into account immediately. Everyone loves him and his intentions.
71	If he were to improve anything, I would say that he should write more on his slides. They are really brief and then he explains them in class. This is great, but if you miss what he says, or misunderstand something, it is near impossible to understand the theory of what we are doing in the slides later on. All you see is equations and hope you use them correctly when the time comes.
72	He answers questions very concisely and shows genuine interest in our learning. He makes class really enjoyable, despite the difficult material. Sometimes he goes through examples too fast, and it is easy to get lost.
73	HE is good
74	Good dedication to student learning.
75	Dr. Verrett is a very passionate professor and shows that he is willing to do whatever his students need to help them understand the course material. Though he did not exactly understand how we learned at the beginning of the year he is very open to comments and suggestions and works to integrate them into his teaching.
76	Dr. Verrett is a great professor but I believe his examinations could be improved. The first midterm was fair but the second midterm was very confusing and unclear. Although this is true, he immediately tried to fix his mistake and he is very open to constructive criticism.
77	Dr. Verrett is a very fair and supportive, and he is an excellent instructor. He explains the material in such a way that it seems easier to understand. I would recommend using simulations or demonstrations during lectures, because sometimes the students lost focus during lecture while Dr Verrett was going through an example or explaining a difficult concept. If he could engage the students a bit more and explain the course's relevance to the chemical engineering industry more often, we would be better off.
78	Dr. Verrett was clearly very devoted to helping students. I think the way the examples were done in class was probably too fast, working on shorter examples in class is something I prefer. The slides weren't as clear as I would have liked when reviewing, but that might have been by design to encourage good note taking. A lot of questions in the slides didn't have answers to them, same with the book. I really like being able to check my answers so I didn't like that. Overall the lectures were always organized but not always very clear, particularly in the conceptual explanations of concepts Dr. Verrett doesn't always use simplified terms. The assignments and weekly quizzes were helpful.
79	Did well in the notes department. Premaking slides and having the updated slides alongside the onenote slides was really helpful. To improve I suggest to slow down either the theory and test more heavily on that or have more practice on applications. Right now it seems we're trying to do too much in a single lecture.
80	Dedicated but could be more interactive. Class was generally boring and never expected anything exciting
81	Caring for the students
82	Always felt that Jon had the students best interests in mind and that he cared about our learning. Overall great prof

A.1.2 CHBE 241 2017W1 Student Evaluations

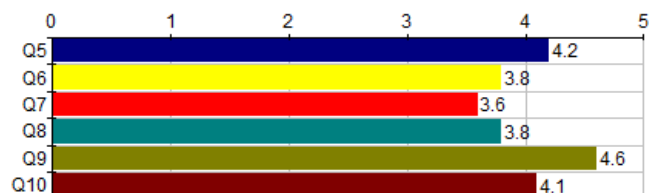
Course: CHBE 241 101 - Material and Energy Balances	Department: CHBE
Responsible Faculty: Jonathan Verrett	Responses / Expected: 120 / 190 (63.16%)



Course	CHBE 241 - 101										
	Responses					Course					
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev	
Q1	The assigned workload for the course was heavy.	6	49	40	16	9	120	2.8	3	2	1
Q2	The course material is rather advanced.	3	17	37	48	15	120	3.5	4	4	.97
Q3	The material is relevant to my professional needs.	3	12	19	35	51	120	4.0	4	5	1.10
Q4	The course material is interesting.	1	13	37	45	24	120	3.7	4	4	.95

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett										
	Responses					Individual					
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev	
Q5	The instructor made it clear what students were expected to learn.	0	3	13	62	41	119	4.2	4	4	.72
Q6	The instructor communicated the subject matter effectively.	2	9	24	55	27	117	3.8	4	4	.93
Q7	The instructor helped inspire interest in learning the subject matter.	2	15	40	38	24	119	3.6	4	3	1
Q8	Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	1	15	18	60	25	119	3.8	4	4	.95
Q9	The instructor showed concern for student learning.	0	2	8	30	79	119	4.6	5	5	.69
Q10	Overall, the instructor was an effective teacher.	0	4	17	61	37	119	4.1	4	4	.76

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

Question:	Comment on the things you appreciated about the course and provide suggestions for improvement.
Response Rate:	60.83% (73 of 120)
1	very applicable to the profession
2	this course was a great introduction to material balances but can be significantly improved by teaching the course material in a more concise and understanding manner!
3	perhaps slightly less portion; more practice questions
4	have more relevant webwork questions for the midterm and final
5	Workload and question explanations were good, but often times lectures were very boring and not very interactive
6	When doing problems in class, it seems pretty slow and tedious. It might help to have the problems posted beforehand. Also, the written notes in class seem helpful but a neater and more in-depth step by step version of the solutions would be appreciated.
7	Well organised content.
8	Though a bit on the easier side, there was far too much of a difference between the difficulty of webwork/in-class quizzes and the midterm
9	This course is not very interesting.
10	This course was unbelievably dry and boring. so boring.
11	This course provided an insight on what type of calculations we would face as chemical engineers. An improvement will be to do more excel coverage
12	There is a huge range of material for the course that is loosely related, would help if modules could relate or structure the course differently.
13	The webwork and lecture problems were very relevant, and exam expectation were very clear. The team quizzes were fair, and errors were corrected with marks for compensation. The midterm was very fast given the length of the problems, but the professor let us overwrite our midterm mark with our final exam mark.

14	The webworks corresponded with the material we were learning in class which was great. Piazza was a great help to answer some of the Webwork questions and other questions.
15	The material is interesting and applicable to my career. However, I would suggest presenting the material in a more engaging manner.
16	The lecture slides and class notes are very helpful, but more practice questions that are closer to exam materials can be provided.
17	The lectures were clearly explained, but with the amount of material in the course I struggled to keep up with the quizzes and to be prepared for the midterm.
18	The course was very well prepared but slightly disorganized especially during quiz time.
19	The course was extremely well structured. It would be great to see use of computation in this course(possibly Aspen?) since this is the only course we take before applying for co-op that has practical applications. Questions could also focus more on setting up equations rather than solving them since computation by hand is irrelevant in the real world.
20	The course is very relevant however there was not a lot of course resources available for studying
21	The course material itself is very relevant to chemical engineering degree and was interesting.
22	The course is easy to follow however, some parts of the content were rushed
23	The course structure was good and it was made clear what we should know or what we are going to learn from this course.
24	The course is thoroughly very interesting and fun.
25	The course is structured very well, but more examples and questions needs to be solved in class as we proceed with the material.
26	The content was adequate for year level
27	The Webwork was really great to practice! I think more webwork and less in class quizzes would have helped more, because the webwork was more similar to the exam type questions than the quizzes. The quizzes I found easy, but less helpful to problem type solutions.
28	Quizzes could have been better prepared with less errors.
29	Provide optional review sessions before midterms. These are very useful for students.
30	Proofread all quizzes and homework assignments.
31	Professor is very organized and helpful when asked questions
32	Piazza is very efficiently used, and the prof tries his best to make students understand the concepts. Well prepared.
33	Often it felt like the material was quite trivial but overcomplicated by forcing everything into a recipe
34	More long answer practice questions
35	More complete and easy to follow notes please!
36	Material was relevant and plenty of online resources were available. The material was a bit dry but was still fine overall. Some of the online answers on the wiki page had issues with missing some work which made it confusing where certain things were obtained but were useful overall. One improvement I would suggest would be to make what needed to be looked up online for webwork questions available in the questions or more clearly stated that they needed to be looked up.
37	Less long examples in class would allow for more time to learn the material.
38	It would be really nice if there was more practice problems to study for quizzes/exams.
39	It was very relevant to chemical processing and really helped in a few other classes also. I think you could improve on showing videos in class or real life pictures to relate the diagrams and questions to actual life.
40	It took me roughly two weeks to completely understand what the learning goals of CHBE 241 were. However, I feel that it is a very applicable course and find the material quite interesting. Along with our seven other courses it was difficult to stay on top of 241 as it doesn't seem as important as all the other courses.
41	It is difficult to distinguish between the topics since they are very similar, however this affected me negatively when solving questions and trying to figure out what topic it is on. Another issue is that the questions are very long and it takes so much time to read and understand. Most people had this issue during the midterm as well. I appreciated the professor's effort since he showed concern for student learning.
42	I'm in IGEN and this is a mandatory course for me. I'm not too interested in chemistry and don't see it applying to my own career, but I can see it being very useful to others.
43	I would like more detailed descriptions of some of our material and the actual proof behind it.
44	I wish the quizzes better prepared students for the midterm. The style of questions was very different between the two types of assessment. The quizzes were significantly easier than the midterm and were not helpful in preparing for the midterm. For this subject, I believe practicing long answer questions is one of the best ways to study and I wish the quizzes reflected this.
45	I think multiple choice quiz evaluations aren't very effective as many people guess the correct answers without really knowing how to do the questions. Due to the large class size, written evaluations may prove difficult, but would be more effective overall and better preparation for exams.
46	I really liked the organization of lectures. It was always clear what was going on. I would love to hear more about industrial applications of the concepts we were learning, because sometimes it wasn't particularly clear.
47	I really appreciated the content but some of the questions were too difficult
48	I found the course to be very interesting and really enjoyed the teaching style of the professor
49	I find it much easier to pay attention when you do clicker questions and questions which do not have as much reading involved. This would be a great way to start new concepts then slowly go into the questions with more reading. I find it very hard to understand whats going on and end up not being able to pay attention when you jump into long problems at the beginning of new concepts. Tutorials are very well done, I would suggest not changing anything there. The clickers really help to keep me engaged. Your notes are also very good and useful.
50	I enjoyed having many practice examples.
51	I didn't found the quizzes helpful to prepare for the midterm and final
52	I can see how this material is very relevant to our program, but since it is an hour and a half class, it is sometimes hard to focus so intently for the full class, especially when we are solving only one or two problems. Having a break in-between would be really nice.
53	I appreciated Prof. Verret's work in trying to teach this course to us. It's very difficult, but he puts in a lot of work to make things easier for us.
54	I appreciated the weird verity of learning resources and the practicable applications of the material. An improvement would be better preparing the students for long form questions.
55	How the professor gives out a lot of resources for learning. Assignments are also good in order for me to grasp the content of the topic being taught
56	Help was always readily available. Its very applicable of things i will apply in chbe. It was a good mix of new things and building off previous knowledge.
57	Good notes are provided to study.
58	Good examples.
59	Good and clear notes
60	Good and applicable problems to the real world.

61	Effective and important course.
62	Do more real world problems. This is the most important class to a chemical engineer but it's way to theoretical.
63	Difficult material in some cases but it's broken down well and I like how you create step by step processes to simplify difficult problems
64	Course was fairly well structured, webwork was helpful. Class notes were often confusing because although there were several methods that could be used to complete problems, only one was ever demonstrated.
65	Concepts learnt in CHBE 241 relate closely to topics in other courses, which made it feel very useful and practical in a real-world setting. Some concepts are taught with long problem-solving steps when there is a shorter way of solving it; this should be highlighted to the students whenever applicable so that students are aware of multiple ways to solve a particular problem
66	Completing more problems similar to how it was done at the beginning of the course (similar to how it was done with mass balances)
67	CHBE 241 is a fundamental course for students who want to pursue chemical engineering. It is relatively challenging since most of the concepts seem to be different from what we are used to, however, as the term progresses, it gets more interesting.
68	Amazing
69	Although this class is boring, I feel like it will prepare me more for jobs than most of my other courses do
70	A pretty difficult course. A lot of material was covered in a short period of time. There weren't enough assignments to help students practice the material.
71	A lot of practice was given to help students.
72	- this course needs more practice problems with fully worked solutions - it would be helpful if teachers from this spoke with teachers from our other courses (such as chem 251) which have overlap in material so that the same variables could be used for the same things and so on
73	- I really appreciated that a variety of resources were provided to really give students additional support if needed - the extra TAs circulating around really helped manage the large class - having those bi-weekly quizzes to help offset the weight of our grades and help us study for the larger exams was a really nice boost and kick to force us to keep up with the material

Faculty:	Jonathan Verrett
Question:	Comment on what the instructor has done especially well in teaching the course and what he/she might do to improve it.
Response Rate:	72.50% (87 of 120)
1	provided a lot of learning resources but should arrange course material and improve teaching style.
2	boring, talk with more enthusiasm so students can be more interested in material, too monotone
3	You are very nice and approachable. Your lessons are well structured, you are an engaging speaker and I enjoy your lecture. You are one of the best uni profs I have had. If you could provide more practice questions that would be greatly appreciated. Also, if you cancel a quiz, could you please post the quiz so that we can still practice the questions?
4	Was very clear in his teaching. One suggestion would be not to over complicate the topics as many are quite simple but come across as complicated.
5	Very helpful and approachable prof. Good lecture material and clear in what material to learn.
6	Very communicative with students
7	Verrett is a really good professor. Maybe spice up the presentations a little bit?
8	Tries his best to translate complex problems to something simple.
9	The slides online are well organized. He could put answers on the slides for the multiple choice, as there were only the questions. An explanation for these answers would also be great. The quizzes could be better worded, as it was very difficult at times to understand what was being asked. As well, the midterm was extremely difficult, and could be worded more effectively.
10	The quizzes helped evaluate my understanding very well.
11	The professor is very helpful and is always there to help. He provides materials and all the sources that would be helpful for us to study for exams.
12	The prof was concerned with our learning which made the course better
13	The notes need to be more organized with better examples
14	The instructor was also very approachable; it was never hard to ask him questions. This also extended to Piazza, where all answers would be answered quickly.
15	The instructor explains hard material in the way it is understandable and provides lots of additional problems with sufficient information
16	The instructor is very thorough in explaining problems but he can improve a little on his tone to sound more excited.
17	The instructor was very good at providing lots of resources to help the students learn the materials outside of lectures. He could improve by having a slightly strong grasp on the questions we went over during class (some question solving sessions felt very unfocused and hard to follow)
18	The instructor taught this challenging course very well, and is very generous.
19	The inclusion of research and specific areas of work in to the problems made the class interesting. Also, the introduction and welcome of the course was well prepared. However, the teaching method requires improvement. Explain the topic with a step by step procedure and include in the slides less confusing notes/ answers to questions. In general try to explain more slowly and less confusing the problem solving.
20	Super enthusiastic about a rather dry subject matter, effort is much appreciated! The amount of resources is incredible, but it seems rather skeletal, and a larger variety of applications would be well applied.
21	Shows great concern for students' ability to grasp a concept. Very generous with marks in order to help the students.
22	Provide and work through more advanced problems with class. Introduce long answer problems to quizzes.
23	Professor provides a lot of resources for students in order to practice and learn from. Lectures are well prepared and Professor Verrett does a good job of working through the material.
24	Professor Verrett was extremely engaging and cared for the students. Assigned a fair amount of homework and was a fair marker.
25	Professor Verrett was exceptional and very helpful. His quizzes were fair and the webwork was challenging. The midterm was very difficult and did somewhat demotivate me however it also helped me to understand how much more work was needed to be put in. Moreover, there wasn't enough time for the midterm to be completed
26	Professor Verrett was patient and always keen to help us understand. He would answer fast on Piazza as well which was beneficial.
27	Prof Verrett was knowledgeable to the subject however did not communicate it effectively.

28	Prof Verrett did a good job and cared about how his students did, was a fair prof, but course was so boring. And also difficult.
29	Probably the best professor in the department.
30	Presented content well. Needs more practice/help writing exam/quiz materials
31	Our professor tried to help us to the best of his ability considering this course is challenging.
32	Organization of slides is good. I like how he posts in class notes after the lecture as supplemental notes. Going over more long answer practice problems will be helpful in ensuring a good understanding of the material.
33	More helpful examples can be solved in the class to improve students' learning.
34	More depth with questions and more enunciation while teaching; otherwise everything is was fine
35	Lectures can be monotone and a break in the middle of class would be beneficial since it is easy to lose focus in a lecture this long.
36	Jonathan was really passionate and kind about answering every questions without a hesitation.
37	Jonathan was knowledgeable and cared about his teaching.
38	Jonathan showed a lot care for student learning and put in a lot of effort for teaching the content. Maybe changing the way he writes the solutions would be more helpful because they're messy
39	Jonathan is a really good prof that knows how to transfer information.
40	Jonathan Verrett is always patient and ensures people understand the concept before moving on.
41	Johnathan was very considerate and accommodating of our schedules and worked to reduce the workload during the busiest times of the year. It would be helpful if we had access to more practice material before exams and quizzes.
42	It's obvious he is putting a lot of effort into the course. It would however be nice if he found a way to better prepare us for the longer questions.
43	It would be really beneficial to have more practice problems available online to study. I felt very under prepared for the midterm just because there was nothing else I could study. One thing that is really good is the webwork. I find it very applicable to what we are learning even though it can be hard it is a good way to study.
44	It would be really helpful if for the long answer questions that are done on one note there is the question actually attached so that you don't have to spend a lot of time looking for the question in the other notes
45	It is clear than Jonathan cares about his students and works hard to ensure that everyone understands the material. He is definitely one of the best profs that I have had. With that being said though, it was difficult to stay focused and on track within the class because there was nothing that demanded our attention. I think that more clicker questions and group discussions would be a great addition in his lectures!
46	Instructor is really organized and cares about students.
47	Instructor showed genuine care for student learning and often looked for feedback.
48	I think it is much better this year. You have definitely refined the course and it feels much smoother this year
49	I liked Dr Verret's teaching style and the slides. Quizzes should be slightly more reflective of exam type problems. A bigger wiki of practice problems would also be better along with slightly more annotated slides.
50	I have learnt a lot of new material from this course; accordingly, not many of them that I am confident to work with. One of the major reasons is that there are plenty of equations, so it would be very great if you can provide a few practices with different difficulty and solutions for us to work. In conclusion, you are a great instructor who always try your best to help us to understand the complicated material of this heavy-load course.
51	I found the quizzes to be very helpful, as it helped stay on track with the class. Also the tutorials were very good since it gave us a chance to practice questions each week.
52	I appreciated how much the instructor asked for student's input. Using Piazza was also very helpful. To improve, the instructor could speak with a little more enthusiasm while giving lectures
53	I appreciated the clear voice, thorough explanations, and knowledgeable responses to the students' questions. One thing I would suggest is to make it very CLEAR which we work problems require external sources. Some of the questions were marked, but sometimes I spent time wondering if I needed to look up data on NIST. Thank you for the year!
54	He was always prepared for the class, and efficiently communicated with students.
55	He showed concern for student learning and asked for feedback which was very nice of him. The only issue was trying focus during class so maybe he can find a way to keep students focused
56	He needs to stop being monotonic in lectures. The classes are long but hard to concentrate.
57	He is very well prepared for each class, and has a clear outline of what we are expected to learn. I think giving more exam-like questions throughout the term would be helpful, instead of just the last week. Also the difficulty of quizzes varied week to week, and it was hard to know what to expect, causing a lot of stress.
58	He is really nice and hardworking.
59	He is probably one of the nicest instructors ive talked to. He is happy to help and answer whenever. Responds in a timely matter and is heavily involved with design teams and student learning
60	He is amazing. So accommodating and just a great teacher in general. I would definitely love to take his classes again. Great work prof!
61	He has good slides but I usually fall asleep in class; I wish he was better at keeping people engaged, speak with more enthusiasm and stuff.
62	He gives solid practice questions.
63	He doesn't seem to have much industry experience which is shown in his lack of real world problems
64	He did well
65	He did a good job referring to student feedback to tailor the course to the class. He did a solid job explaining concepts and problems. Something that could be improved would be focusing more on doing more example problems in class and rather than mostly concepts as that would make the material a bit more interesting and expose us to more variety of questions.
66	Good in class questions, receptive to feedback and cares about student concerns. Could improve in speaking more clearly and explaining the concepts more thoroughly.
67	Good access to notes and resources
68	Going over good examples in class
69	Giving out a lot of resources and a clear way of telling students solutions of numerous problems. The way he speaks would be something to improve on. The tone during the lecture is a bit monotonic, hence making the classes static.
70	Friendly, knowledgeable, dedicated
71	Explains the materials very well and is an excellent professor. The lecture slides were not very helpful at times though for reviewing more advanced material. I felt it would have been helpful if the prof gave the students some additional notes in class

72	Examples. Maybe give some more in the PowerPoint notes.
73	Dr. Verrett demonstrates a large amount of effort in his teaching, going above and beyond to try to help students understand course material. That said, exams are long and difficult and class doesn't seem to prepare us well enough for them. Significant self-study is required to understand concepts that are sometimes skimmed through in class. Still an enjoyable professor to have.
74	Dr. Verrett was always available to help, which was highly appreciative. As for improvements, I found background noises during the lectures really distracting, people were often talking quite loud, and time to time professor let this through, so I guess "to control the crowd/audience"?
75	Dr. Verrett is very organized and uploads course slides and notes in a very accessible way to connect. I think that the focus should be less on the definition in the powerpoint (they can still be in the slides) but rather than reading the slides, going through by writing down the notes would provide a better lecture pace.
76	Dr. Verrett is a very kind and caring professor. He will try his best to help all his students to understand the material and I think this is his best quality in his teaching career. Good job Dr. Verrett! However, in term of his presentation, Dr. Verrett is a little bit monotonous and this will in return cause students to be a little bit bored and sleepy. I hope Dr. Verrett can add more interactive activities while teaching so students' attention can be caught while in class.
77	Dr. Jonathan did a good job in showing how to solve problems by going over all steps thoroughly in class. It would be better if Dr. Jonathan can teach the material in a creative way instead of mainly following the slides. Also, I hope he can change his tone a bit while teaching, as his voice somehow made me super sleepy every single lecture, even I tried my best to focus...
78	Dr. Verrett was very helpful at all times and he is one of the rare teachers who post a lot of content such as class notes from tablet or extra resources for a specific topic.
79	Done especially well with: the github, providing all solutions to in-class stuff on the website, a very easy to navigate website (although not very visually appealing but it doesn't matter), making sure everything is done fairly =, not rushing through the material Improvements: Getting people's attention more because an hour and a half of solving one question gets a little boring sometimes and the prof does have a slightly monotonous way of talking.
80	Cares for student learning and wants them to succeed but provide more midterm/final reagent material
81	Cares about students learning and puts a lot of effort into additional resources to help students which is great. Lecture notes are good however with a long class it can get boring perhaps a 5 min break in class half way through would help or other ways of making class more exciting
82	Bi-weekly quizzes are too easy, make them more challenging for better practice on midterms or finals. CHBE Exams wiki is very helpful.
83	Amazing
84	All of the examples have been great. One improvement might be making sure that the class can have a 5 minute break in the middle. It is really difficult to focus in on the power points for the entire hour and a half.
85	A very thoughtful teacher and helped students keep up in a hard course. Was very forgiving with grades.
86	-would be helpful if he didnt just read slides in class -going through examples slowly and explaining the steps he took would be very helpful -he is incredibly organized and always willing to help -the lay out of the connect page is very helpful -sometimes he goes through a problem in a much more complex way than necessary and it can make things confusing
87	- was very clear about the concepts in lecture - was very patient and often asked for questions and answered them thoroughly - was kind and approachable if students had any issues

A.1.3 CHBE 241 2018W1 Student Evaluations

Project Title: **University of British Columbia Course Evaluation 2018 Winter**

Course Audience: **179**
 Responses Received: **154**
 Response Ratio: **86.03%**

Report Comments

Percent Favourable Rating

This is the percentage of respondents who rated the instructor a 4 or 5 (Agree or Strongly Agree).

Interpolated Median

The data collected for Student Evaluations of Teaching (SEoT) are ordinal in nature, with a natural order (from 1 to 5). While the mean may be used as a measure of central tendency for such data, it is not an appropriate or accurate representation of SEoT data (cf. Stark & Freishtat, 2014). The usual measure of central tendency for ordinal data is the median. As a result, we have been reporting the mean and the median for the last several years. Because students more often provide higher ratings (4 or 5), the median is consistently higher than the mean. After considerable thought and data modeling, we now believe that the interpolated median is the best representation of the data, since it takes the frequency distribution into account. Consider the following example:

Frequency Distribution		
Response for UMI	Class 1	Class 2
5 = Strongly agree	13	4
4 = Agree	26	43
3 = Neither agree nor disagree	35	32
2 = Disagree	20	11
1 = Strongly disagree	6	10
Mean	3.2	3.2
Median	3.0	3.0
Interpolated Median	3.2	3.4
Percent Favourable Rating	39%	47%

In this example, the two classes have identical mean (3.2) and median (3.0). However, the instructor in class 2 received 47% favourable (4-5) ratings, compared to 39% for the instructor in class 1. While both have a Median of 3, the Interpolated median values of (3.2 and 3.4), much better reflects the distribution of the scores above and below the median. Furthermore, the interpolated median is better correlated with percent favourable rating; such that an interpolated median of 3.5 on a Likert scale of 1 to 5, corresponds to 50% favourable rating.

Creation Date: **Monday, February 11, 2019**

Dispersion Index

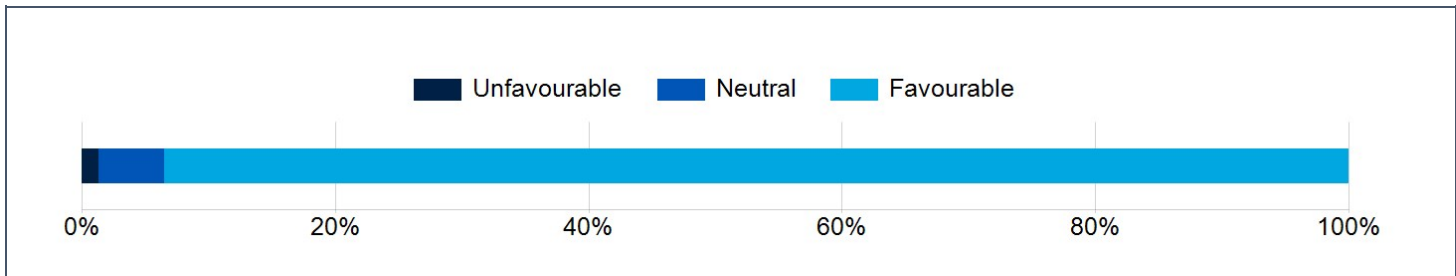
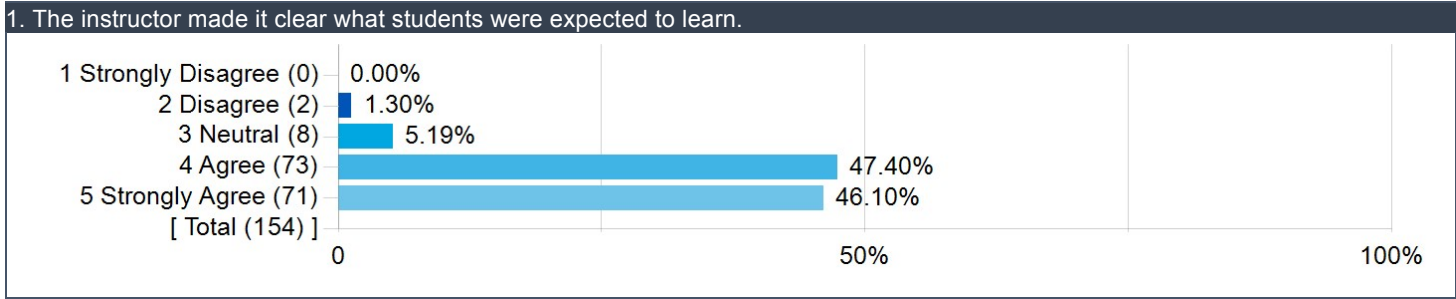
The dispersion Index is a measure of variability suitable for ordinal data (Rampichini, Grilli & Petrucci 2004). This dispersion index has values between zero and 1. A zero dispersion index indicates that all students in the section gave the same rating to the instructor. An index value of 1.0 is obtained when the class splits evenly between the two extreme values (Strongly Disagree & Strongly Agree), a very rare occurrence. In SEoT data at UBC, the index rarely exceeds 0.85, and mostly for evaluations not meeting the minimum recommended response rate.

Recommended minimum response rates

Class Size	Recommended Minimum Response Rates based on 80% confidence & $\pm 10\%$ margin
< 10	75%
11 - 19	65%
20 - 34	55%
35 - 49	40%
50 - 74	35%
75 - 99	25%
100 - 149	20%
150 - 299	15%
300 - 499	10%
> 500	5%

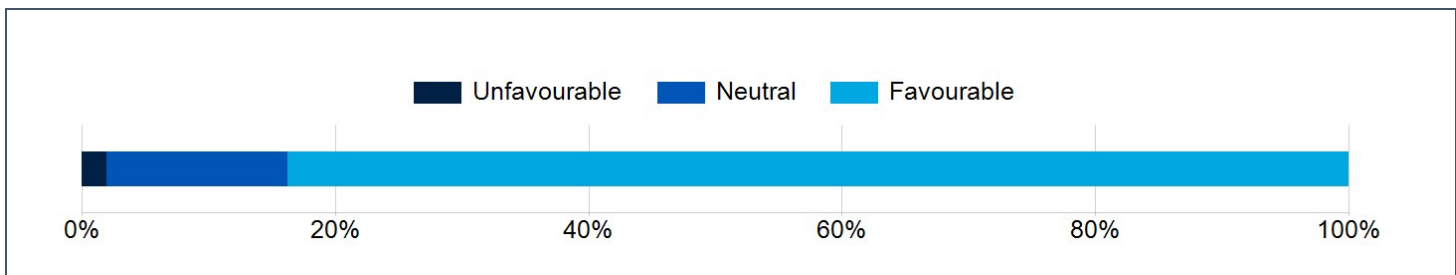
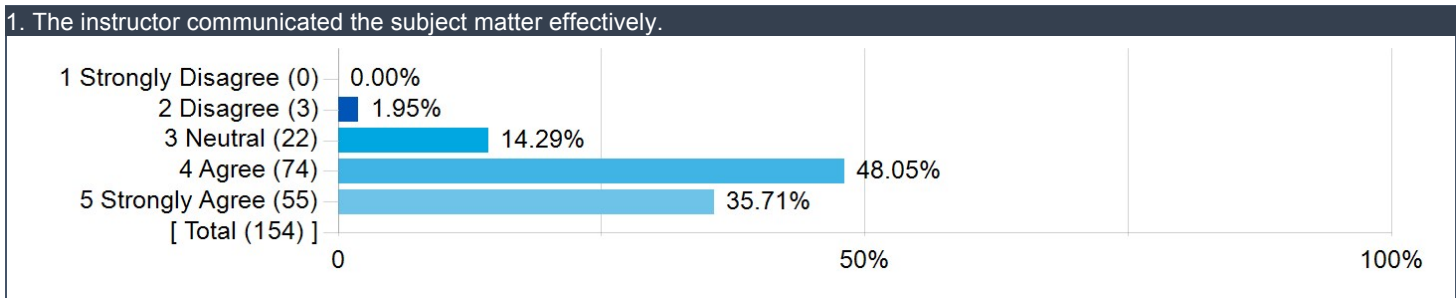
UBC-Wide Questions

The instructor made it clear what students were expected to learn.



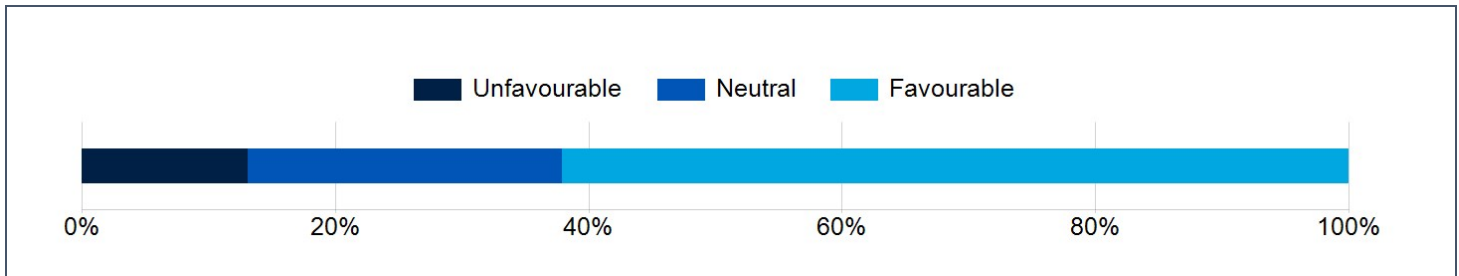
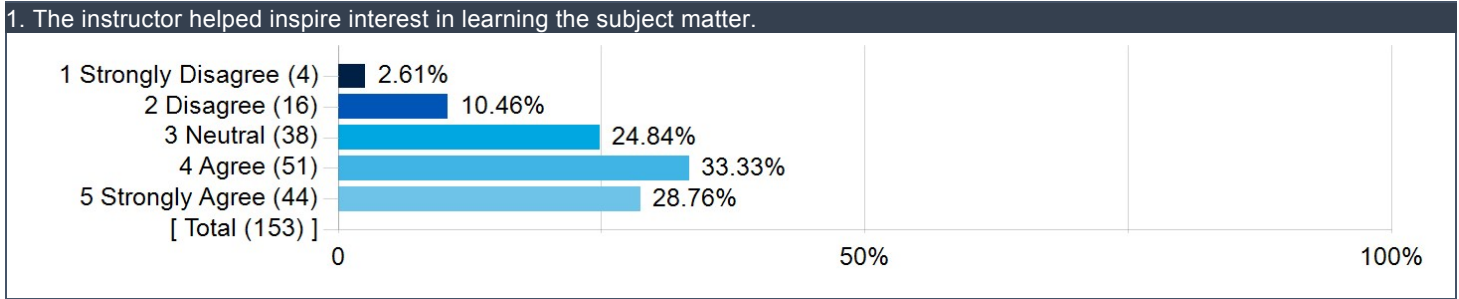
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
179	154	86.03%	93.51%	4.42	0.32

The instructor communicated the subject matter effectively.



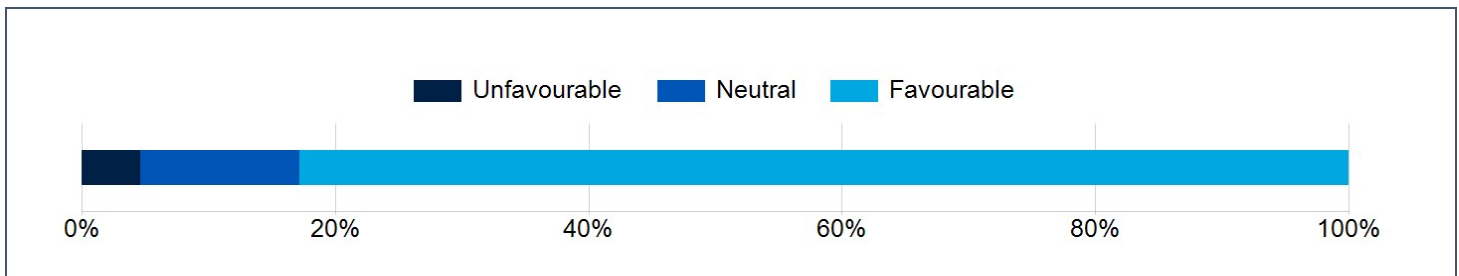
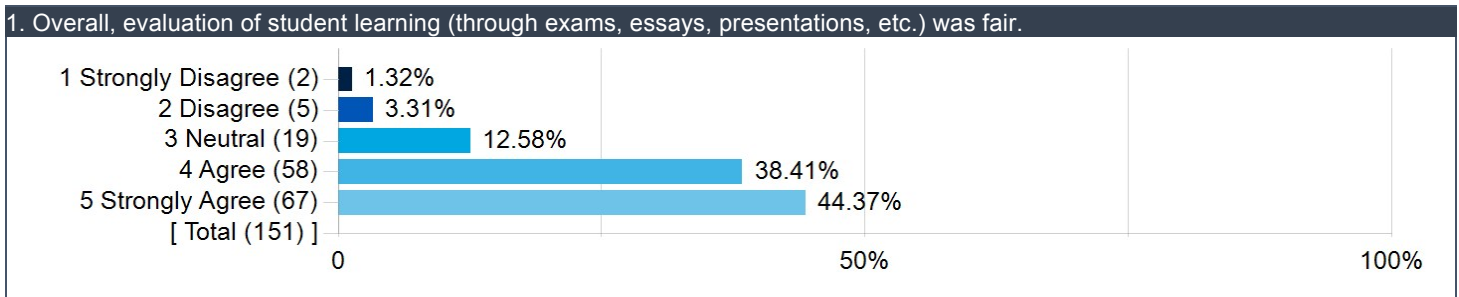
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
179	154	86.03%	83.77%	4.20	0.38

The instructor helped inspire interest in learning the subject matter.



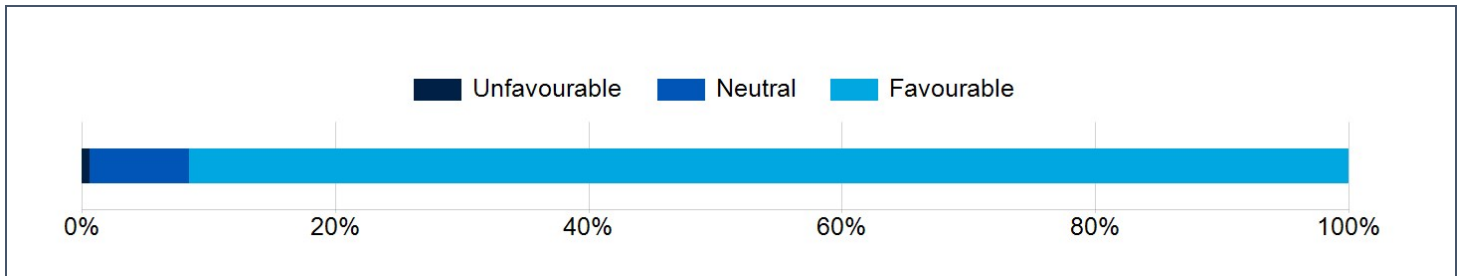
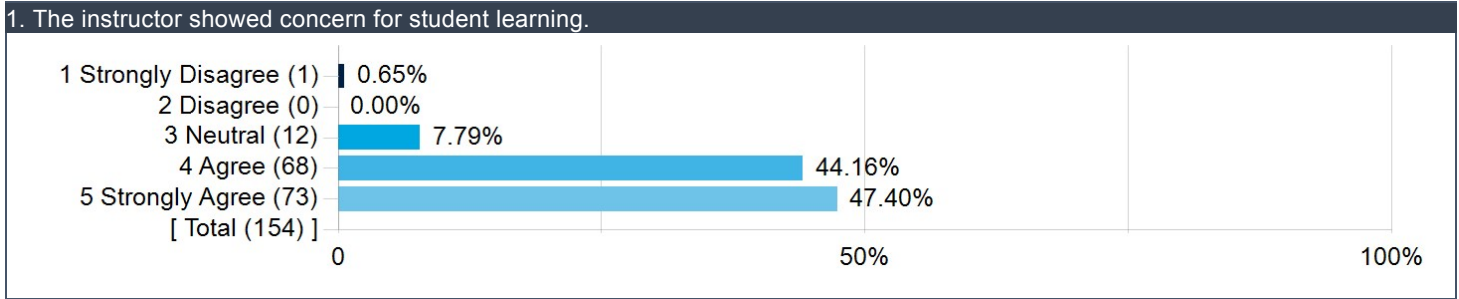
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
179	153	85.47%	62.09%	3.86	0.58

Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.



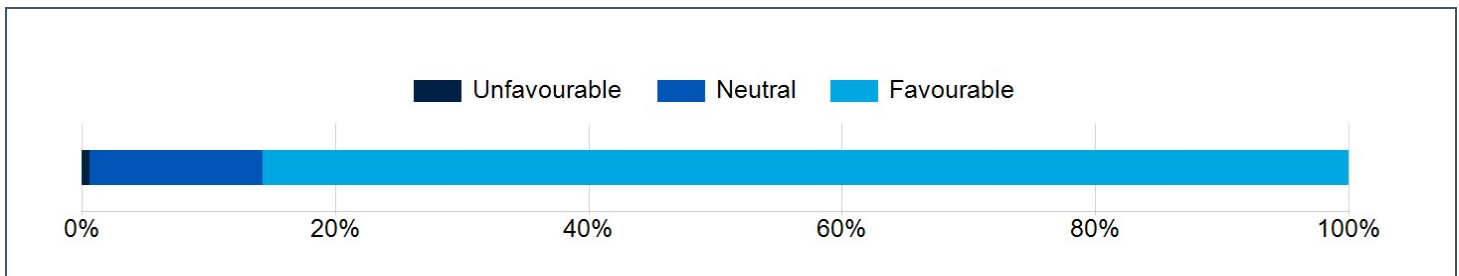
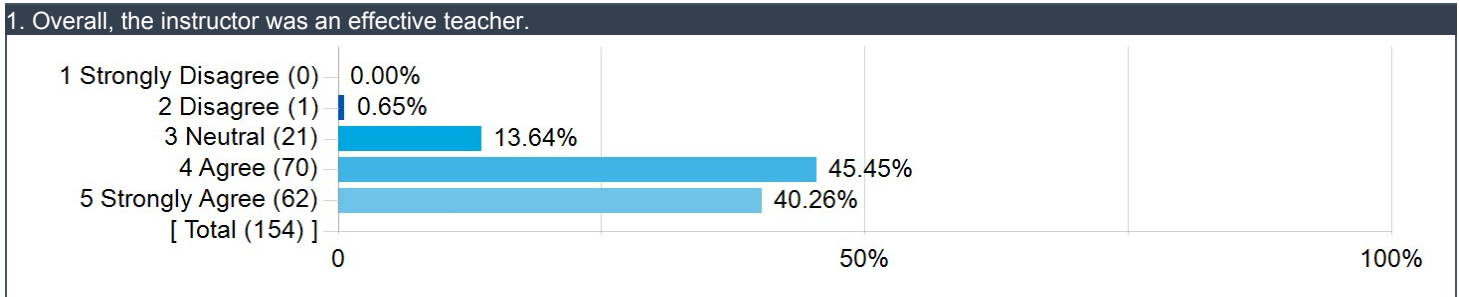
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
179	151	84.36%	82.78%	4.35	0.45

The instructor showed concern for student learning.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
179	154	86.03%	91.56%	4.44	0.34

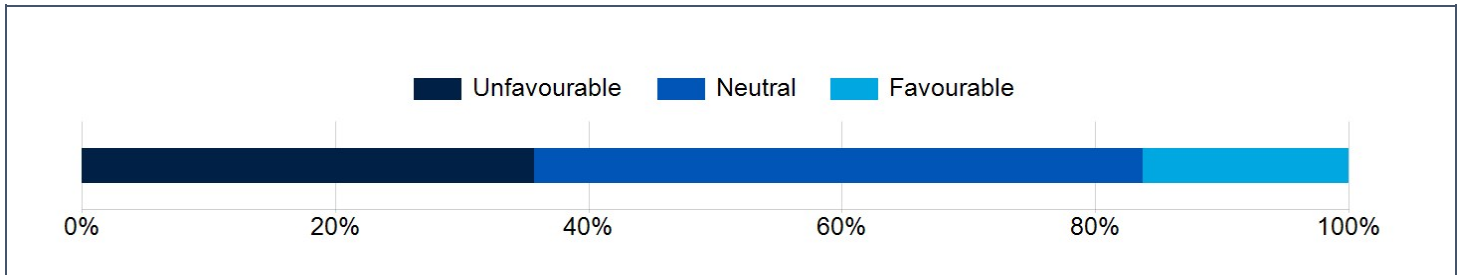
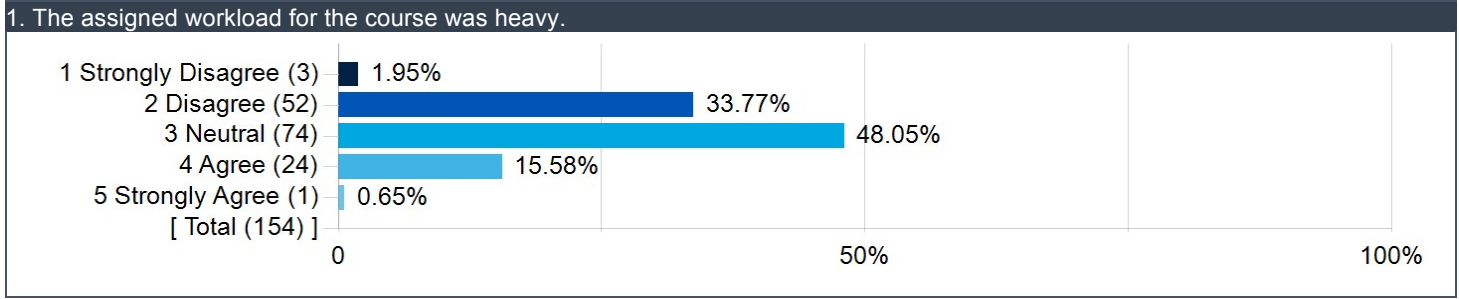
Overall, the instructor was an effective teacher.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
179	154	86.03%	85.71%	4.29	0.37

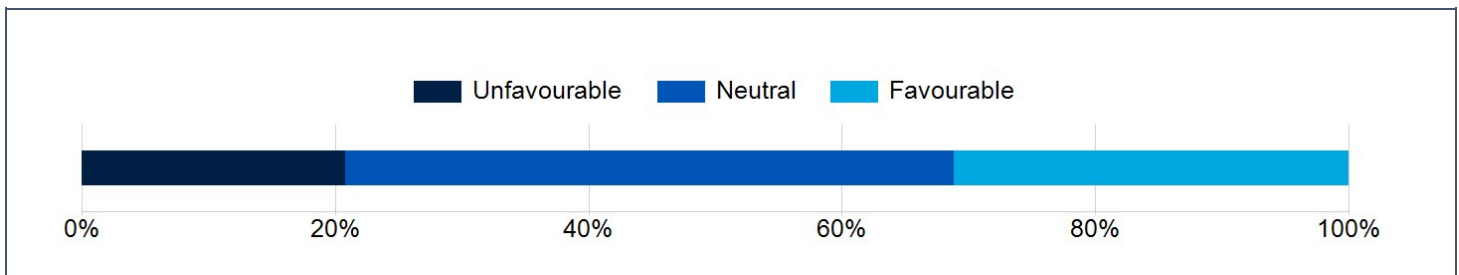
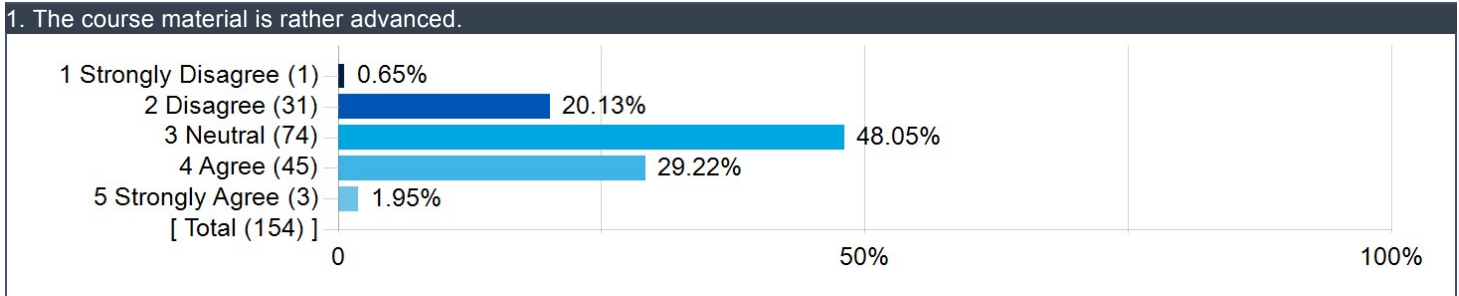
Faculty of Applied Science

The assigned workload for the course was heavy.



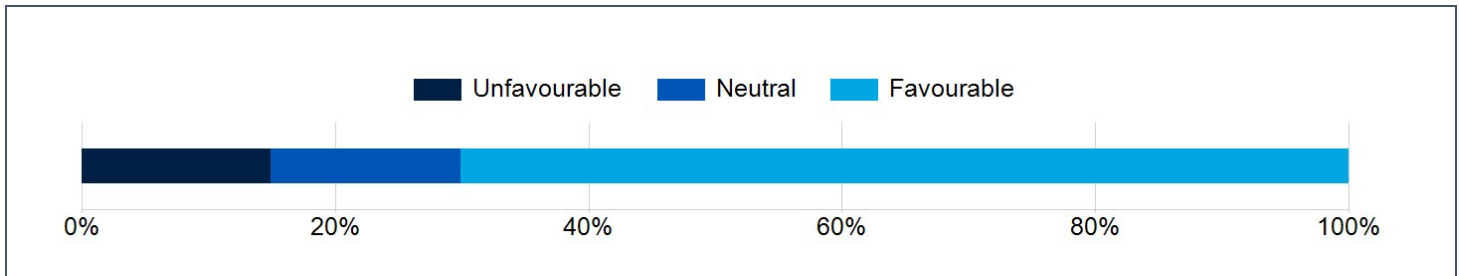
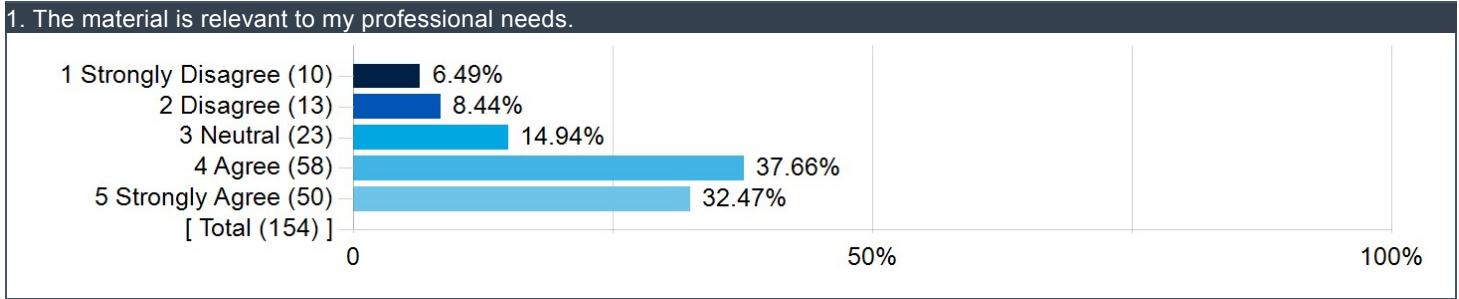
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
179	154	86.03%	16.23%	2.80	0.39

The course material is rather advanced.



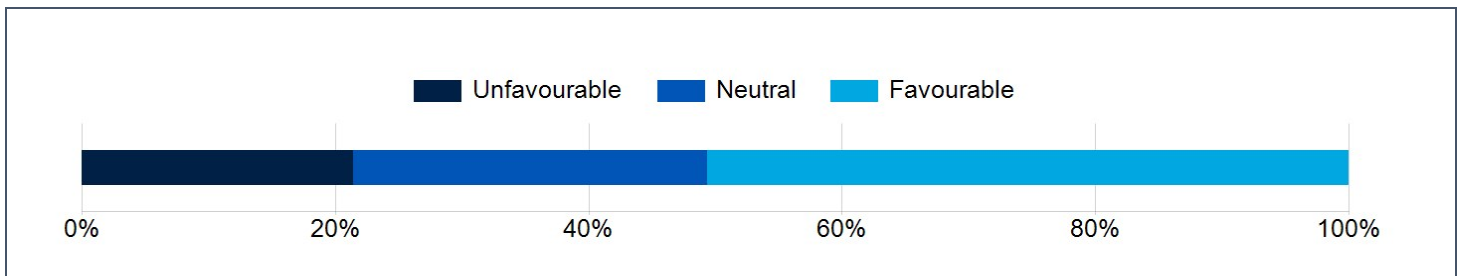
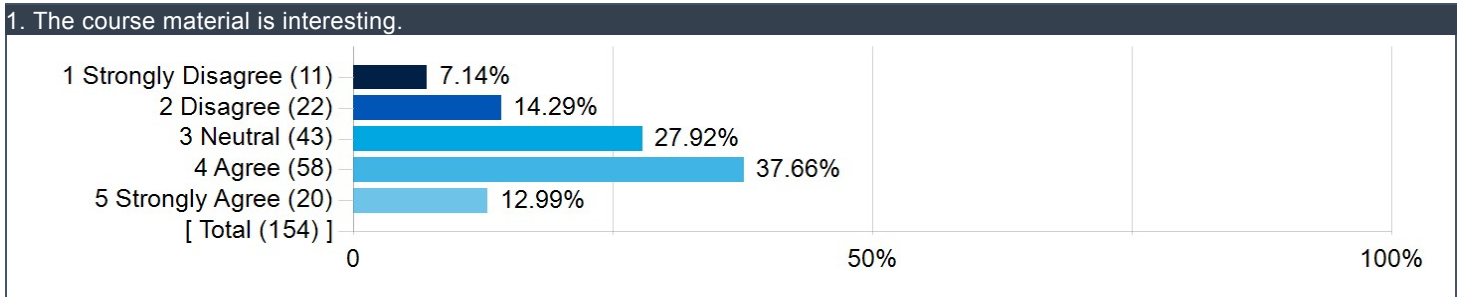
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
179	154	86.03%	31.17%	3.11	0.40

The material is relevant to my professional needs.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
179	154	86.03%	70.13%	4.03	0.62

The course material is interesting.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
179	154	86.03%	50.65%	3.52	0.60

Open Ended Feedback

Comment on the things you appreciated about the course and provide suggestions for improvement.

Comments
 Attempts to make topics relatable where good. Really liked having the overall plan on canvas where notes etc got posted as the

Comments
relevant class was done
I like the professor post the note for every class.
No scaling of the grades doesn't seem fair, also having only a few questions on the final makes it more of a hit or miss depending on how your state of mind was during the final and not your actual preparedness. I think jonathan is a really good teacher and really cares about his students which is deeply appreciated. The course was extremely well organised and the content is not too heavy and the instructor does his best to promote student learning and wants students to do better.
Very relevant material and applications. The class was sometimes quite noisy which made it difficult to concentrate, but overall a positive experience. Assignments were at a good difficulty level. I would have appreciated a better practice exam for the second midterm, as the one provided had only one relevant question. Helpful teacher, always time to answer a question no matter how basic/complex.
Very effective learning environment, Jonathan is very inspiring and teaches both inside and outside the classroom. Learning objectives are clear and it is obvious Jonathan wants everybody to succeed. The topics in class are very interesting and valuable to a chemical engineering job.
I really enjoyed this class, the course material is taught really well and the webwork is very good practice.
BEST PROF EVER!
Well designed course with substantial content, taught at a decent rate. Potentially, more practice exams could serve to prepare students better prior to midterms.
Professor showed a lot of care for students. Never undermined questions, was incredibly nice and helpful in office hours. Hands down one of the most caring thoughtful professors. Explanations clear. I hope he teaches a lot more courses in my upper years.
The materials covered are very thorough and Dr. Verrett is very helpful. The course is carefully and very well organized. The homeworks are very relevant to the materials covered. One improvement can be more practice on questions and harder problems during class.
Very well organized in general
The course was very detailed and interesting
more practice questions the lectures are often very dry I appreciate that Johnathon is very respectful of the students
He was effective , could be more enthusiastic.
It was good that we had some challenging problems. Maybe try bringing in some questions that directly relate to the outside world, so that students can understand how to apply their knowledge to real world options.
Please make this course less dry, and non-mandatory for IGEN
- The teacher did a really good job making himself available to students. He communicated effectively and the work was reasonable.
The array of examples for applications are very helpful
i liked the webwork and written assignments. i found piazza to be a really useful tool when doing webwork. i liked the professors slides. i also liked that he consistently provided us the opportunity to give feedback throughout the semester. midterms were fair.
Appreciate that the professor is very approachable. Would appreciate more practice questions that would not be graded.
The hand written notes along side the power point notes is an excellent way to go over the course material
Provide more past paper questions.
I appreciate that Jonathan tries his best to make sure everyone gets tye course. However, it would be best if the lectures were spread out to 3 times a week.
The course was very well-taught and the lectures were very clear. I appreciated the notes were uploaded online as well as it made it easier to study. I felt that the example/question difficulty in lecture/tutorial was significantly lower than on exams and would like to see more practice material to better prepare.
Maybe provide step by step calculations on powerpoint and do more exam-related questions
I would like to see more practice problems demonstrated in class.
Verrett is a nice guy and good at explaining concepts but I think he should mix in a joke or funny story once in a while, as the class can be extremely dry and boring.
I liked how the course is organized. The notes were easy to follow and I appreciate how the professor takes his time to upload the notes he writes in class and in tutorials. I suggest that the professor uploads more past exams or exam-like questions so that we are able to better prepare for the midterms. Otherwise, I truly appreciate the hard work the professor puts into understanding his students' needs and into the course in general.

Comments
Was very interesting to see how practical the course is to my degree/future job The instructor was very friendly and always ready to help
Overall a good lecturer but I felt that sometimes the course material was taught rather fast. I understand that there is a lot to cover, hence the speed in teaching. Perhaps the syllabus can shorten just a bit to give students some breathing room to understand the concept.
I appreciated the chance to do written work for assignments as opposed to just webwork, I find having a split between the two helps me learn. The only room for improvement I could see is more medium difficulty questions in the assignments. Most assignment questions were either very easy or very difficult with little inbetween.
I really enjoyed taking this course! Though next year try to make what's expected for the written assignments a little clearer in the beginning and also for the midterms make it a bit clearer when you want us to explain our assumption. It's nice having a professor that's knowledgeable about the course and genuinely seems to care about the education of their students. Thanks again!
I like how practice problems were done in lecture.
The course was well designed by the instructor who communicated the information very efficiently in class as well as through his online notes
Jonathan Verrett is an excellent instructor and passionate about the subject. UBC needs more professors like him. Expectations were laid out clearly and help was provided whenever needed. The material can feel dry at times, though he has acknowledged this. It is likely a result of the course material itself more than anything.
Pre boring, but stress was not too bad.
This was a great class, however I did find that there was quite a lot of overlap with CHEM 251. In the future the course might be improved by trying to coordinate better with 251 to avoid too much overlap, or at least be covering material at similar times.
I loved how you actually really cared for the students to learn and take what we want from the lectures and one improvement I think should be implemented is the speed in lectures of how fast you go through practice problems felt very very fast for me and while I was busy writing down I would miss important information and my notes from lectures would always be incomplete because I am not able to keep up.
It was fun, it is fun
I appreciated the clarity and structure of this course but as an IGEN student looking to do mech/cpen/elec it served very little interest to me. The professor and lectures in general could be dry at times but given the subject matter, I don't think that there is a good way around this. My only recommendation would be to have the course offered as an elective alongside a civil/cpen/mech course for IGEN students given the smaller percentage of IGEN students interested in CHBE.
Very concrete learning outcomes, taught to them effectively
I appreciated Dr. Verrett's willingness to get feedback and flexibility. He treats students with respect.
Going over examples in lectures help a lot with understanding how to go about a problem.
Maybe alter the notes a little. I found myself going back to check the notes and stuff I had written and some of the examples were hard to follow. Not sure how to fix that as it might just be an issue on my part.
Appreciation: <ul style="list-style-type: none"> – The syllabus of the course is layout extremely clearly on Canvas, which helps a lot when I want to refer back to previous lectures. Not many instructors I've had been this organized. – I like the anonymous feedback form, it is an effective way to improve the class – Frequent Piazza responses from the instructor is swift, clear, and direct. Really appreciate this. – Instructor is willing to listen to students' needs, for example making a poll to move the midterm because of other midterms in the same week, changing the final mark of HW3 because students believed the question was worded unclearly, asked students what they wanted to be covered in tutorials. – Formula sheet from the instructor is really clear, organized (helped me a lot in midterms)
Suggestions: <ul style="list-style-type: none"> – Continue to have the instructor and TAs around in tutorials – Improve the solutions to the sample practice / homework, because sometimes there are steps skipped and, in general, a bit hard to follow for some questions.
Overall the course was well organized and well delivered
Perhaps more exercises to be included into the in-class slides. I think perhaps after class some students would like more examples and practice in addition to the in-class problems.
Professor Verrett clearly cares about teaching, and puts a great deal of effort into making confusing material comprehensible. However, at times many of us were lost as he solved problems in front of the class. When learning something for the first time, it could help if he occasionally draws back while in the midst of solving a problem, and reminds us of the overall strategy/overall concept behind why we're doing what we're doing. That said, Piazza was much appreciated—I do not know that I could have managed the assignments without his (and the TA's) constant feedback and guidance. Overall, an excellent prof and a great guy.

Comments
I didnt love this course but I can see how it would be useful to know if I was in CHBE.
The written assignments were challenging and that helped develop my understanding in the material that was taught in class. Everything was well organized, enough time was provided to complete assignments and study/go through the material a good amount of time before the midterm. Midterm reviews done in class and tutorials were very helpful as the questions were slightly harder and the TA's and professor were always very approachable and open to questions.
Course was really interesting, we would benefit greatly from some kind of field trip to see the material we learn in real life. The course load was perfect, no unnecessary classwork grades and the assignments facilitated our learning and were to the point.
The course material is very relevant to what is expected for chemical and biological engineers. The way the course is organised is cohesive, and students are able to follow the flow of the course. However, some rough patches in the beginning, namely with the start of process flows, could have prevented students from fully understanding the course after that point (since the course is cumulative in its nature).
<ul style="list-style-type: none"> – More past midterms or past exams questions for practice – Put answers to i-clickers or questions on class slides so that it is easier for students to review course material Appreciate: – difficulty level of tutorial questions – weekly resource guide (please upload them on time)
The course overall is very interesting.
Thank you for uploading all the slides, notes, and detailed solutions on Canvas!
Providing so many resources including lecture slides and notes on Canvas really helped my learning. Maybe go over more examples in class that are similar to the webwork assignments.
Although Jonathan has been teaching for a short period of time, I appreciate what he has done for us, loved his enthusiasm towards the course but he could raise his voice from time to time, and prevent being so monotonous in class
Lectures are quite dry. Not profs fault, clear expectations for exams and assignment problems are relevant to course material.
It ll be better to post the solutions for the webwork, so we can study just because we dont really get how did we get one question right.
Found the teaching style and content (especially the slides) to be dull and hard to follow. The instructor was patient and effective but I didn't feel inspired or very interested in the content.
Dr. Verrett spent time on the first day giving us a general feel of the course and made us feel welcome with the postcard activity. That set the tone of the course as being welcoming and open to conversation. As improvement, more examples can be done in class in sync with the homework assignments and more practice problems would be appreciated for exams.
The course is well paced. I would like it if there were more sample midterms and finals posted on canvas so that students have a better idea of what to expect when they are being tested.
I really dislike chbe, but this course was bearable. Thanks for teaching this course in an organized and effective way.
The professor clearly put a lot of effort into creating teaching material and made it very accessible. He also did a great amount of practice and example problems and explained them very thoroughly
I appreciated the professors teaching style, and liked the way he taught with examples and notes. It was effective, along with the given assignment. However I think it would be helpful to go over the paper assignments in class and go through more challenging examples.
Prof Verrett is an amazing prof! He was straightforward, fair and showed genuine care for our learning. I personally did not find the course material to be very interesting, but I still put in maximum effort because Prof Verrett made it so that if you actually tried, you would do well. Essentially, the your efforts directly translated into results – which is perfect! Not too easy, not too challenging.
This course is perfect!!!! I love it !!!And I love my prof!!! He's so good at teaching that he makes everything easy to understand and he shows all steps one by one to solve the problem.
This course is a very big chunk of our professional life hence in my opinion was taught really well. Would want Jonathan for all courses
It would probably be the most necessary and most related content to proper engineering work and courses later in the degree, but boy is the content dry. Well, can't make an egg taste like apples.
Appreciated the time taken by the instructor in terms of going through additional information and test sample questions before each test period. The material was well structured throughout the course and everything could be found easily especially on canvas.
I like the web work and opening past web works for more practice. I hope that you can provide more selected textbook problems – or provide what kind of problems we should focus on for tests and exams.
I just really loved Prof Jonathan. He made me love the course as well and always gave me a reason to always be motivated. There are really few people who stir up an interest and love for studying and wanting to know more and learn more and he is one of them. Prof Jonathan, you are amazing!!!! Thank you so much!

Comments
This was an incredibly well organized and well executed course. The only improvement I have is that lectures can be pretty boring (because Johnathan's voice is so calming) so it hard to pay attention and be interested in the material.
Instructor was very clear during lectures. More older exams for practice would be useful.
Concise teacher, very inclusive and presents subject matter at a good pace and ensures he has enough time each lecture to ask the class if they have any questions prior to moving onto the next subject. My one complaint is sections in the latter part of the course can get pretty dry and he isn't the most animated / engaging teacher – this being said, he still teaches the material well. Also, he is very helpful in his office hours. Overall good teacher.
Be clearer with what you are going to be gonna have questions and how to complete those questions
excellent instruction, very dedicated and interested professor.
more practice work should be available for exam preparation, as the only current source of problems is the WebWork assignments, which, once completed, do not present a good challenge or learning opportunity. better sample midterms/finals would go a long way. Or just a collection of problem sets.
Clear expectations of required knowledge to do well in the course.
Something that I have really appreciated about Dr. Verrett's teaching is his commitment to ensuring that his students are equipped with everything required to succeed in the course. It is evident that Dr. Verrett has true concern for his students' learning; for example, he stays in the lecture hall after class to answer students' questions, he is always courteous and helpful when answering questions during and after class, and he provides students with access to many study resources and tools including recommended textbook questions, online screencasts and modules, and sample exam-style questions. Sometimes I found it difficult to absorb the material presented in the course because Dr. Verrett's pace is rather fast when he is teaching, and I was constantly rushing to write down notes. I think it would have been very beneficial if Dr. Verrett sometimes slowed down his pace or took time to further emphasize and more thoroughly explain the most important new concepts.
that you posted everything online
I love the professor's attention to detail and his organized, professional way of conducting this course. Hands down he is the best teacher I've had, and it seems like he puts so, so much work into this. If anyone with budget authority is reading this, maybe consider a raise for Professor Verrett? :)
It would feel unfair to me (and i'm sure to most of my peers) if this amount of work from the professor goes unnoticed.
I would only ask for more practice questions from the professor. I don't like using the Wikipedia page. If there could be 1,2, or 3 extra practice problems at the end of each slide set for us to practice on our own time, that would be great.
Instructor definitely puts effort into helping students and enjoys teaching. The course material is extremely dry, which makes it difficult to learn. It would be really useful to have more preparation material for exams, because the second midterm in particular didn't have much to study from.

A.1.4 CHBE 243 2018W1 Student Evaluations

Project Title: **University of British Columbia Course Evaluation 2018 Winter**

Course Audience: **117**
 Responses Received: **65**
 Response Ratio: **55.56%**

Report Comments

Percent Favourable Rating

This is the percentage of respondents who rated the instructor a 4 or 5 (Agree or Strongly Agree).

Interpolated Median

The data collected for Student Evaluations of Teaching (SEoT) are ordinal in nature, with a natural order (from 1 to 5). While the mean may be used as a measure of central tendency for such data, it is not an appropriate or accurate representation of SEoT data (cf. Stark & Freishtat, 2014). The usual measure of central tendency for ordinal data is the median. As a result, we have been reporting the mean and the median for the last several years. Because students more often provide higher ratings (4 or 5), the median is consistently higher than the mean. After considerable thought and data modeling, we now believe that the interpolated median is the best representation of the data, since it takes the frequency distribution into account. Consider the following example:

Frequency Distribution		
Response for UMI	Class 1	Class 2
5 = Strongly agree	13	4
4 = Agree	26	43
3 = Neither agree nor disagree	35	32
2 = Disagree	20	11
1 = Strongly disagree	6	10
Mean	3.2	3.2
Median	3.0	3.0
Interpolated Median	3.2	3.4
Percent Favourable Rating	39%	47%

In this example, the two classes have identical mean (3.2) and median (3.0). However, the instructor in class 2 received 47% favourable (4-5) ratings, compared to 39% for the instructor in class 1. While both have a Median of 3, the Interpolated median values of (3.2 and 3.4), much better reflects the distribution of the scores above and below the median. Furthermore, the interpolated median is better correlated with percent favourable rating; such that an interpolated median of 3.5 on a Likert scale of 1 to 5, corresponds to 50% favourable rating.

Creation Date: **Monday, February 11, 2019**

Dispersion Index

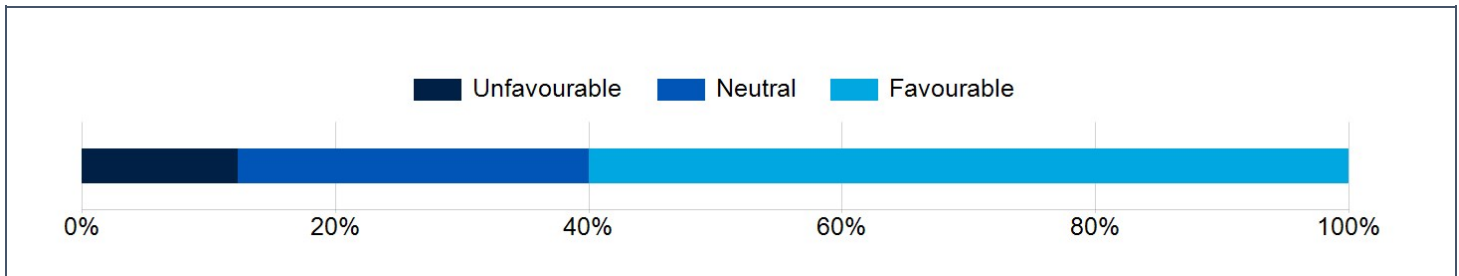
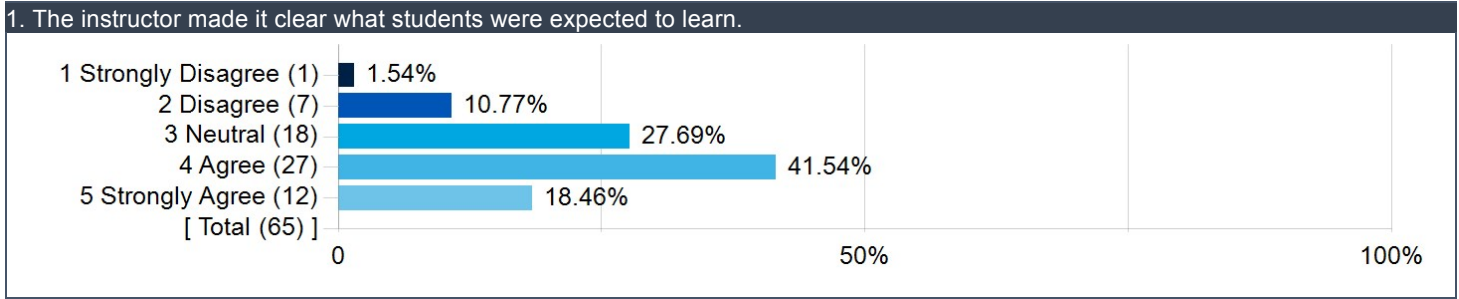
The dispersion Index is a measure of variability suitable for ordinal data (Rampichini, Grilli & Petrucci 2004). This dispersion index has values between zero and 1. A zero dispersion index indicates that all students in the section gave the same rating to the instructor. An index value of 1.0 is obtained when the class splits evenly between the two extreme values (Strongly Disagree & Strongly Agree), a very rare occurrence. In SEoT data at UBC, the index rarely exceeds 0.85, and mostly for evaluations not meeting the minimum recommended response rate.

Recommended minimum response rates

Class Size	Recommended Minimum Response Rates based on 80% confidence & $\pm 10\%$ margin
< 10	75%
11 - 19	65%
20 - 34	55%
35 - 49	40%
50 - 74	35%
75 - 99	25%
100 - 149	20%
150 - 299	15%
300 - 499	10%
> 500	5%

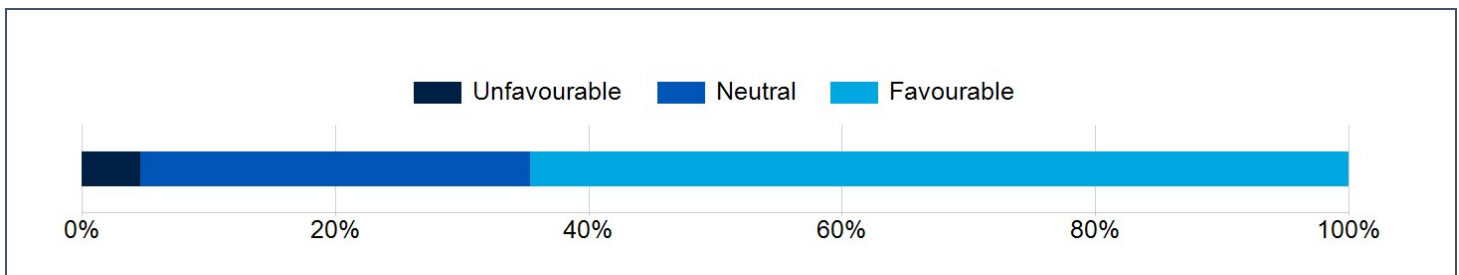
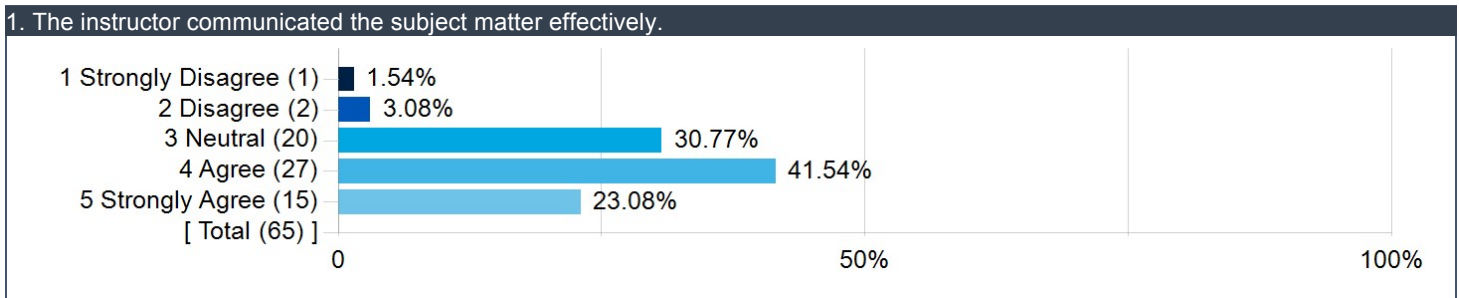
UBC-Wide Questions

The instructor made it clear what students were expected to learn.



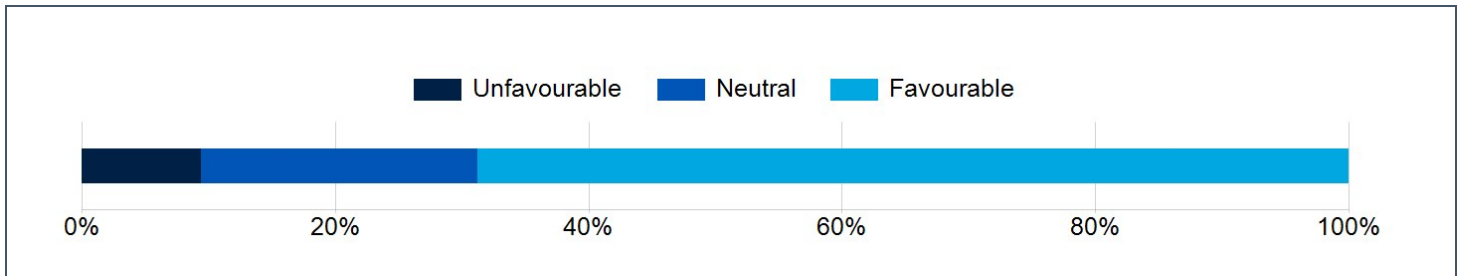
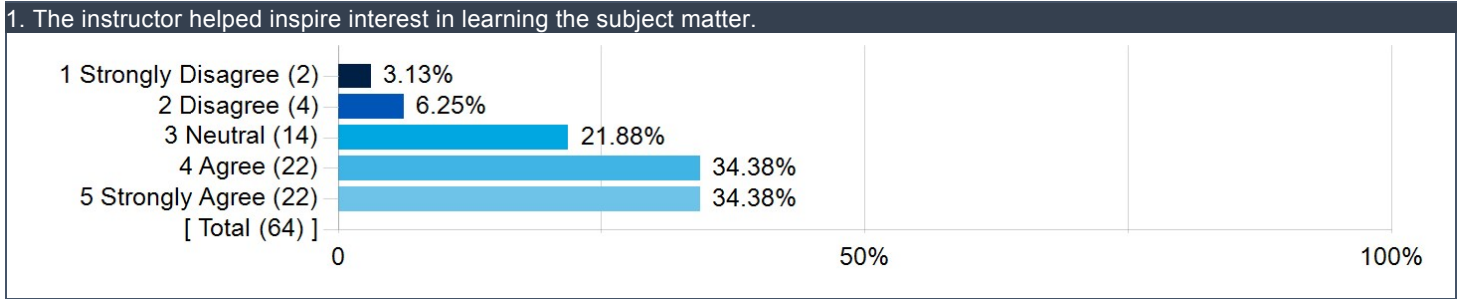
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
117	65	55.56%	60.00%	3.74	0.51

The instructor communicated the subject matter effectively.



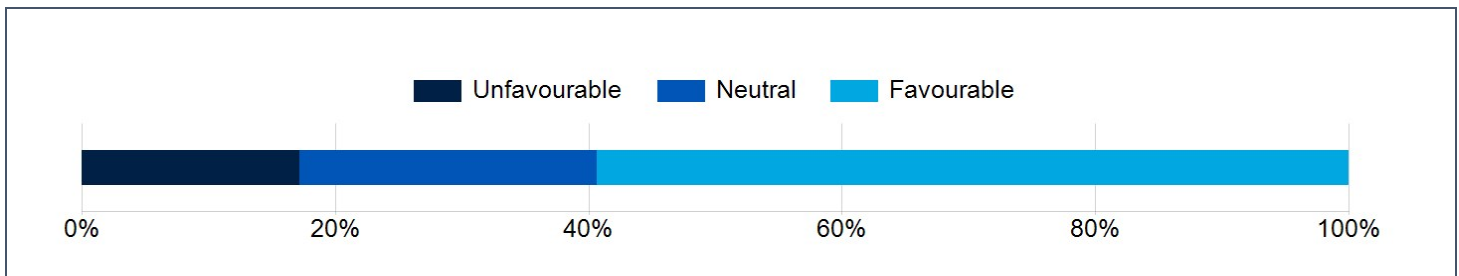
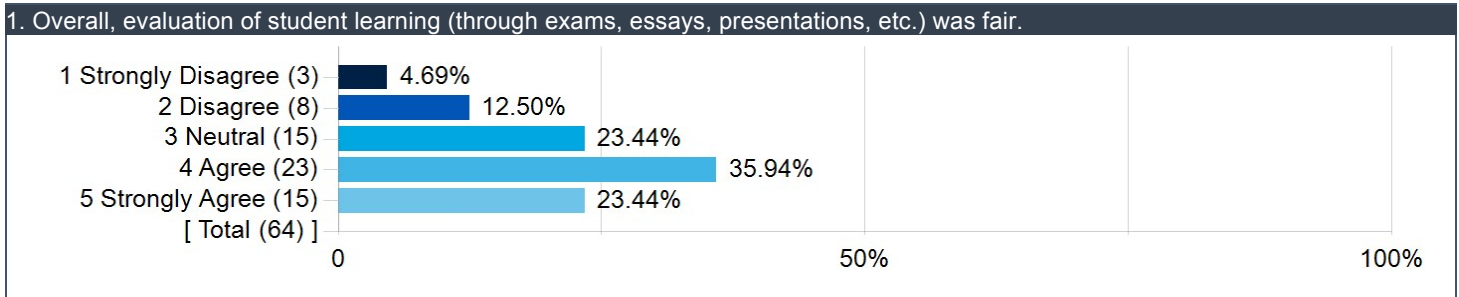
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
117	65	55.56%	64.62%	3.85	0.47

The instructor helped inspire interest in learning the subject matter.



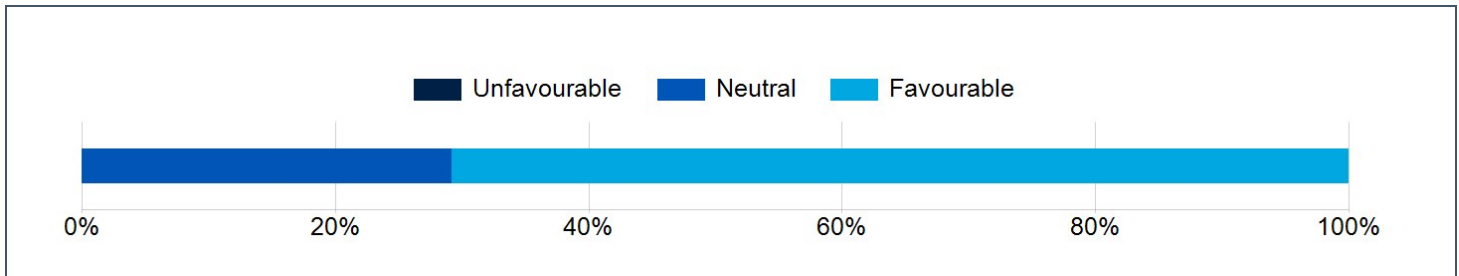
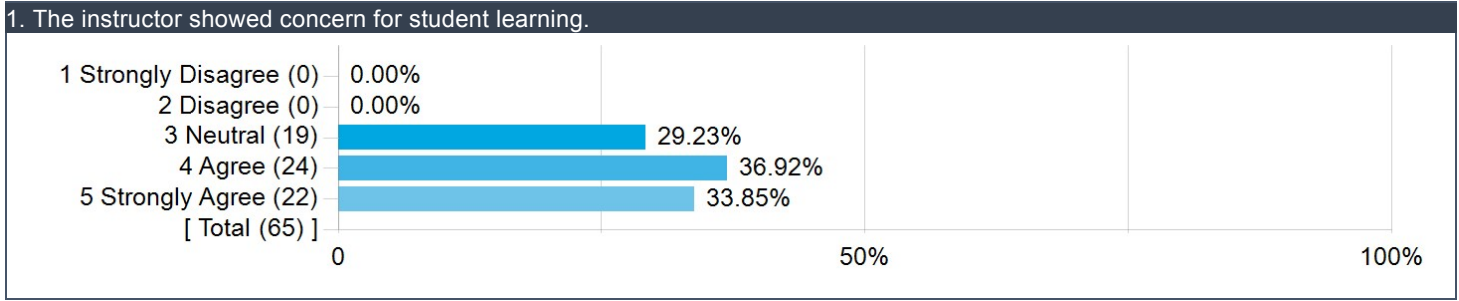
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
117	64	54.70%	68.75%	4.05	0.56

Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.



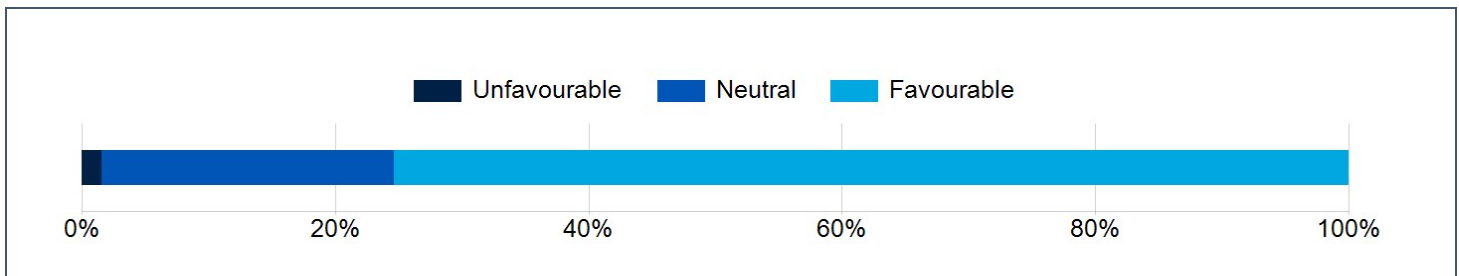
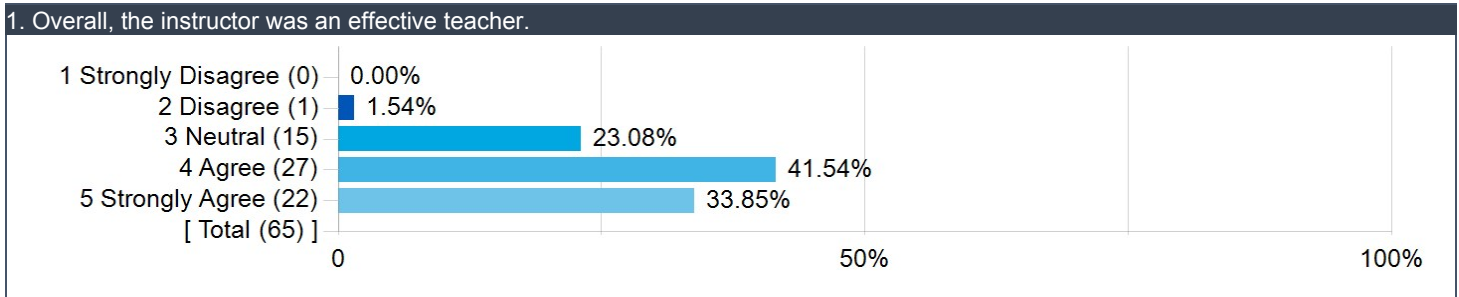
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
117	64	54.70%	59.38%	3.76	0.61

The instructor showed concern for student learning.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
117	65	55.56%	70.77%	4.06	0.43

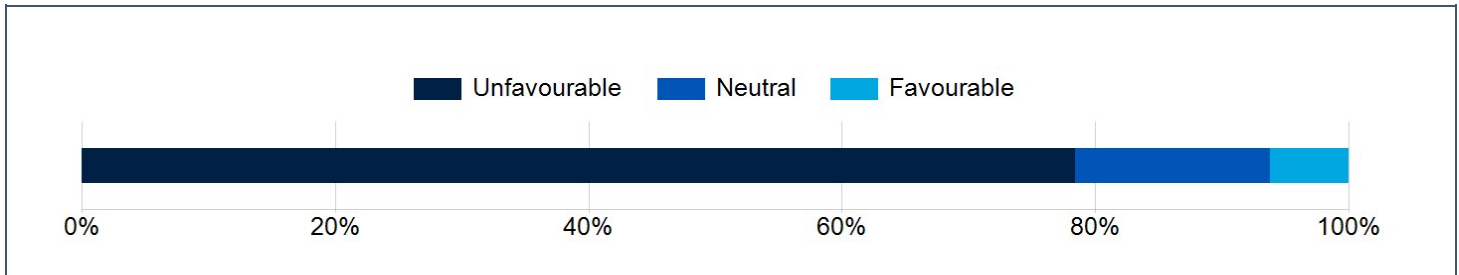
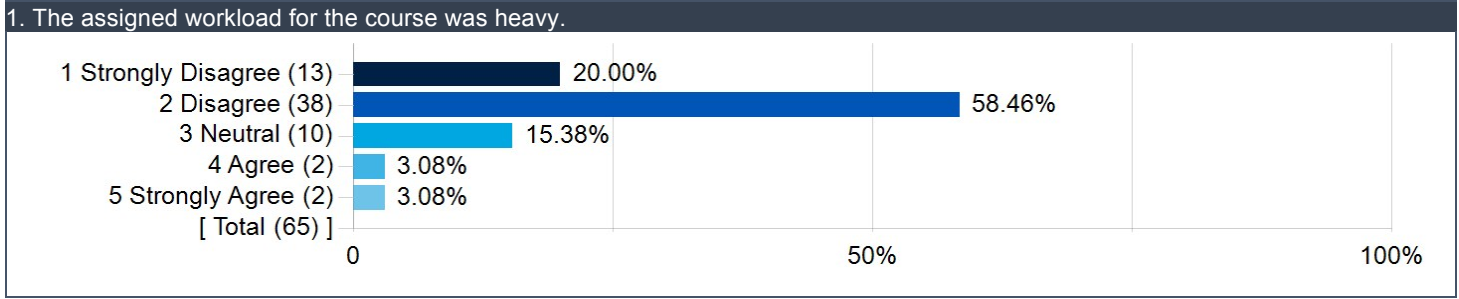
Overall, the instructor was an effective teacher.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
117	65	55.56%	75.38%	4.11	0.42

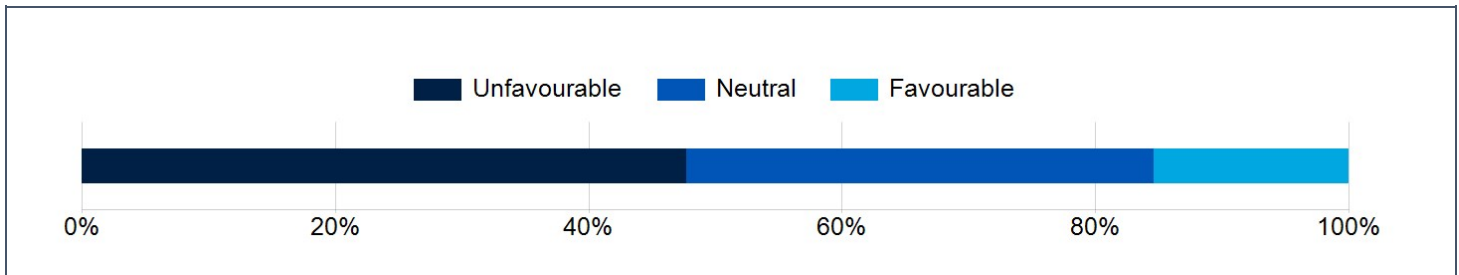
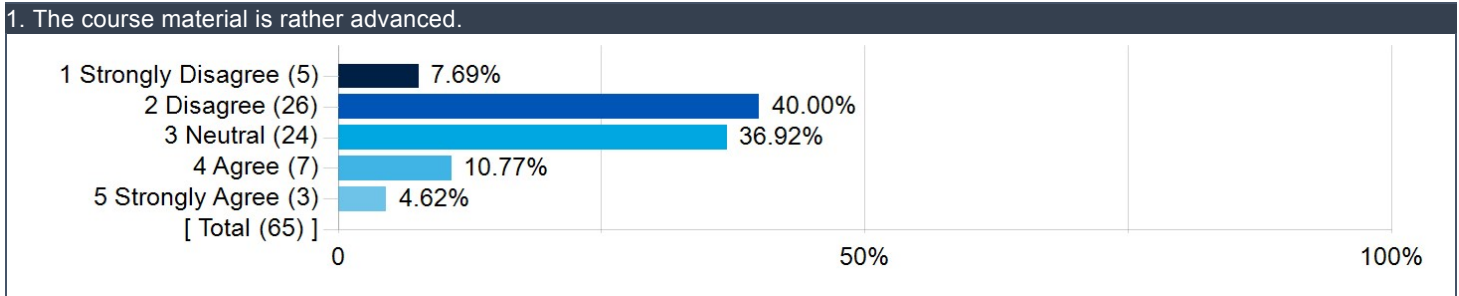
Faculty of Applied Science

The assigned workload for the course was heavy.



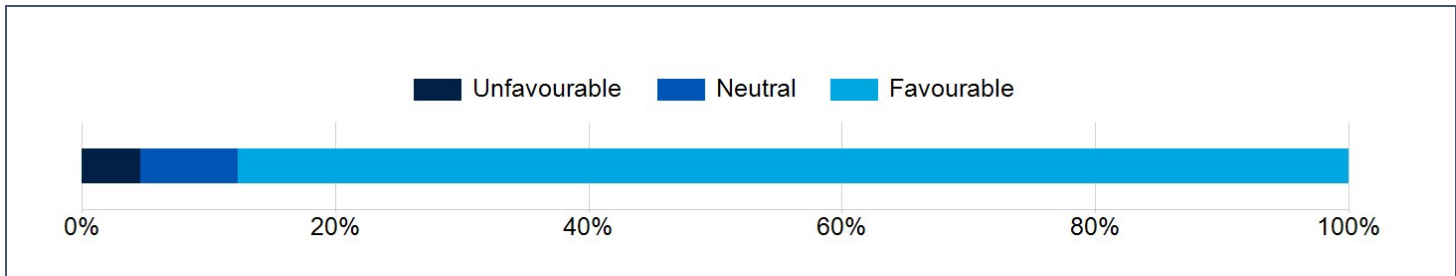
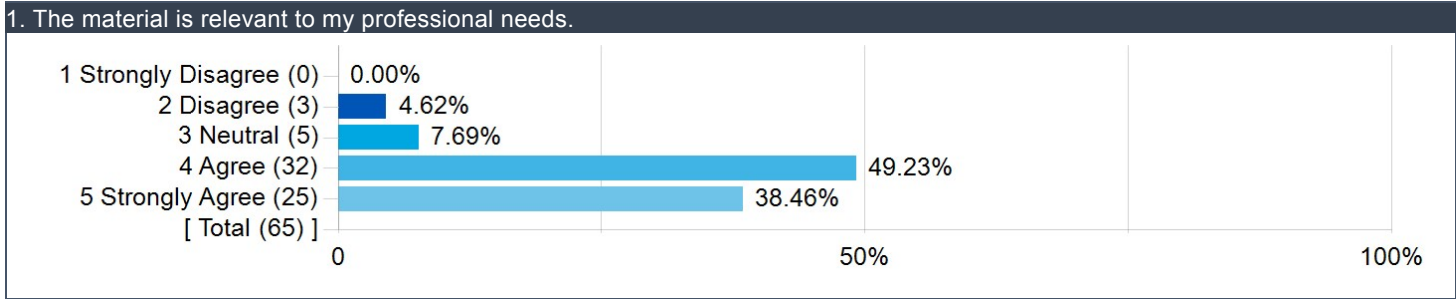
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
117	65	55.56%	6.15%	2.01	0.42

The course material is rather advanced.



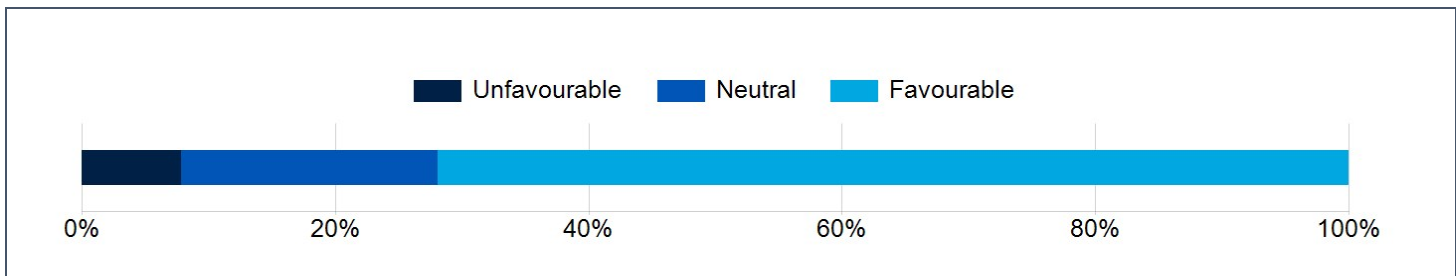
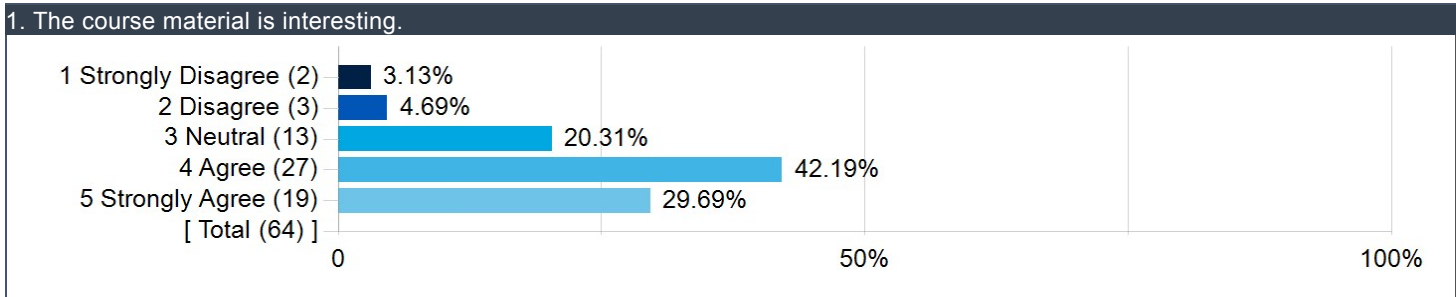
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
117	65	55.56%	15.38%	2.56	0.49

The material is relevant to my professional needs.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
117	65	55.56%	87.69%	4.27	0.39

The course material is interesting.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
117	64	54.70%	71.88%	4.02	0.51

Open Ended Feedback

Comment on the things you appreciated about the course and provide suggestions for improvement.

Comments
 I really enjoyed CHBE 243 because it helped me get a view of the many different career paths I could choose as a chemical

Comments
engineer. I think the overall course is wonderful to have in order to introduce students to the chemical engineering profession, however I feel as if there should have been slightly more substance and learning incorporated in the design exercises.
I understand why we need to hear from industry professionals. It was cool. However, being tested twice, based on their presentations felt a bit different, especially it being a one credit course. Overall, the prof was really nice to work with and was trying to keep our interests at heart by giving us a feel of the industry. Maybe, merging this course with some other course would be more effective.
The guest speakers are all very helpful, but the test material is quite vague. When using the guest speaker lecture slides to study, the material isn't very in-depth in comparison to the questions asked on the test.
I do not understand the purpose of the exam. If it is to make us understand of the topic in class, I prefer last semester method whereby we can bring our notes to exams. I felt that the marks on how I did on the midterms do not reflect my interest and knowledge on the subject as the questions asked felt too specific at times. I just felt that I was hard-pressed to memorize the materials given for the exam rather than understanding them.
The course is great in theory; guest lectures delivered by professionals from various fields of chemical and biological engineering, augmented by class activities related to the topics discussed in lectures. However, there is too much of a difference between what is delivered in lectures, and the activities done in tutorials (tutorials are mostly related to short preparedness quizzes, not the lecture material itself). Furthermore, while it is interesting and rather inspiring to hear insights from professionals, the lectures themselves end up being rather inconsistent, as they are delivered by a different person each time. This made it especially difficult to study for the first test of the course. Additionally, the material that students are tested on is very ambiguous; it was hard to properly study for the test, as I was unsure as to what will be on it, and to what depth the questions will be. Overall, the course itself is interesting and relevant to my professional needs, but the way students are evaluated on it and the way the course itself is delivered could be improved.
Course was very interesting
This course offered a great way to find out about what I can do with degree. It allowed for me to speak with guests and get my foot in the door of the professional world.
Liked the presentations from professionals in the field. Testing could be restructured
Nice having presentations from people of all ranges that had a chemical engineering background. One improvement I would have for this course would be to allow students to bring a "1 page cheat sheet" for tests. I found that it was quite difficult to know what to study, and memorize all the slides without having a strong background for some of the presentations.
back to open book exams or not so specific kind of question
Suggestion: Change the format of the midterm. Have it weigh less? I find it to be a hassle to study so much for a midterm that is a hit or miss (either you know it or you don't).
It's a very hard course to evaluate effectively. Most of the test was straight memorization.
This is a weird class as a kind of case study course where lecturers come in and talk to us, so my evaluation is more of the guest speakers than Jonathan (who incidentally, was fantastic). My only issue with the class was the size of the tutorial groups; 6 people was too large for the amount of work and most groups only had 1 or 2 people actually doing the worksheets.
N/A
Many speakers are from bio side, and most students seem to not have much interest in that side.
having speakers from respective fields of CHBE coming in to talk about their field of study and give advice was eye opening especially for topics that I am interested in going into. design exercises and readings gave me added knowledge and understanding on process flow diagrams and their complexity which will definitely help in the future.
Guest lectures were interesting and group work was engaging and relevant. Material to be tested wasn't entirely clear and mainly involved trying to memorize slides from the guest lectures. better material to test would be general information about Chemical engineering, or the work we did in groups. not a bad class overall, but the midterm was frustrating to study for and somewhat difficult to do well on.
perhaps summaries of key points that speakers made could be produced in order to give students a better idea of what to study from the broad-reaching slides.
i really liked the guest lectures about various careers in chem and bio eng. i did not like the group design exercises. i found them stressful and confusing and i didn't learn much from them. I found the midterms fair considering that they did not include design exercise material :) i think it would be a good idea to give marks for attendance to the guest lectures to encourage more students to attend.
I loved the fact that we get to learn from other experts' past experiences in this course, really gives you an idea of the future you should look forward to
I liked that the guest speakers gave a realistic view of what can be expected with a career as a chemical engineer. However, some presentations felt like a regular class lecture and less like a chance to learn about learning about actual industry and how we can

Comments
get there. Additionally, I do not feel it is entirely fair to test students on speaker presentations as design exercises should be fair game for midterms as well. Jonathan is great!
Appreciate: –the guests lectures – design exercises + solutions and feedback after each design exercise by professor and on canvas Improvement: – make guest lecturers explain any acronym they use as students are not used to too technical terms
We were presented with opportunity to learn about what we can do with a chemical engineering degree
Was wondering why change from open book evaluations to closed book. Was really surprised by the increased in difficulty of the midterm compared to previous year given the fact that they also had open book.
The questions we are tested on are often quite arbitrary, such as the dotted line question. That really did nothing to reflect our understanding of the course material. I think it would be better to have the Tests be more reflective of the main concepts and not so much minutia on it. Also, I think the groups would have been better if they were smaller. For example, my group had different standards and abilities then I did so often I would have to spend most of my time explaining the assignment to them which didn't leave me enough time to check over their work which often had a few mistakes. In a smaller group, it would allow for groups to work more efficiently and effectively in the short time period given for the assignments since there would be less disagreement. But besides these caveats, I really enjoyed the course and it has been one of the most influential I've taken this year.
The group work was interesting and the readings were practical and useful
The tutorials were okay. It was fun to discuss solutions with teammates and lament over the 0.5 marks we couldn't get in the previous worksheet. The lectures however, were a bit disoriented and unfocused. There was no central topic and each lecturer just came over and talked about whatever they wanted to say. Most were boring since I wasn't interested, and the exam that will be based on the slides were simply quite useless, in my opinion. There could be better questions that are asked.
Most of the lectures were uninteresting and boring. The tests rewarded rote memorization and there was no conceptual learning in this course.
I think this course should be assessed with an attendance basis because the point of the course is to learn about the industry by going to the lectures. However most students do not come so they only learn what they need to for the test and as such they don't actually learn about the industries whereas someone who goes to all the lectures and maybe doesn't study as hard would get a worse grade but would have achieved the more of the goal of the course
Johnny V is a beauty
Great lectures overall, the design exercises seemed a little separate from everything else.

A.1.5 CHBE 220 2019W1 Student Evaluations

Project Title: 2019W1 UBC Instructor Evaluations

Course Audience: 115
Responses Received: 66
Response Ratio: 57.39%

Report Comments**Recommended Minimum Response Rates**

Class Size	Recommended Minimum Response Rates based on 80% confidence & $\pm 10\%$ margin
< 10	75%
11 - 19	65%
20 - 34	55%
35 - 49	40%
50 - 74	35%
75 - 99	25%
100 - 149	20%
150 - 299	15%
300 - 499	10%
> 500	5%

Creation Date: **Wednesday, January 22, 2020**

University Module Questions

University Module Questions

Question	N	n	SD	D	N	A	SA	N/A	IM	DI	Mean	STDEV
The instructor made it clear what students were expected to learn.	115	66	0	1	2	24	39	0	4.65	0.30	4.53	0.64
The instructor communicated the subject matter effectively.	115	66	0	1	2	25	38	0	4.63	0.30	4.52	0.64
The instructor helped inspire interest in learning the subject matter.	115	65	0	1	9	22	33	0	4.52	0.40	4.34	0.78
Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	115	66	0	6	4	15	37	4	4.66	0.46	4.34	0.97
The instructor showed concern for student learning.	115	66	0	0	0	16	50	0	4.84	0.18	4.76	0.43
Overall, the instructor was an effective teacher.	115	66	0	0	2	31	33	0	4.50	0.28	4.47	0.56

Question	%Favourable
The instructor made it clear what students were expected to learn.	95.45%
The instructor communicated the subject matter effectively.	95.45%
The instructor helped inspire interest in learning the subject matter.	84.62%
Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	83.87%
The instructor showed concern for student learning.	100.00%
Overall, the instructor was an effective teacher.	96.97%

Faculty Questions

Course Questions

Question	N	n	SD	D	N	A	SA	N/A	IM	DI	Mean	STDEV
The assigned workload for the course was heavy.	115	66	3	12	28	16	7	0	3.14	0.54	3.18	1.01
The course material is rather advanced.	115	66	1	13	24	22	6	0	3.29	0.51	3.29	0.94
The material is relevant to my professional needs.	115	65	0	0	6	15	44	0	4.76	0.30	4.58	0.66
The course material is interesting.	115	65	0	1	14	26	24	0	4.17	0.43	4.12	0.80

Question	%Favourable
The assigned workload for the course was heavy.	34.85%
The course material is rather advanced.	42.42%
The material is relevant to my professional needs.	90.77%
The course material is interesting.	76.92%

Open ended feedback

Comment on what the instructor has done especially well in teaching the course and what he/she might do to improve it.

Comments
Dr. Verrett's approach to teaching the students the practicality of what they are learning is much appreciated. The project side of the course and his engagement with regards to that has been amazing.
Very effective in explaining questions. Cares a lot about student learning and is quite flexible. Listens to the students and their needs. Very approachable teacher. Sometimes lectures can be a bit long as we copy from the slides.
Dr. Verrett was very clear in what we were to do for each assignment and what information was need to review for our midterm exam. He was very helpful in answering our questions too.
Very clear explanations, the design assignments built upon the previous ones, lots of example problems in class
He is a good instructor who made the concepts very clear.
Dr Verrett is knowledgable and approachable. He listens closely to all feedback and implements them quickly to the best of his abilities. But although he teaches the material well his exam material is too challenging.
Jonathan is a very nice guy, and great instructor. The only thing I didn't like about this class is the 8am class. But I really appreciate how all the lecture notes are uploaded, and this does not stop me from coming to class because I feel the explanations I can get in attending classes are awesome.
Really nice and helpful lecture notes as well as the study guide for exam being super convenient and straightforward is a bonus. Assignments are given to practice concepts were fair.
Dr. Verrett did an amazing job teaching the course, and overall I enjoyed what we were learning. The only unfortunate part was that the class was at 8am.
The instructor really took into account what the students wanted as part of their learning. He posted links where students could anonymously post their opinions on how to improve the lecture, and Dr Verrett really did take those into account. He further made it his mission to help students for however long they need whether it was appointments or office hours.
Made good review notes for midterm and final. Would have liked to have more practice tests or question.
An improvement would be to give more examples of testable material and make it more clear what we need to learn (tutorials)
Slides were always posted and available quickly after lectures. Assignments and tutorials were always clear in what needed to be done and he was flexible and accommodating to students when needed.
Really patient with students and considerate of workload. Would like for instructor to explain certain theories or concepts with more effective methods. Feel like when the instructor is asked some questions the answers are 'just because'. Would be nice to really understand why a certain concept or calculation is approached or though of in a certain way.
Dr.Verrett organized the material and class extremely well. Probably one of the most organized classes I have ever taken. I really appreciate that as it takes the stress out of trying to figure out what is going on.
Dr.Verrett seems interested in the material and in student success. He is approachable and easy to talk to.
One area he could improve would be in tone of voice during lectures. He can come off as monotone, which was unfortunately elevated in our 8am lectures.
Overall, I enjoyed the class and his teaching and would take a class with him again if I had the choice.
He made it clear what we had to learn and know for the exam, and also helped us to apply these concepts. In the earlier part of the semester there weren't many examples which made the assignments difficult, but in the second half of the semester there were more examples and they were very helpful.
I liked the project aspect of the course.

Comments
He's a bit monotone even though the lecture content is usually fun, it was too early.
Dr. Verret is an excellent teacher that is very understanding and helpful. All his notes are clear and make it possible for the student to go over the material as much as needed.
This is a new course. For its first year running, it was not very clear what we were supposed to learn. For example, we were all confused as to what would be on the midterm (the kind of questions) and the class average without scaling was at 52%, which tells us that many people did not know the structure for the course.
Overall the instructor was helpful and effective and taught very well in class, just that the expectations were not exceptionally clear.
Have more interaction with students, try to make class more interesting.
Dr Verrett is a really good instructor who cares about his students and helps them when they need.He can empathize with the students which is important. The assignments were fair but can be more easier since it's kind of different than what we do in lectures. However, midterm exam was hard and and could be made reasonably easier.
The course was taught well, professor spoke clearly and loudly for the lectures.
He was very helpful and easy to approach.
very nice instructor
Verrett is very approachable. He is kind of upset when the attendance in his lecture is low, and it is not his fault mainly because his lecture is at 8 a.m. Next time maybe try to talk to the department to schedule the course in a different time?
Dr. Verrett is an amazing professor. Extremely kind and caring who really takes an interest in each students learning. He is super helpful and an extremely effective teacher. The course material overall can sometimes be confusing when doing the assignments. The assignments are sometimes not completely related to the material (or if they are, its sometimes really hard to find the answer). The midterm exam was overly complicated in my opinion and the negative points for the multiple choice just seems like an unnecessary punishment in case you get the wrong answer. For the tutorials, it was not always clear what was expected of us. Even after reading over the rubric multiple times, it didnt seem like the maximum amount of points correlated with the rubric. Overall, it seemed like they were looking for it to be overly technical and detailed while the rubric did not represent that, and before being taught about these technical details in class or elsewhere. Overall, Dr. Verrett is an amazing teacher who gives his all to every subject. The course material/set-up however could be improved
extremely caring, great instructor who cared about the welfare of his students. Course content was a bit difficult but the instructor always helped students the best he could with understanding. Thank you so much!
Providing case studies to enhance learning.
The instructor made it clear what the learning goals are before lectures and gave us templates on the assignment so that we have some idea of how to start/format it.
The instructor shows great care for the students' development and understanding of the subject. He is also patient and helpful when explaining essential points to students.
Dr. Verrett shows genuine interest in student learning, however, the course load for CHBE 220 is way too heavy with the IA, webwork, and tutorials.
Prof. Verrett cares a lot about student learning and made it clear what we were supposed to know for the course. I would suggest that he provide more practice problems for topics that are difficult. Thank you!
Dr. Verrett's way of presenting the slides while writing lecture notes made it very easy to follow the lecture and helped me understand the content. Uploading the slides and lecture notes on Canvas made it easy to study from them. One thing that can improve is to give us more practice material and sample questions for the exams.
Dr. Verrett has done an excellent job integrating the lecture material with the design project. For each deliverable, we had sufficient knowledge from the lectures to apply to our deliverable smoothly and without delay. Also, Dr. Verrett's approachable nature allows students curiosities and confusions to be easily resolved. His teaching style makes for a very enjoyable course.
The professor is always engaging and makes lectures and tutorials interesting.
Great job on keeping everything relevant and engaging for the class!
Posted all lecture slides and annotated notes for students to catch up/review from Maybe make class a little less 'read off the slides' but it's hard to do that with a new course
The instructor explained al the concepts well and made sure everyone understood it. Made notes and resources available. Also he arranged the canvas page in a super

Comments
systematic way which was great.
He always cares about his students and he is usually very helpful during office hours. Although, in class, it sometimes feels like he just reads off what is on the slides.
The instructor made it very clear what he expected of us and was great at communicating and answering questions. He seemed to genuinely care about our understanding of the course material. Dr. Verrett did a great job, and I'm not sure there is much room for improvement!
It would be better if we could have practice midterms. Everything else is awesome:)

Comment on the things you appreciated about the course and provide suggestions for improvement.

Comments
Please don't have this course at 8 AM. That was the most discouraging part of the course.
Instructor was very organized and thoughtful in regards to students concerns.
It would be beneficial to see shorter concrete examples on how this applies to real life rather than one long term example. Sometimes there is a bit too much overlap with CHBE 241 which could be avoided.
The hands-on experience in the design process that this course provided us with was so helpful and interesting and it gave us insight to what our futures would look like.
Very good introduction to chemical engineering, provided a good overview of related concepts
I would rather suggest not repeating the same materials as thought in 241. I guess 220 can dive more deeply on basic process safety, economics, and conceptual understanding on plant components. But not to material or energy balances.
Maybe try to have less modules, so its more manageable with our overall courseload, especially leading up until the last week of classes and finals.
Some lectures covers the same materials from CHBE 241
The theory we were learning in class was being directly applied to our term long project. This made it really beneficial for us to understand the content of the course.
Interesting material that can be further supported with some more detailed explanations.
schedule the class better and people will show up more often
The processes and theory that we learned were directly applicable to what we would potentially be doing in industry in the future.
Appreciated all the things it taught me, now how a better understanding of what chemical engineering demands. Would suggest having a tutorial session for this course.
Assignments, tutorials, and lectures were very well organized. It was helpful to have a consistent assignment schedule to rely on. Deliverables were clearly stated and I always felt that I knew what was expected of me/my group.
It could be helpful to have more practice material like practice midterms and more calculations practice like the WeBWork problems.
The course project was good because it helped give an insight into the use of what we were learning. More in class examples would be better.
I like the general idea of the course. Overall, quite useful.
This is a very interesting course and overlaps with CHBE 241 slightly, just that the structure and class notes can be made clearer.
The first couple of tutorial instructions were sort of unclear and somewhat confusing
The course is structured clear as well as the course materials are very,very useful. Probably the most useful course we have been taken is university do far.
appreciated = the professor improvements = the courseload (very heavy with assignments and projects), the level of technicality needed for the written group assignments with no prior experience to these processes.
Course was well-organized, it tied well very nicely with CHBE 201 and the group portion (the project reports) especially were extremely effective in helping my understanding of some of the learning outcomes.

Comments
I appreciate that real-life examples were used to picture the given scenario.
The course repeats the things learned in CHBE 241. I think that if this course combines with the technical communication course, it'll be a "fuller" course that can stand on its own.
The course taught me essential knowledge for becoming a chemical engineer.
I appreciate that the tutorials are relevant applications of the course content.
I thought the group and individual elements were integrated nicely in this course, and the workload was appropriate. I sometimes found the lecture material a bit dry and suggest more interesting problems presented during class.
Do not take marks off for wrong answers on multiple choice questions.
I appreciate the term-long project approach. I found the project very interesting and found that applying the concepts taught in class to the project as we learned them really helped me understand the concepts. It also greatly increased my appreciation for chemical engineering as a profession.
The design project is very interesting and engaging, as it allows us to visualize the way our courses in CHBE are integrated in industry. Moreover, I appreciate that the course gives us an overview of what to expect in future courses in CHBE. While the assignments were sometimes challenging, Dr. Verrett's help during office hours and through Piazza was very valuable. The level of difficulty was appropriate as it allowed us a chance to critically analyze and apply the course material.
It is a great course, I would only suggest to include more examples during lectures
I personally loved the fact that we're using material from other classes and applying them to scenarios relevant to us.
The tutorials and the design project were very engaging and helped significantly to understand material and apply knowledge from class to real scenarios
The course was interesting and should be really useful for the work-field. The projects were interesting. However there was a cross between 220 and 241 and maybe one of the courses could diversify and focus less on the material also presented in 241. Also please don't put the course as an 8 am. The only reason I skipped some lectures was because of the time slot.
I really like the fact that we get to work on projects that are related to some of the fields in engineering.
I really appreciated that the course overlapped with other courses in the semester. It provided more incentive to really learn and understand it. For improvements, there should be better overlap with the 201 course. I felt that although they were integrated, it seemed like 201 was always left behind, like an afterthought.
I loved the extent of real-world application that this course provided. It really made me care about the material that was being taught. This was supplemented by Dr. Verrett's interest in the course and willingness to help in office hours and such.
I really enjoyed how applicable this course was to all other term 1 CHBE courses I was taking. Additionally I enjoyed the textbook readings (especially the later ones) and thought they were an excellent way to introduce or reinforce material taught during lecture or tutorial. My only complaint is around the teaching style in lecture, I feel there was a large amount of rewriting what is on the slides which does not seem like the best use of lecture time, while on the other hand it does make the lectures quite slow and digestible.

Explanatory Note

Percent Favourable Rating

This is the percentage of respondents who rated the instructor a 4 or 5 (Agree or Strongly Agree).

Interpolated Median

The data collected for Student Evaluations of Teaching (SEoT) are ordinal in nature, with a natural order (from 1 to 5). While the mean may be used as a measure of central tendency for such data, it is not an appropriate or accurate representation of SEoT data (cf. Stark & Freishtat, 2014). The usual measure of central tendency for ordinal data is the median. As a result, we have been reporting the mean and the median for the last several years. After considerable thought and data modeling, we now believe that the interpolated median is the best representation of the data, since it takes the frequency distribution into account.

Consider the following example from 2015W, the two classes have identical mean (3.8). However, the instructor in class 2 received 77% favourable (4-5) ratings, compared to 53% for the instructor in class 1. The Interpolated median values of (3.7 and 4.2), much better reflects the distribution of the scores above and below their respective median. Furthermore, the interpolated median is better correlated with percent favourable rating; such that an interpolated median of 3.5 on a Likert scale of 1 to 5, corresponds to 50% favourable rating.

Frequency Distribution

Response for UMI	Class 1	Class 2
5 = Strongly agree	5	5
4 = Agree	3	5
3 = Neither agree nor disagree	6	0
2 = Disagree	1	2
1 = Strongly disagree	0	1
Mean	3.8	3.8
Median	4.0	4.0

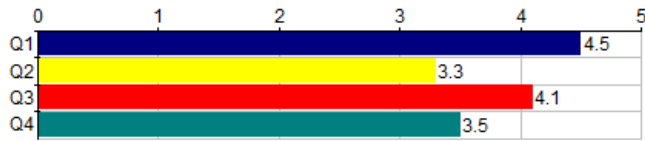
Interpolated Median	3.7	4.2
Percent favourable rating	53%	77%

Dispersion Index

The dispersion Index is a measure of variability suitable for ordinal data (Rampichini, Grilli & Petrucci 2004). This dispersion index has values between zero and 1. A zero dispersion index indicates that all students in the section gave the same rating to the instructor. An index value of 1.0 is obtained when the class splits evenly between the two extreme values (Strongly Disagree & Strongly Agree), a very rare occurrence. In SEoT data at UBC, the index rarely exceeds 0.85, and mostly for evaluations not meeting the minimum recommended response rate.

A.1.6 CHBE 362 2017W1 Student Evaluations

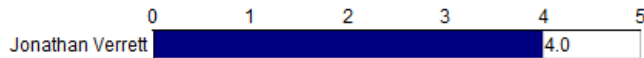
Course: CHBE 362 101 - Process and Environmental Engineering Laboratory	Department: CHBE
Responsible Faculty: Dhaneshwarie Kannangara; Jonathan Verrett	Responses / Expected: 24 / 64 (37.50%)



Course	CHBE 362 - 101									
	Responses					Course				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q1	0	0	2	7	15	24	4.5	5	5	.64
Q2	1	2	11	9	1	24	3.3	3	3	.84
Q3	0	1	2	15	6	24	4.1	4	4	.70
Q4	2	3	4	12	3	24	3.5	4	4	1.12

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

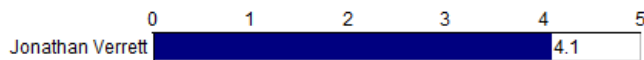
Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett									
	Responses					Individual				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q5	0	0	4	15	5	24	4.0	4	4	.61

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

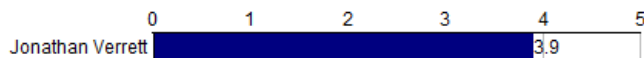
Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett									
	Responses					Individual				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q6	0	0	4	13	7	24	4.1	4	4	.67

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

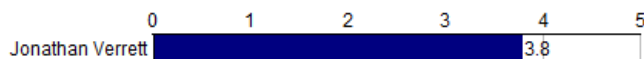
Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett									
	Responses					Individual				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q7	0	0	9	9	6	24	3.9	4	3,4	.78

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

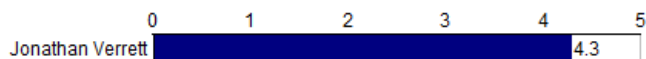
Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett									
	Responses					Individual				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q8	0	1	5	12	3	21	3.8	4	4	.73

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

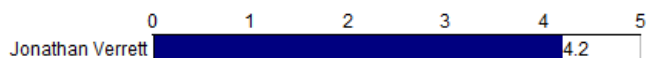
Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett									
	Responses					Individual				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q9	The instructor showed concern for student learning.									
	0	0	3	12	9	24	4.3	4	4	.66

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett									
	Responses					Individual				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q10	Overall, the instructor was an effective teacher.									
	0	0	3	13	8	24	4.2	4	4	.64

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

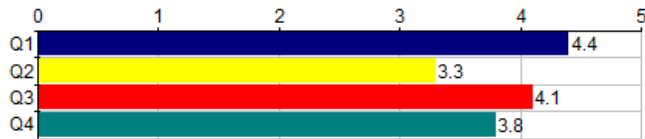
Question: Comment on the things you appreciated about the course and provide suggestions for improvement.

Response Rate: 70.83% (17 of 24)

1	difficult with reports being due during midterm a lot of work given it's only 2 credits (about 150 hours per person)
2	This course is very disorganized. The work load is not representative of a 2 credit course. The labs are dry, repetitive, and much of the time is spent waiting for other students to finish using an apparatus or piece of equipment. Assignment guidelines are loose but marking is strict; the expectations should be better communicated. Grading is also not consistent and depends heavily on which professor or TA is marking. The templates provided for calculations are full of mistakes. The actual grading process takes a long time; I received marks for one lab the day before my next one was due, which left very little time for corrections. Labs are supposed to build upon the material learnt in our classes, but often do not align with the courses. This course seems to be suffering from a general lack of communication.
3	There is a lot of down time within these labs. With us spending upwards of 70% of the time doing nothing waiting. The lab consumes an incredible amount of time for a 2 credit course.
4	The labs were much better presented this year. It was nice being done early some days. The decrease in lab write ups was nice and it is nice doing the write up individually for the short reports.
5	The labs were closely related to the material we were learning in class which was nice.
6	The labs were interesting and relevant to what we were learning in class. Course load is extremely heavy for a two credit class. There is a lot of waiting times during the experiments - a way to reduce this time, or providing another task to do during the waiting would be good. Putting the linked workshops and experiments together would be helpful because we didn't end up learning the theory in class before getting to the experiments anyways. Feedback on lab reports was very slow - wouldn't get the first report back before having to hand in the second.
7	One of the most effective methods of learning is having to communicate it via a report. This course is effective in doing that.
8	Lot of work for only 2 credits! The marking of the reports were also very harsh!
9	It was nice having 6 sessions in the labs as a result of the workshops and labs . The workload is extremely heavy for a 2 credit course. It would be nice to have the results and discussion more open ended to be able to comment on more results in the lab .
10	Interesting experiments but the pacing of the course is too heavy towards the end of the semester. Many people have said that the experiments should be rearranged, but the response has been that the theory from other classes isn't taught earlier in the semester. This is irrelevant, since every experiment that I performed this semester was before I learned the material in other courses anyway. I suggest this: pair the experiments up with the workshops (Particle workshop and fluidization lab, water assays and bioreactor, and then heat exchangers and LabView) running them back to back in different orders for the different groups, so each group alternates between workshops and experiments. This allows reports to be completed, returned, and graded in between, instead of them being all at the end. Also, the heat exchanger experiment is interesting material, but the lab contains no actual work, it is just watching numbers stabilize, this experiment should include more LabView work. Penultimately, the Lab Assistants are terribly underprepared for the labs, all of them grading drastically differently, and most of them not knowing how to do the labs. Finally, the manuals and excel sheets contain many errors and need revisions.
11	In general, I like this course. Materials were laid out nicely and all resources we needed were accessible and organized on connect. Using piazza for questions was effective and I hope it is continued for other lab courses (especially if the overseeing instructor is as quick as Dr Verrett in responding!) I would have liked receiving feedback in a more timely manner (i.e. getting lab reports back), but I don't think it's possible without an additional instructor.
12	I liked the concept - However the marking takes way to long (such that I'm completing my last lab without getting feedback on my first lab) and the marking is very inconsistent. Also, this is only a 2 credit course, but it easily takes up 80% of my time (and other students agree). My advice would be to either make the marking more lenient, or decrease the work load, or increase the amount of credits we receive.
13	I appreciate that we get access to such realistic equipment like we would in industry, but the work load is very high for a 2 credit course.
14	I appreciated the thoroughness of this course and how it is structured. I really liked how it was well intertwined with our other courses such as unit operations, heat and mass transfer, and wastewater treatment.
15	I appreciate the ability to take a practical look at what we're learning in the term, but it is really difficult to get a good understanding of some of the labs when you haven't gone over the material in classes yet. Specifically, I had serious trouble with heat exchangers, which weren't discussed in class until the last week. I find the calculations and workload incredibly heavy for a two credit course in combination with all the other work we have for other classes.
16	Hard material, forces students to work and depend on other students. This is important life skill. Material forces students to have to work hard and often look for help, which can be realistic, yet very time consuming (especially for 2 credit course).
17	Appreciate that we get to see real life example of the material we cover in other classes, like heat exchangers, particle characterization. TAs/ instructors always helpful during and outside of lab in case we need help finishing the reports / finishing calculations.

Faculty:	Jonathan Verrett
Question:	Comment on what the instructor has done especially well in teaching the course and what he\she might do to improve it.
Response Rate:	75.00% (18 of 24)
1	understands that not all the information is present that students need to use and works with the students to achieve the correct result.
2	good prof
3	Was extremely helpful when it came to answering questions. Was well prepared in the lab - able to answer all questions.
4	Very respectful, always available to help
5	The instructor is good at communicating with students; the course would greatly benefit if he integrated this communication into the rest of the course structure.
6	The course was well taught. There should be less weight given to the appendices in the short lab report and more given to the write up to make up for other lab members that don't put in as much of an effort and end up bringing your mark down.
7	Jonathan is always really helpful if you have any questions about calculations or lab procedures at any time. During labs, he always elaborates with interesting details or applications that make the experiments a lot more engaging, because we can see their application to real-world situations.
8	Jonathan is delightful to work with. Like Danesh, he is very helpful when called upon and clearly shares her passion for student development.
9	Jonathan has gone above and beyond the call of duty on many occasions and is one of the best professors I have had in CHBE. Conveys subject matter effectively, inspires interest, works hard to improve the course, and is open to questions about deeper understanding of the material. Only improvement that could be made is if there were two of him.
10	Implemented piazza for this course, and Dr Verrett did a great job of managing it. He communicated with us well through email. Haven't received many assignments back that were marked by him, so cannot comment on how his marking style is like. Generally very helpful and likeable.
11	I think the laboratories this semester could be a bit more interesting.
12	He was very approachable and helpful during the lab.
13	He is very informative and professional. Very responsive on the media platform piazza. Thanks Jonathan.
14	Has a genuine concern for the students learning and takes questions seriously
15	Great professor and helpful when students had questions
16	Excellent at responding to questions. Very helpful when sought out for help.
17	Dr. Verrett is somewhat new to CHBE and I think he is doing a wonderful job. It is noticeable how much more organized the labs have gotten compared to the earlier years and that doesn't go unappreciated. He is very understanding of the material and I hope that he continues to do everything he is doing.
18	Always willing to help in the lab and is always approachable. Was incredibly helpful when I was struggling with calculations, and even took the time to walk me through a particularly tricky section.

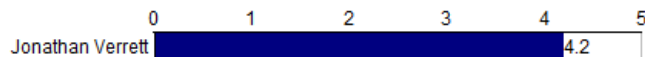
Course: CHBE 362 102 - Process and Environmental Engineering Laboratory	Department: CHBE
Responsible Faculty: Dhaneshwarie Kannangara; Jonathan Verrett	Responses / Expected: 18 / 48 (37.50%)



Course	CHBE 362 - 102									
	Responses					Course				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q1	0	0	3	5	10	18	4.4	5	5	.76
Q2	0	1	11	6	0	18	3.3	3	3	.56
Q3	0	1	3	7	7	18	4.1	4	4,5	.87
Q4	1	0	3	12	2	18	3.8	4	4	.85

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

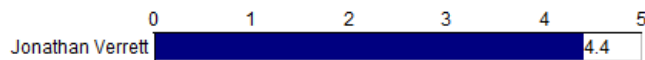
Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett									
	Responses					Individual				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q5	0	1	1	8	7	17	4.2	4	4	.81

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

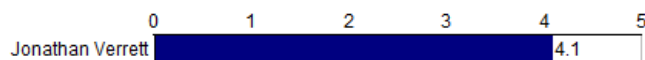
Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett									
	Responses					Individual				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q6	0	1	1	6	10	18	4.4	5	5	.83

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

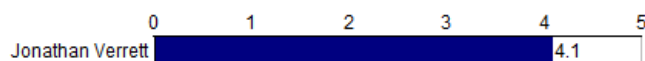
Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett									
	Responses					Individual				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q7	0	0	6	4	8	18	4.1	4	5	.87

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

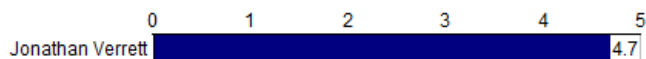
Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett									
	Responses					Individual				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q8	0	1	3	6	6	16	4.1	4	4,5	.90

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

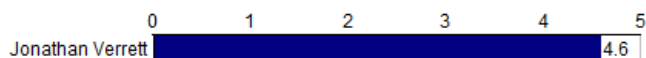
Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett									
	Responses					Individual				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q9	The instructor showed concern for student learning.									
	0	0	1	3	14	18	4.7	5	5	.56

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Jonathan Verrett									
	Responses					Individual				
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev
Q10	Overall, the instructor was an effective teacher.									
	0	0	2	4	12	18	4.6	5	5	.68

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

Question: Comment on the things you appreciated about the course and provide suggestions for improvement.

Response Rate: 44.44% (8 of 18)

- 1 The sample D and A file were often very frustrating to use. The answers never quite matched (though usually small enough that it would round to the same 1-2 sig figs) which is incredibly annoying as the samples should be 100% exactly the same to every decimal place. Sometimes data from one half would match exactly and the other half would not (example: Exp B. The water fluidized bed matched perfectly for the most part, but the air beds did not match at all). It seems to me like the sample answers or sample data were updated but the other half was left old, or some odd approach was used and not made known. This was also an issue in CHBE 262. Please fix this to save many students from this silly head ache.
- 2 The instructors are very helpful during the lab and after lab
- 3 The course gives us a good chance to apply our knowledge to actual.
- 4 Labs need to be more evenly spread out.
- 5 If there is any way to reduce the workload of this course it would be much more reasonable. Over the term I have spent much more time on this course than any other and it is only worth 2 credits. Maybe reduce the pre-lab assignments and/or the requirements for the appendices
- 6 I liked that the coursework is easy at the beginning of the semester, and there is no final exam for this material. Maybe having groups of 6 rather than 4 might help with speeding up the process of creating the formal lab reports for students, but nothing can really be improved.
- 7 I like how the experiments are done at the same pace as the course materials. I also like how they allowed each student to do their own short reports to enhance their report-writing skills. However, I feel that the workload for this course is too heavy, because of the amount of workshops and experiments we had compared to CHBE 262. I think what takes up most of out time is the lab reports. I suggest that the workshop deliverables should be combined with the experiment lab report deliverables (similar to Exp A) especially if they are related, like the particle characterization workshop and the settling and fluidization experiment. This way students won't have to spend time submitting assignments for the workshops and can focus more on the lab reports of experiments.
- 8 For a 2 credit course, the Lab course has taken so much of my time. I find it unnecessary to hand write the appendices. I feel with this course the students are essentially given a lab manual and no other instruction.

Faculty: Jonathan Verrett

Question: Comment on what the instructor has done especially well in teaching the course and what he/she might do to improve it.

Response Rate: 44.44% (8 of 18)

- 1 he is amazing!!! he gives lots of help !!!!
- 2 Professor Verrett really concerns about the problems students are facing while writing the reports. He'd answer questions on the online forum over the weekends and fast reply time, which is very helpful
- 3 Helps students as much as possible. Maybe having a bit more office hours might help.
- 4 He replied our questions always in time
- 5 Dr. Verrett is exceptional at teaching this course. He is kind, approachable, easy to communicate with, clear, and knowledgeable. I have no complaints.
- 6 Dr. Verrett is very approachable and cared about students' learning.
- 7 Communication between the students is amazing, but marking between the professors are different. there is no consistency.
I also appreciate how he cares about the learning of the students and pushes deadlines if other courses are conflicting.
- 8 Although I am not a fan of the course, I believe that the instructors have done a good job, especially with respect to their availability and understanding.

A.1.7 CHBE 362 2018W1 Student Evaluations

Report Comments

Percent Favourable Rating

This is the percentage of respondents who rated the instructor a 4 or 5 (Agree or Strongly Agree).

Interpolated Median

The data collected for Student Evaluations of Teaching (SEoT) are ordinal in nature, with a natural order (from 1 to 5). While the mean may be used as a measure of central tendency for such data, it is not an appropriate or accurate representation of SEoT data (cf. Stark & Freishtat, 2014). The usual measure of central tendency for ordinal data is the median. As a result, we have been reporting the mean and the median for the last several years. Because students more often provide higher ratings (4 or 5), the median is consistently higher than the mean. After considerable thought and data modeling, we now believe that the interpolated median is the best representation of the data, since it takes the frequency distribution into account. Consider the following example:

Frequency Distribution		
Response for UMI	Class 1	Class 2
5 = Strongly agree	13	4
4 = Agree	26	43
3 = Neither agree nor disagree	35	32
2 = Disagree	20	11
1 = Strongly disagree	6	10
Mean	3.2	3.2
Median	3.0	3.0
Interpolated Median	3.2	3.4
Percent Favourable Rating	39%	47%

In this example, the two classes have identical mean (3.2) and median (3.0). However, the instructor in class 2 received 47% favourable (4-5) ratings, compared to 39% for the instructor in class 1. While both have a Median of 3, the Interpolated median values of (3.2 and 3.4), much better reflects the distribution of the scores above and below the median. Furthermore, the interpolated median is better correlated with percent favourable rating; such that an interpolated median of 3.5 on a Likert scale of 1 to 5, corresponds to 50% favourable rating.

Dispersion Index

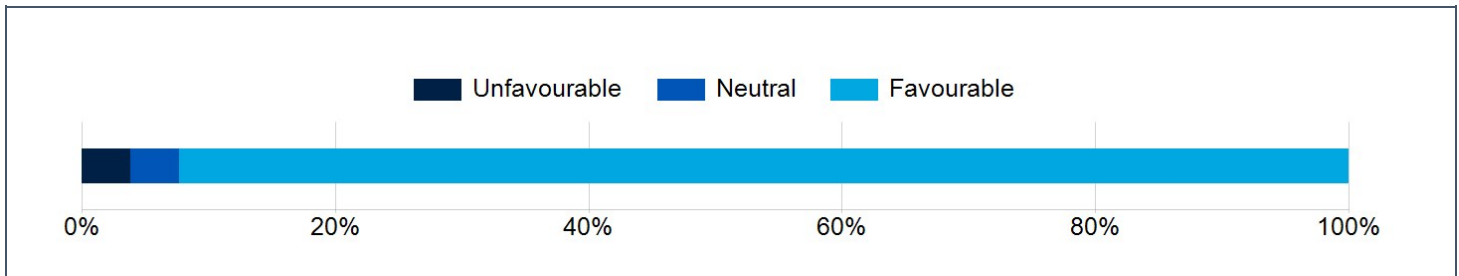
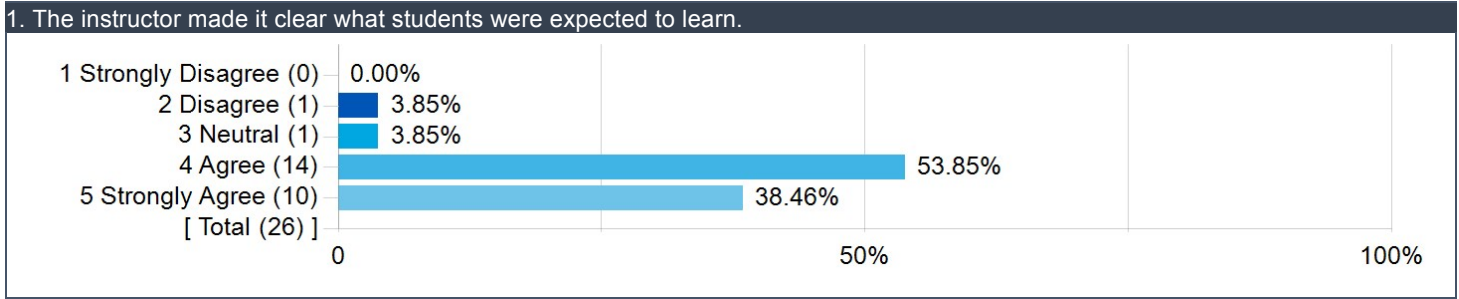
The dispersion Index is a measure of variability suitable for ordinal data (Rampichini, Grilli & Petrucci 2004). This dispersion index has values between zero and 1. A zero dispersion index indicates that all students in the section gave the same rating to the instructor. An index value of 1.0 is obtained when the class splits evenly between the two extreme values (Strongly Disagree & Strongly Agree), a very rare occurrence. In SEoT data at UBC, the index rarely exceeds 0.85, and mostly for evaluations not meeting the minimum recommended response rate.

Recommended minimum response rates

Class Size	Recommended Minimum Response Rates based on 80% confidence & $\pm 10\%$ margin
< 10	75%
11 - 19	65%
20 - 34	55%
35 - 49	40%
50 - 74	35%
75 - 99	25%
100 - 149	20%
150 - 299	15%
300 - 499	10%
> 500	5%

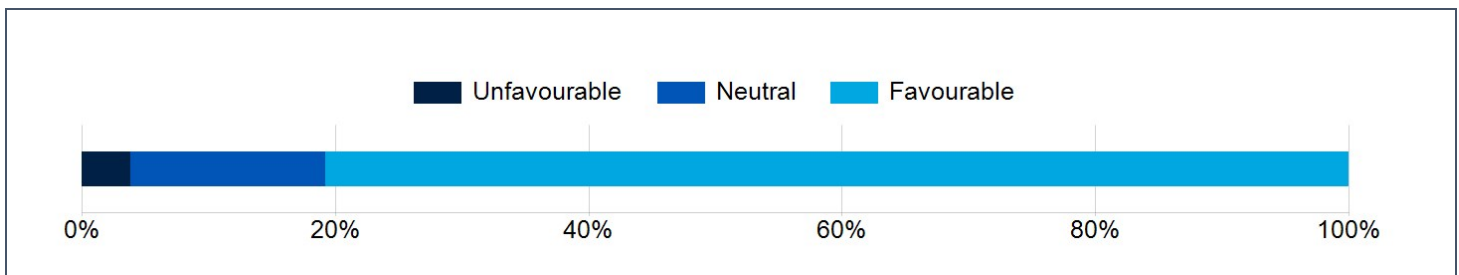
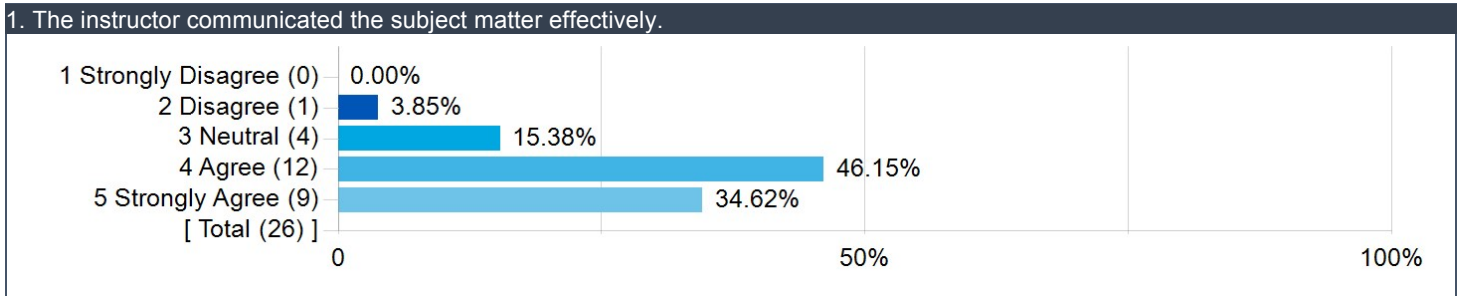
UBC-Wide Questions

The instructor made it clear what students were expected to learn.



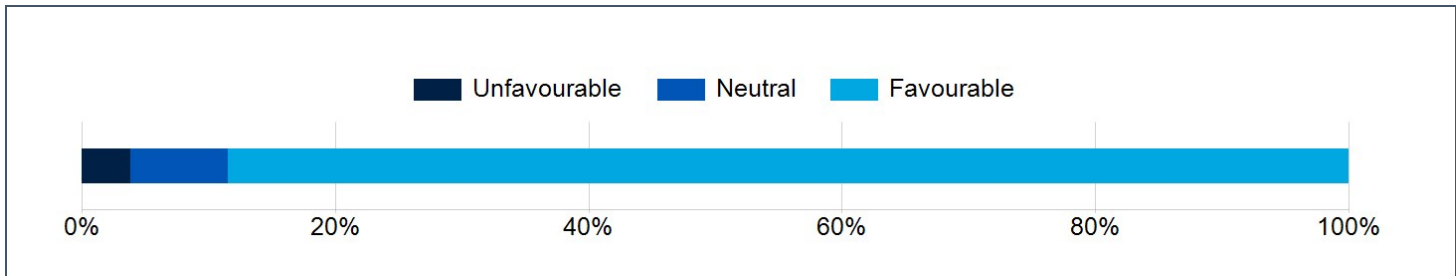
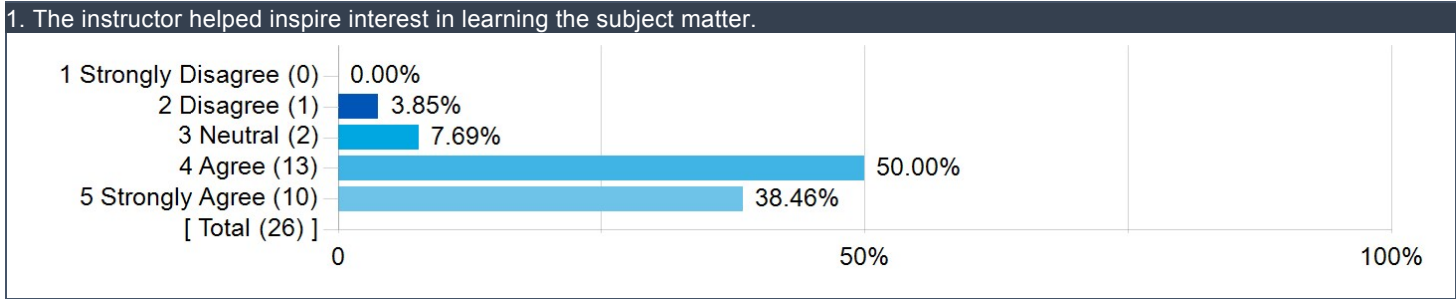
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
69	26	37.68%	92.31%	4.29	0.34

The instructor communicated the subject matter effectively.



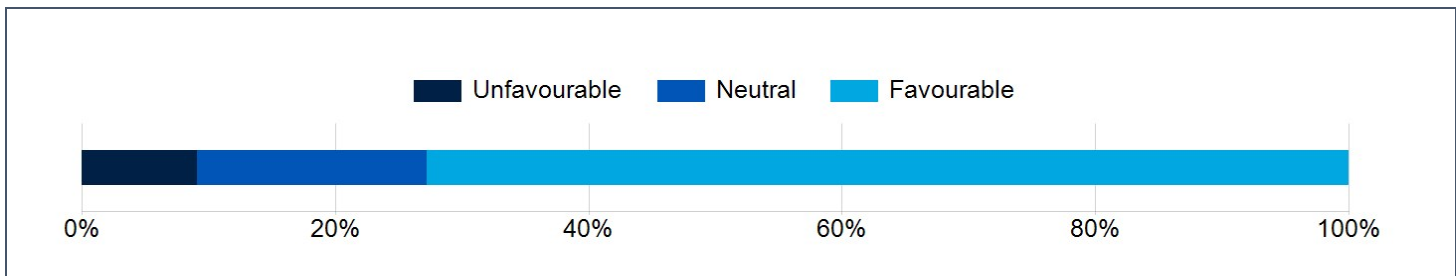
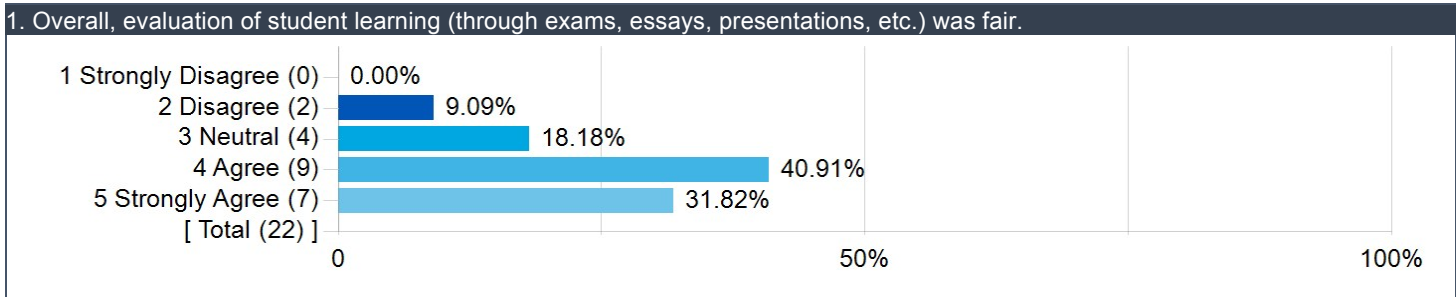
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
69	26	37.68%	80.77%	4.17	0.42

The instructor helped inspire interest in learning the subject matter.



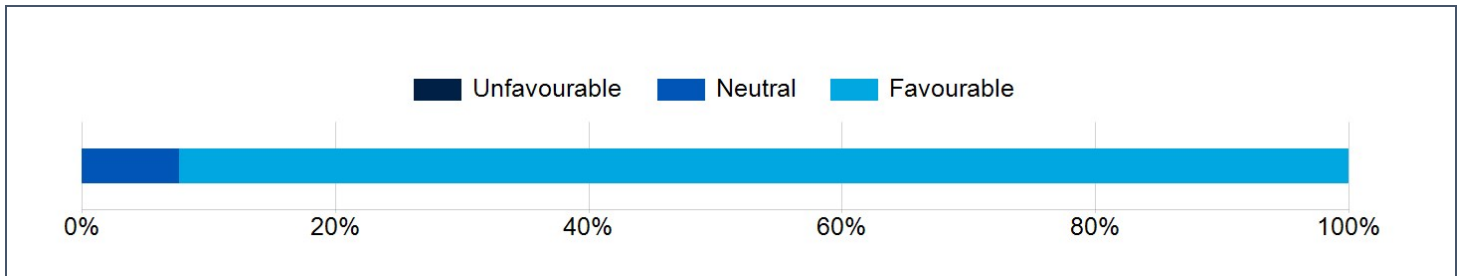
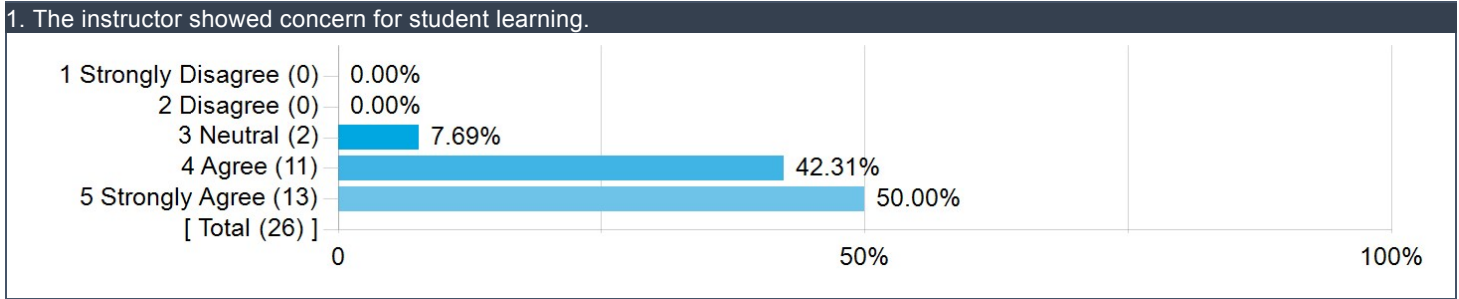
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
69	26	37.68%	88.46%	4.27	0.38

Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.



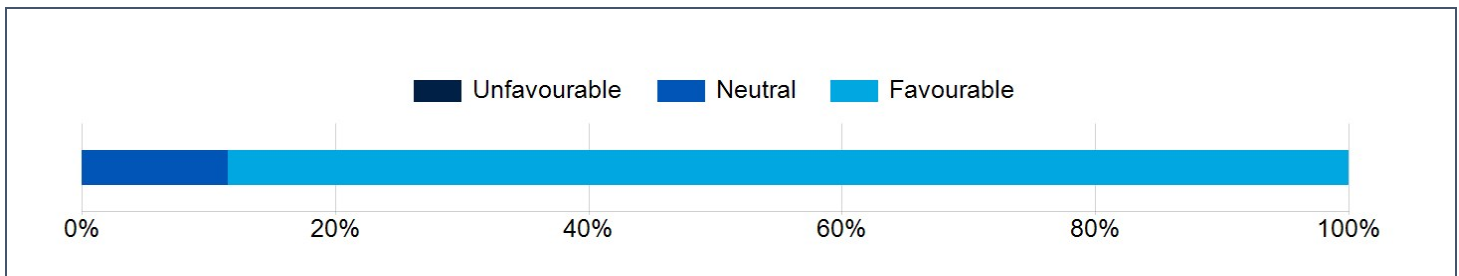
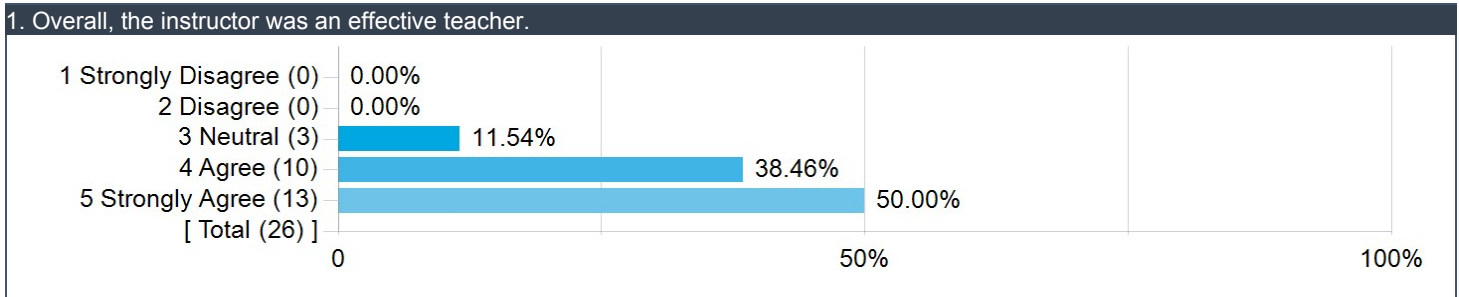
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
69	22	31.88%	72.73%	4.06	0.50

The instructor showed concern for student learning.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
69	26	37.68%	92.31%	4.50	0.32

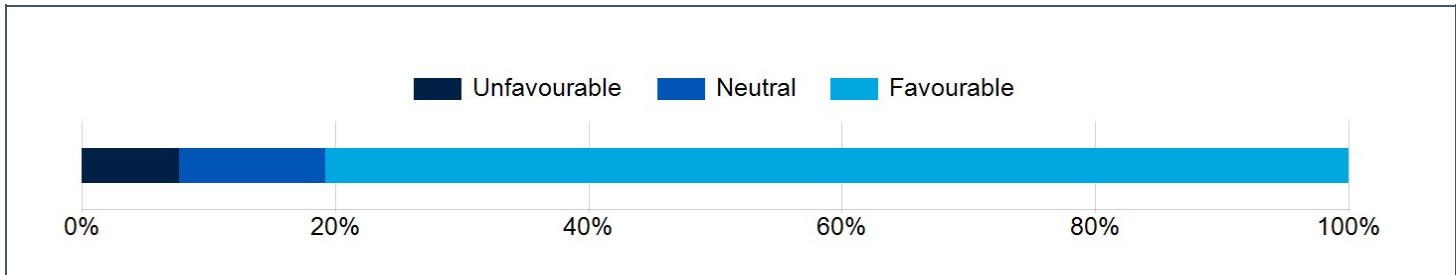
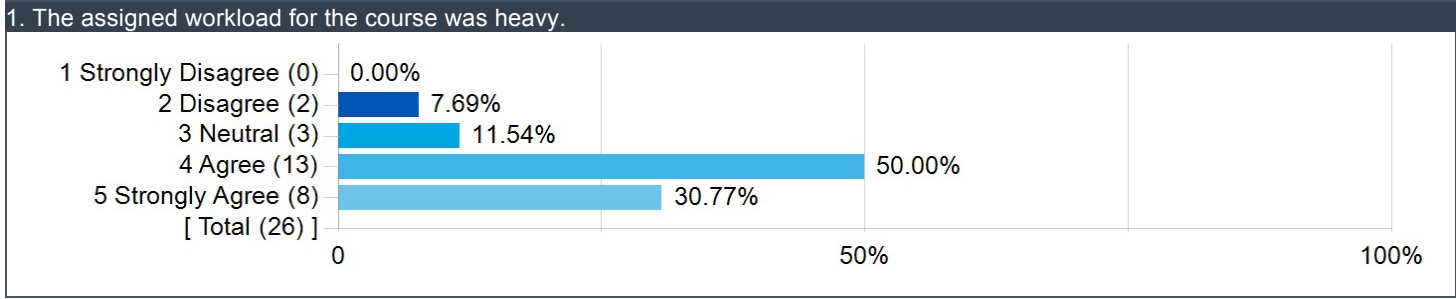
Overall, the instructor was an effective teacher.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
69	26	37.68%	88.46%	4.50	0.35

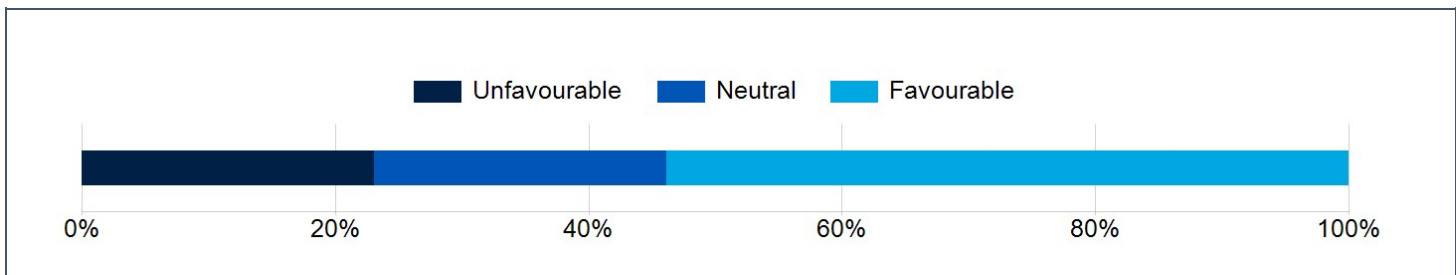
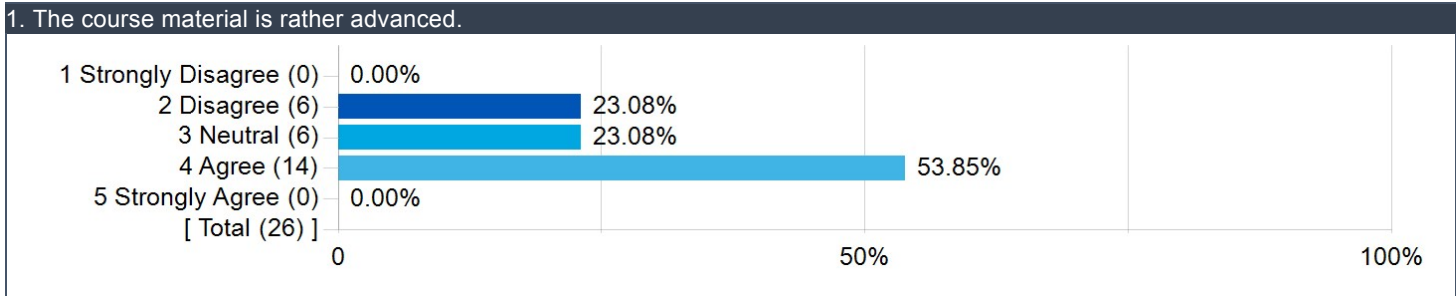
Faculty of Applied Science

The assigned workload for the course was heavy.



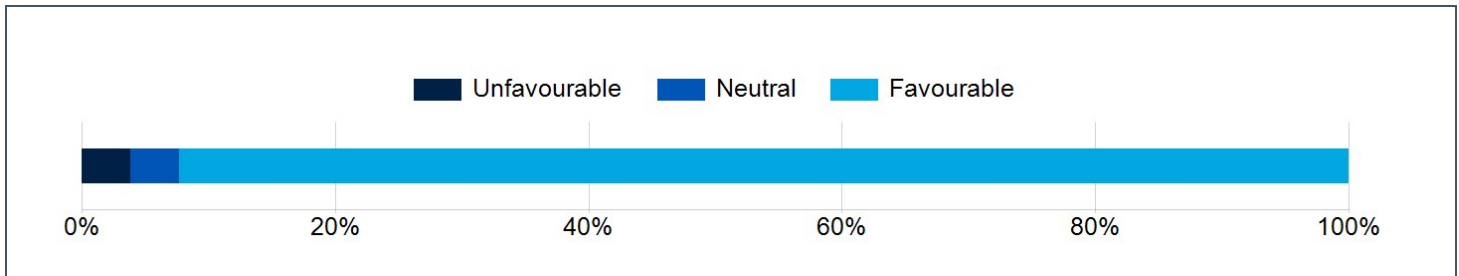
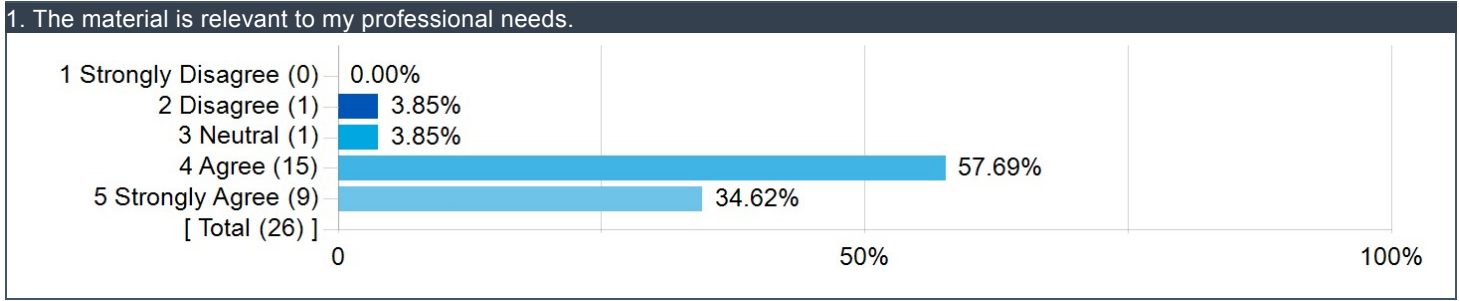
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
69	26	37.68%	80.77%	4.12	0.44

The course material is rather advanced.



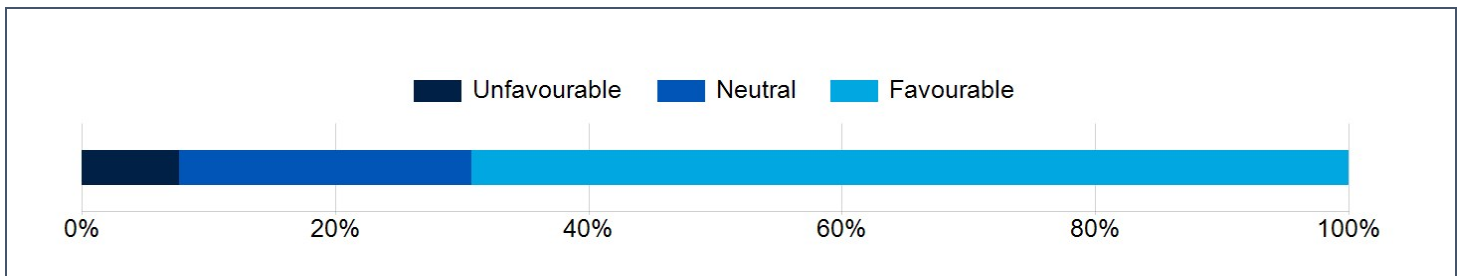
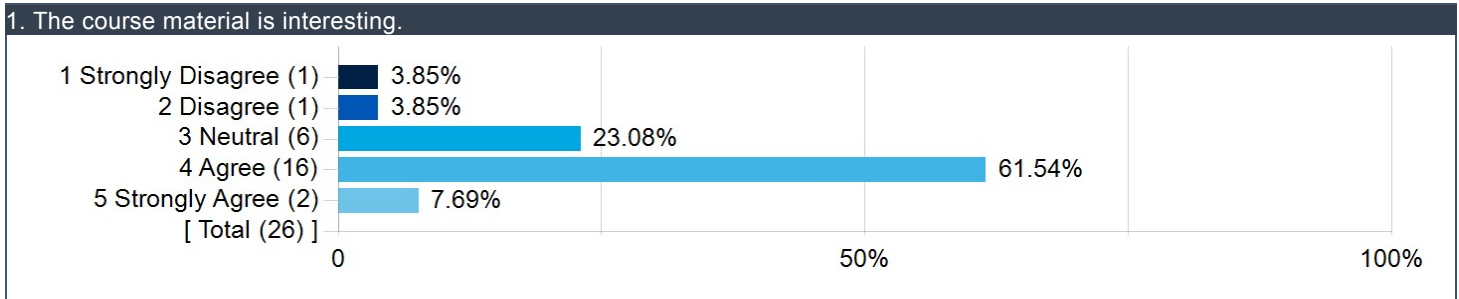
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
69	26	37.68%	53.85%	3.57	0.43

The material is relevant to my professional needs.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
69	26	37.68%	92.31%	4.23	0.33

The course material is interesting.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
69	26	37.68%	69.23%	3.81	0.39

Open Ended Feedback

Comment on the things you appreciated about the course and provide suggestions for improvement.

Comments
 Very well organized course. Some labs are boring and tedious. Workload is very heavy, with labs and reports. Feels like a 6 credit

Comments
course.
Really well organized course, and Dr. Verrett was very helpful and understanding in all possible aspects. I really appreciate how short/formal reports were marked before the next was due so that we were able to learn from mistakes and apply improvements to the next reports.
<p>I appreciate how relevant a lot of the labs are to other 3rd year coursework. However, this would be much more beneficial if the labs took place AFTER the content was introduced in lecture courses. I know this is not always possible but it seems the coordination can be improved:</p> <ul style="list-style-type: none"> -Exp. A: about half the relevant content was covered after the lab. -Exp. B: Hindered settling was covered already in 344, but fluidized bed content was not covered before the lab. -Exp. C: the heated rod was based on content we learned, but the heat exchanger content was not covered yet. <p>(I know not all students performed every lab at the same time, further complicating the coordination. However, the above statements hold true for every student, reflecting how bad the coordination currently is.)</p>
Without first covering the content in lecture, the students are just applying the equations in the lab manual without a deeper understanding of the underlying theory which is not as pedagogically useful. I could easily imagine 344, 373, (and to a lesser extent 351) being structured so the content relevant to the lab would be taught before the lab as the content in these courses is modular and does not build off of previous content.
<p>My main complaint in this course was that I found that there were discrepancies in the way that some lab reports were marked. When comparing marked reports with other groups who had their reports marked by someone different, it was very obvious that one was marked "harder" than the other. It is also frustrating how our major experiments are based off of course material that we learn in the last week of class. It would be much nicer to learn material in class before performing lab experiments with them, as I find the lab manuals are not a good learning resource. For example, in CHBE 365, I found the lab course to be much less stressful as I was very comfortable with the material that I was writing lab reports on. Even in CHBE 362 Experiment C, performing and writing about the Heat Transfer section was very clear since we had learned the foundational concepts in class before going into the lab – it definitely enhanced my learning to perform hands-on experiments after I had a good understanding of the theory. However, for the fluidized bed and heat exchanger labs, I often felt lost during the experiments and like I was learning the material after the fact. Other than these points, the course instructors were very good. Dr. Verrett was a fantastic instructor as usual, and he was always willing to go out of his way to help us out and make sure that we understood everything. I did not correspond with Dr. Ghasvareh as much but she was helpful when we talked to her in the labs. I liked how one of our short reports was changed to be a presentation this term, as I think that presentation skills are very important and we don't tend to get a lot of opportunities to develop them in our other classes.</p>
<p>The experiments were okay to highlight important chemical engineering concepts but my gosh were they ever painfully boring. Compared to the experiments in second year and in the 2nd term of 3rd year (the biotechnology labs) these felt so dry and bland as they possibly could be. A lot more creative thinking could go into these experiments to not make them the most generic thing I could possibly imagine.</p>
<p>Johnathan was a good professor. I was a little unhappy with the amount of marks he took off for what I felt was extremely minor errors (for example we got 60% on our glossary, when were missing 2 variables out of 20+ that were not even used in our calculation template). Felt bad after spending so much time and effort on making it perfect.</p>
<p>Other than that Johnathan was a very chill dude, and was nice to talk to and have around. Good guy.</p>
<p>My biggest complaint of the course (other than the boring experiments, obviously) is the structures of the lab manuals. As someone who takes initiative to complete the templates, it's very annoying when completing the calculation template how many different places we are required to look through in order to find the proper method to do something in order to achieve the matching answer. There are hints posted in the post lab section of the manual, there are hints posted in the theory, there are hints posted in the appendix, in the glossary even (not joking, there is a random necessary formula for Reymond's number in Exp C in the glossary that I could not find anywhere else, check it if you don't believe me), and in the excel sample template.</p>
<p>Multiple people, instructors, TAs, whoever need to sit down and go through and restructure the manuals/templates so students aren't wasting incredible amounts of time completing sample templates.</p>
<p>I like the idea of completing templates. Its an amazing feeling when your answer matches the one in the template, but more structure would make it way less frustrating.</p>
<p>Major improvement from second year labs. The lab manuals are much more concise and easy to understand. Students has a lot of issues last year regarding the instructions in the lab manual, which wasn't the case this time. Also, the TAs provided much clearer explanation this time.</p>
<p>This course really depends on with whom you are paired up as a team. There are just some people who don't do their work properly and on time, which reduced the quality of our entire group. It was very frustrating to deal with such person. This has influenced my learning experience.</p>

Comments
<p>The labs were honestly what was expected, I thought the presentation portion of the course was really nice since we could just present and explain what we got for that experiment. There was some marking inconsistency with the TA's but overall they were prepared and helped us during often long labs.</p>
<p>Overall this course went fairly smoothly. I found the labs more challenging than previous years/second term of 3rd year. At times I felt that the lab manuals lacked important information and clarity. I appreciated that the profs were available to meet to discuss my questions. I also appreciate that they were able to accommodate me when a co-op interview conflicted with my scheduled lab. One suggestion for improvement I have is for the iPeer grading system. I assume that each point we evaluate our group members on are weighted equally, but I feel like quantity and quality of contribution by other group members matter significantly more than the other points (ex: attendance). I also feel like the 4 point grading system does not accurately reflect how I think my group members should be evaluated at times. For example, at times I do not think they fully met expectations, but I also don't feel like they performed poorly enough to warrant a marginal rating (50%) (ex: they deserved ~60% for their quality of contribution). Perhaps a 10 point grading system with some aspects weighted more heavily than others would better reflect my feelings for how I felt my group members performed.</p>
<p>Jonathan Verrett made this course a thousand times easier than anyone could ever make. Clear guidelines and everything is just in order. Piazza was so useful. Always love taking your courses Dr.Verrett and I look up to you a lot. Thanks for the great term!</p>
<p>Being able to learn the material in class before doing labs would be very helpful for understanding the labs. As well rubrics for the presentations and reports so we can see what the breakdown of grades is would allow us to know what to focus on when writing</p>
<p>Jonathan Verrett is an absolute UNIT. The course had a lot of work to go with it, but it was good otherwise. Unfortunately, there was a lot of sitting around during the labs.</p>
<p><3 Jonny V</p>
<p>The professors for this class are very understanding of students and can relate to our workload and this helped quite a bit throughout the term, knowing that our professors were willing and capable to help with any questions or concerns. A large amount of the labs covered material that had yet to be taught in the class making it difficult to draw conclusions on material that we had yet to learn, so maybe further coordination with other class professors would be useful in making more accurate conclusions in our labs. Previously, students were provided rubrics in order for us to write our reports with sufficient information however this year rubrics were not provided and I saw this negatively impact my report grades and quality. I believe in the future the marking rubrics should be made available to students so we are able to write successful reports.</p>
<p>I found the lab course was much more organized this semester than in any of my previous labs in CHBE, which I appreciated a lot. Some of the labs involved a lot of waiting around, which took away some of my interest in them. Overall though, the course was good.</p>

Project Title: **University of British Columbia Course Evaluation 2018 Winter**

Course Audience: **67**
 Responses Received: **24**
 Response Ratio: **35.82%**

Report Comments

Percent Favourable Rating

This is the percentage of respondents who rated the instructor a 4 or 5 (Agree or Strongly Agree).

Interpolated Median

The data collected for Student Evaluations of Teaching (SEoT) are ordinal in nature, with a natural order (from 1 to 5). While the mean may be used as a measure of central tendency for such data, it is not an appropriate or accurate representation of SEoT data (cf. Stark & Freishtat, 2014). The usual measure of central tendency for ordinal data is the median. As a result, we have been reporting the mean and the median for the last several years. Because students more often provide higher ratings (4 or 5), the median is consistently higher than the mean. After considerable thought and data modeling, we now believe that the interpolated median is the best representation of the data, since it takes the frequency distribution into account. Consider the following example:

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Median	3.0	3.0
Interpolated Median	3.2	3.4
Percent Favourable Rating	39%	47%

In this example, the two classes have identical mean (3.2) and median (3.0). However, the instructor in class 2 received 47% favourable (4-5) ratings, compared to 39% for the instructor in class 1. While both have a Median of 3, the Interpolated median values of (3.2 and 3.4), much better reflects the distribution of the scores above and below the median. Furthermore, the interpolated median is better correlated with percent favourable rating; such that an interpolated median of 3.5 on a Likert scale of 1 to 5, corresponds to 50% favourable rating.

Creation Date: **Monday, February 11, 2019**

Dispersion Index

The dispersion Index is a measure of variability suitable for ordinal data (Rampichini, Grilli & Petrucci 2004). This dispersion index has values between zero and 1. A zero dispersion index indicates that all students in the section gave the same rating to the instructor. An index value of 1.0 is obtained when the class splits evenly between the two extreme values (Strongly Disagree & Strongly Agree), a very rare occurrence. In SEoT data at UBC, the index rarely exceeds 0.85, and mostly for evaluations not meeting the minimum recommended response rate.

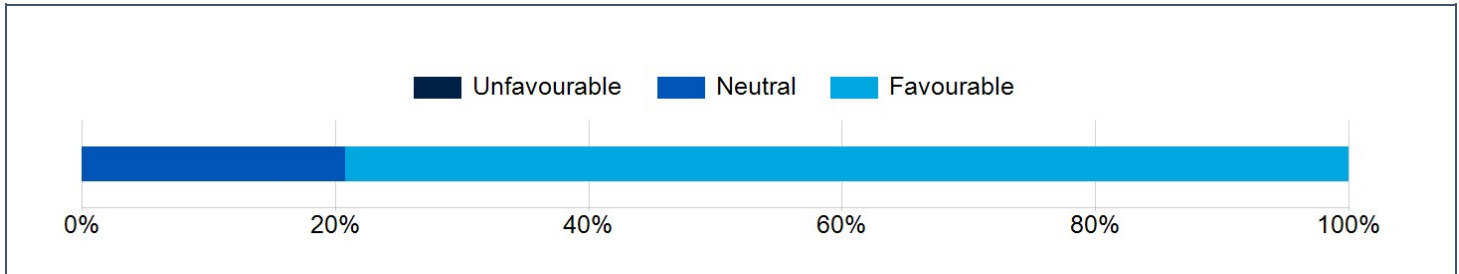
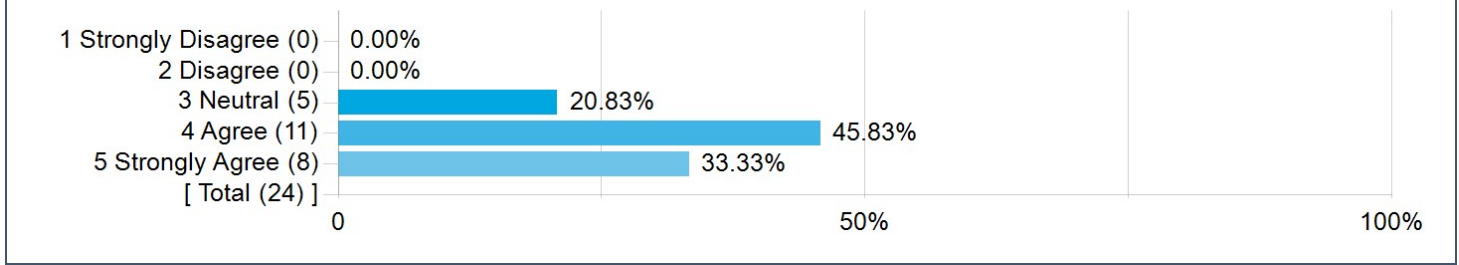
Recommended minimum response rates

Class Size	Recommended Minimum Response Rates based on 80% confidence & ± 10% margin
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20 - 34	55%
35 - 49	40%
50 - 74	35%
75 - 99	25%
100 - 149	20%
150 - 299	15%
300 - 499	10%
> 500	5%

UBC-Wide Questions

The instructor made it clear what students were expected to learn.

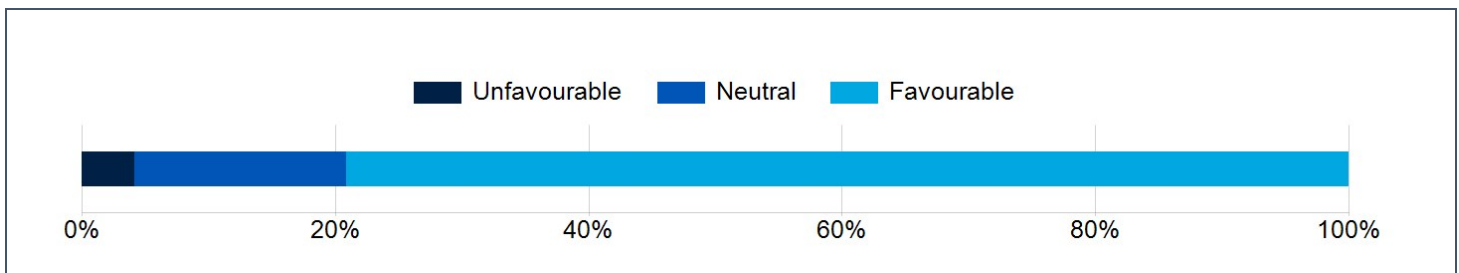
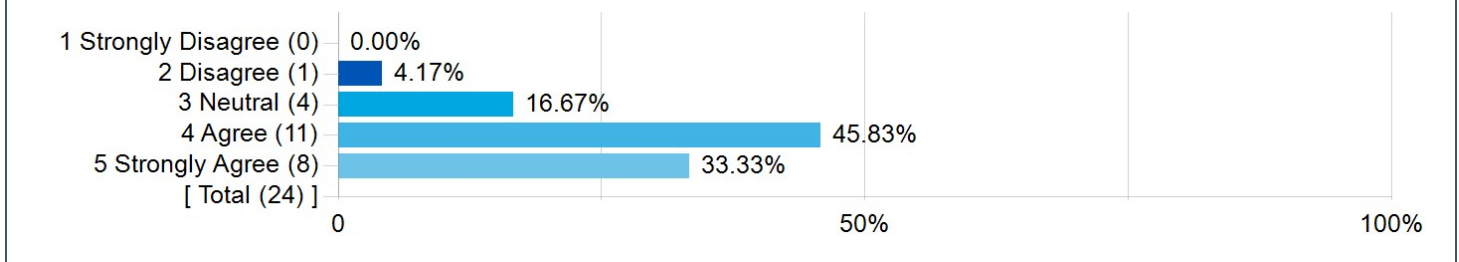
1. The instructor made it clear what students were expected to learn.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
67	24	35.82%	79.17%	4.14	0.39

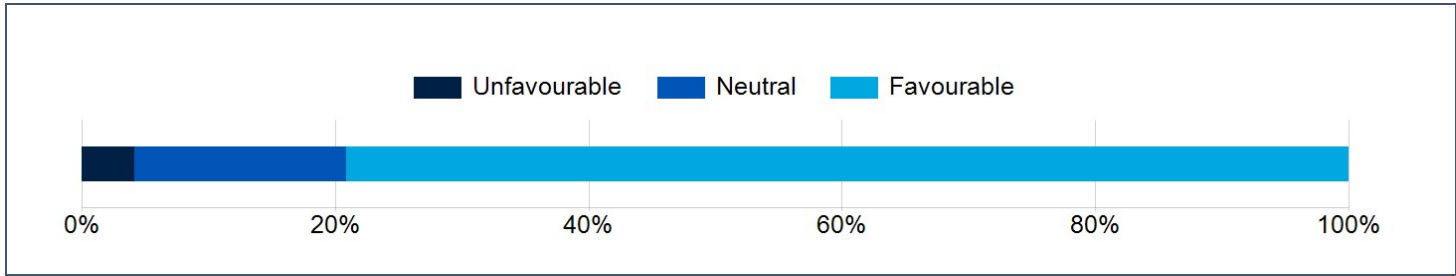
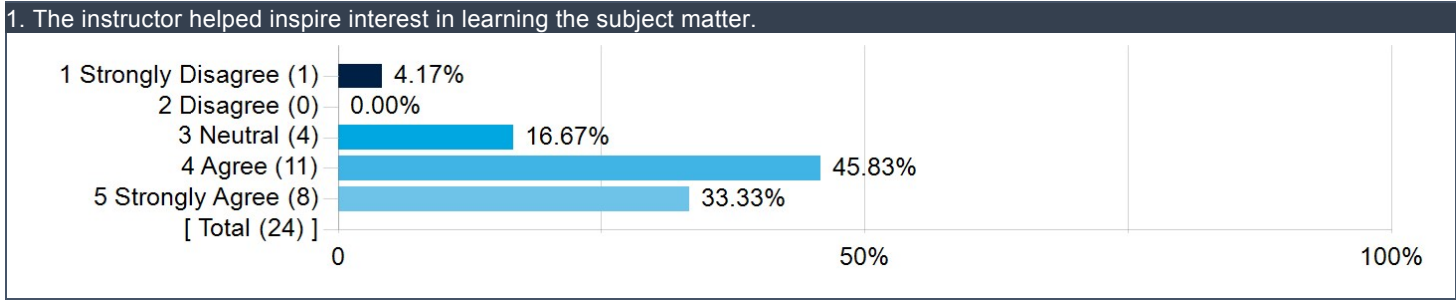
The instructor communicated the subject matter effectively.

1. The instructor communicated the subject matter effectively.



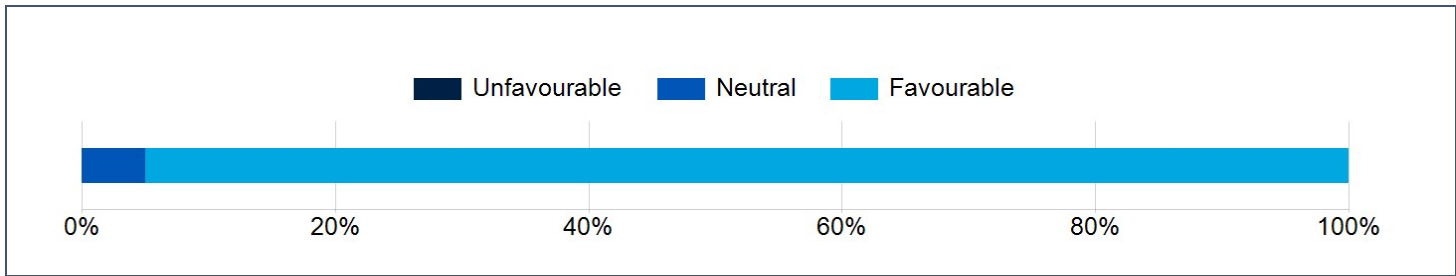
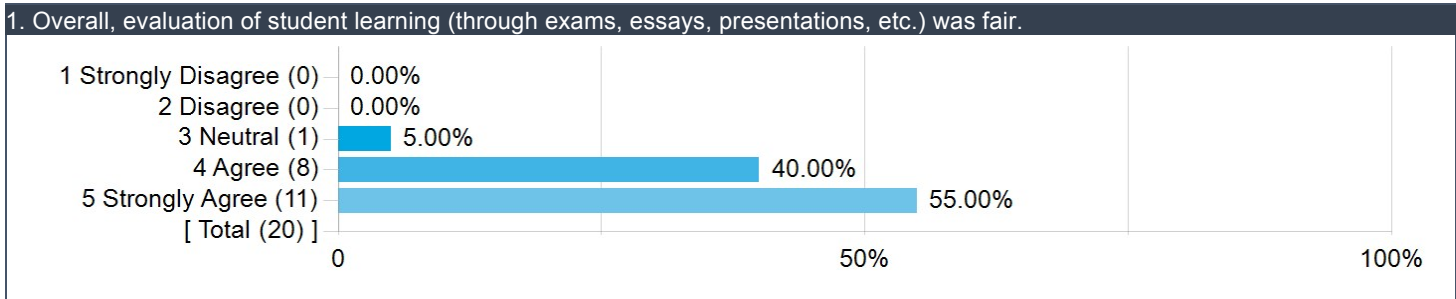
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
67	24	35.82%	79.17%	4.14	0.43

The instructor helped inspire interest in learning the subject matter.



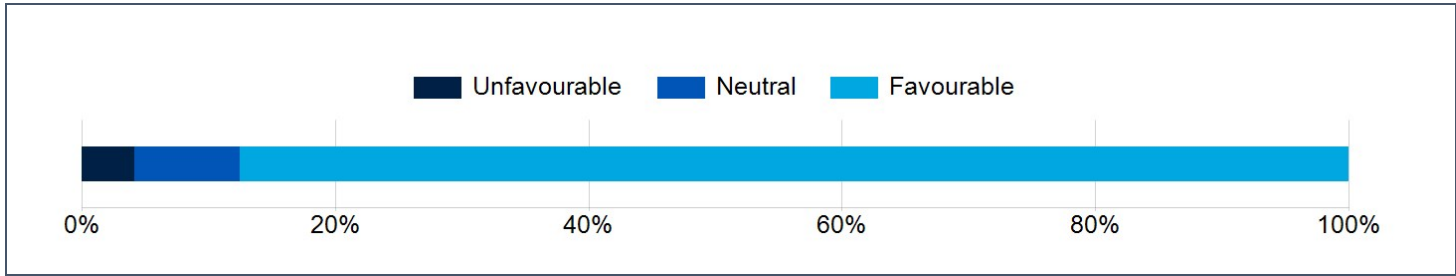
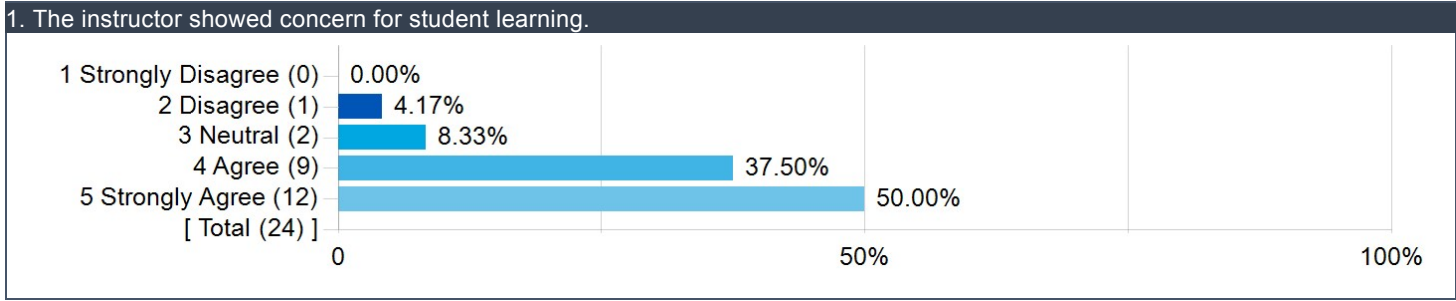
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
67	24	35.82%	79.17%	4.14	0.47

Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.



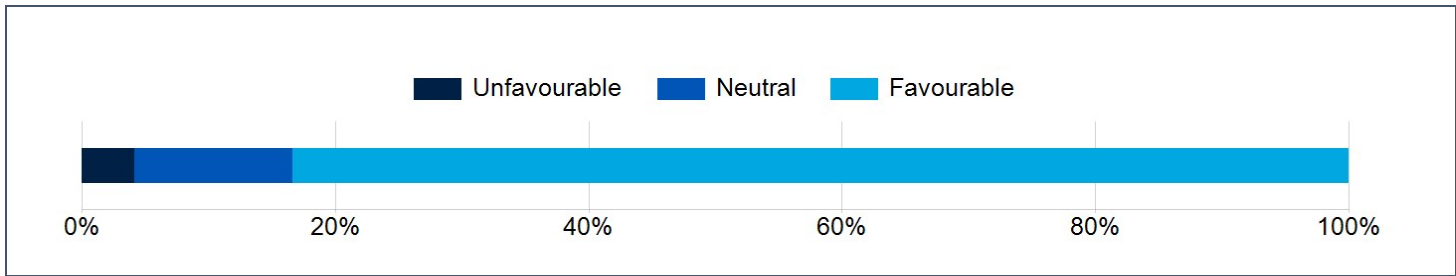
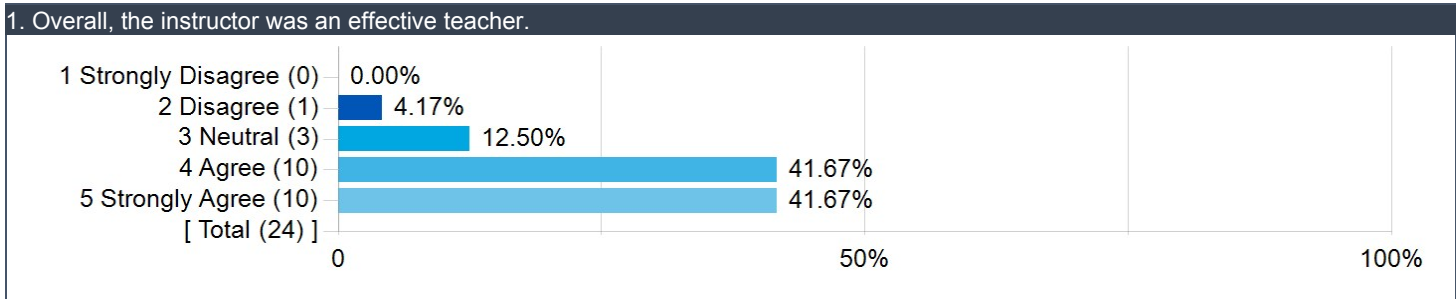
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
67	20	29.85%	95.00%	4.59	0.30

The instructor showed concern for student learning.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
67	24	35.82%	87.50%	4.50	0.40

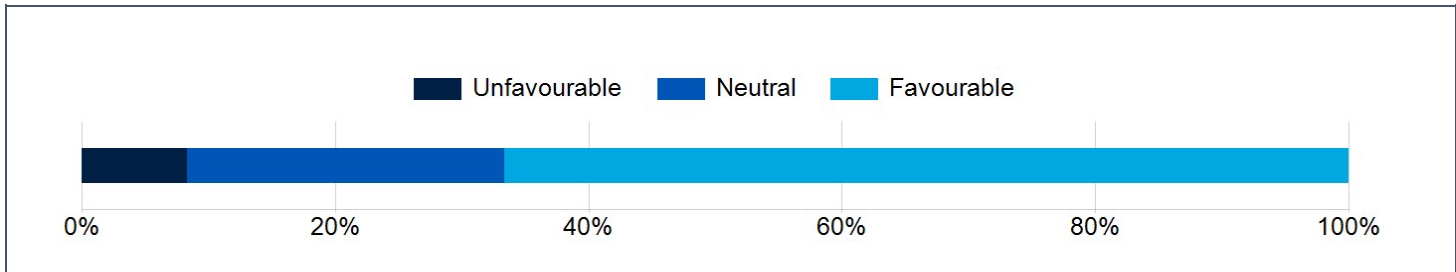
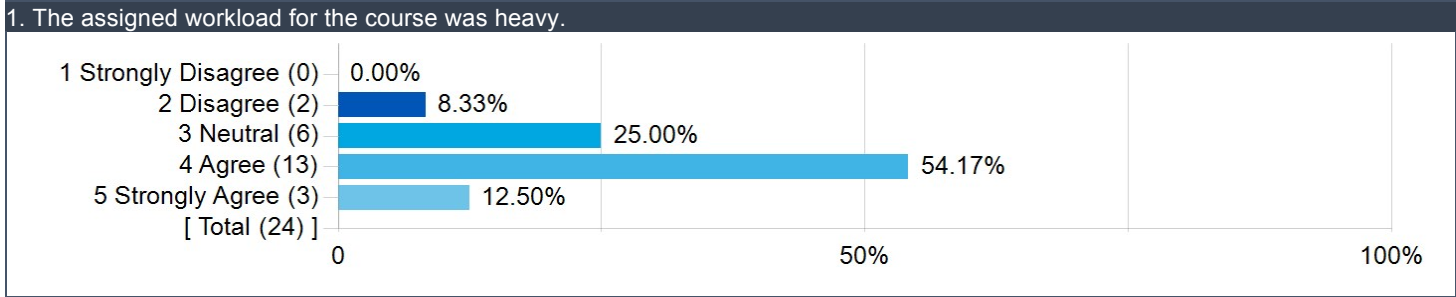
Overall, the instructor was an effective teacher.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
67	24	35.82%	83.33%	4.30	0.42

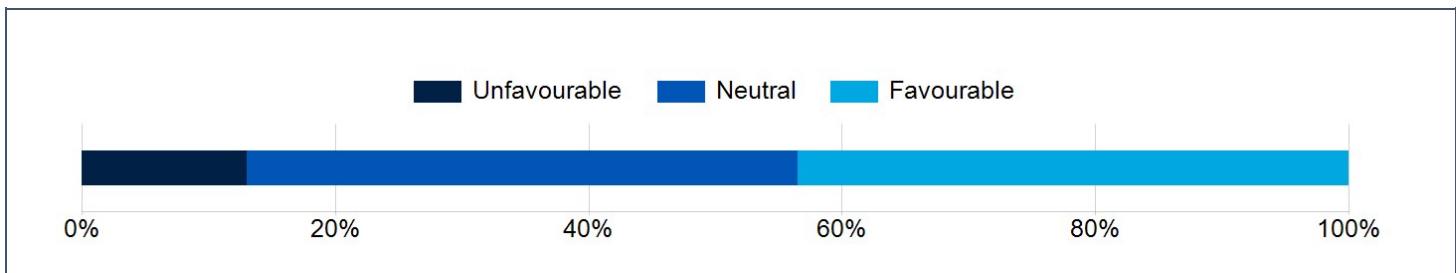
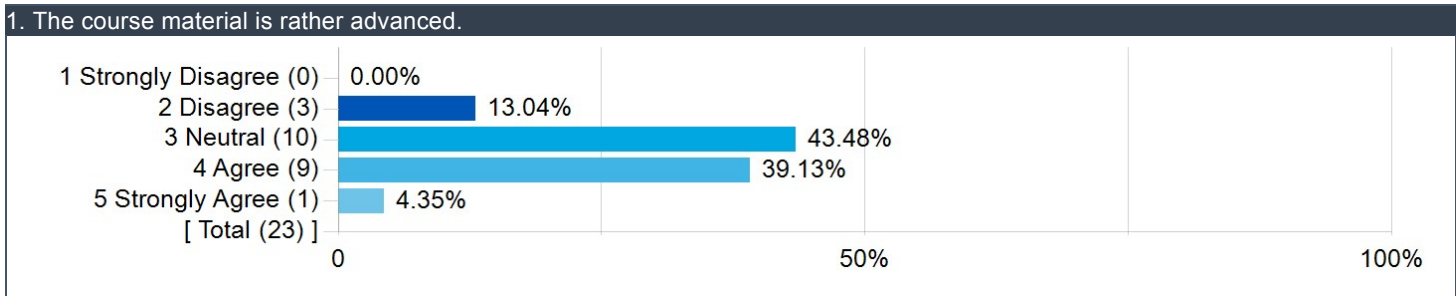
Faculty of Applied Science

The assigned workload for the course was heavy.



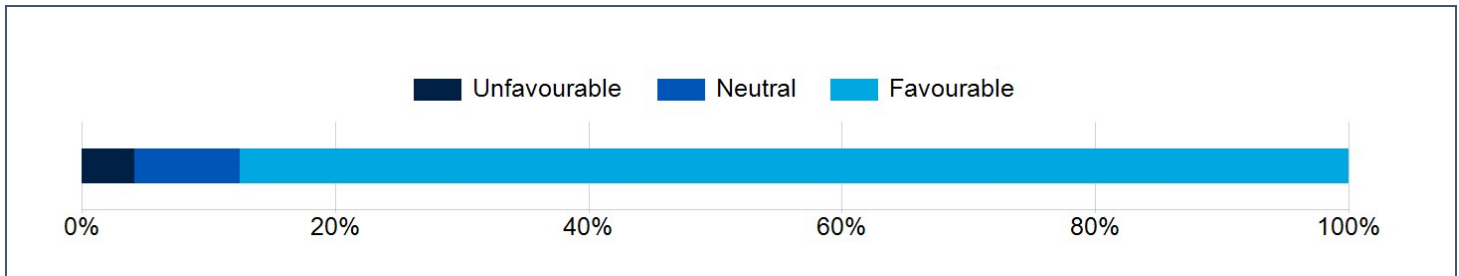
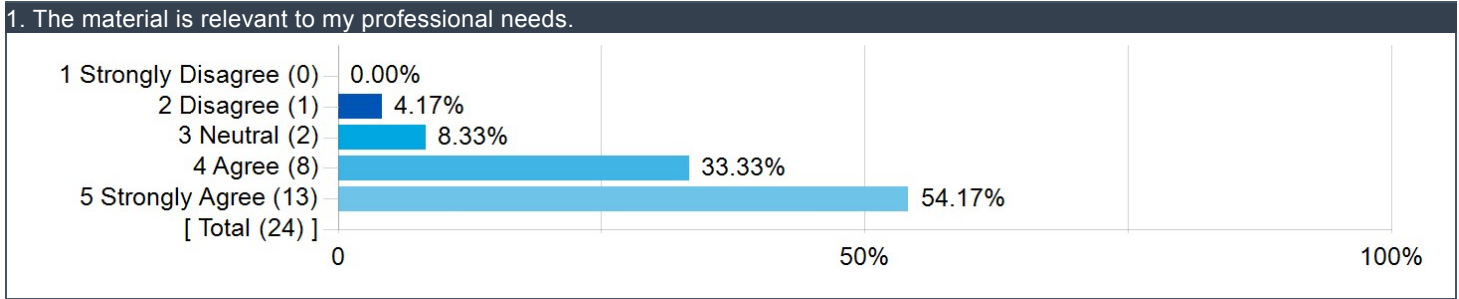
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
67	24	35.82%	66.67%	3.81	0.41

The course material is rather advanced.



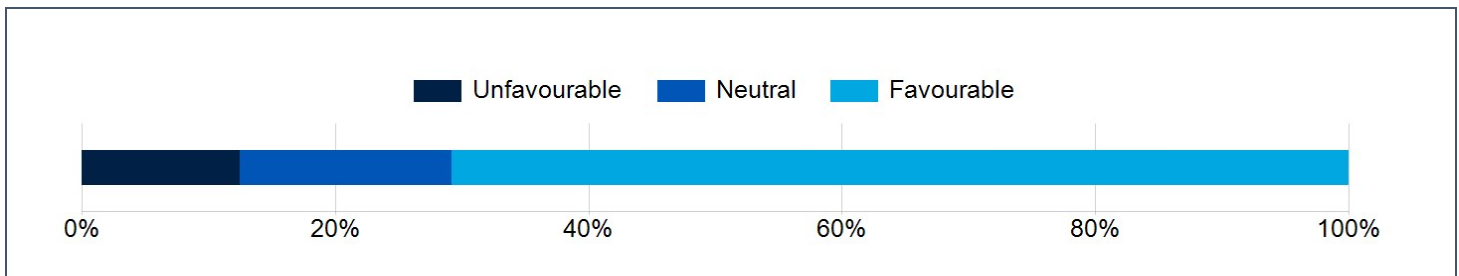
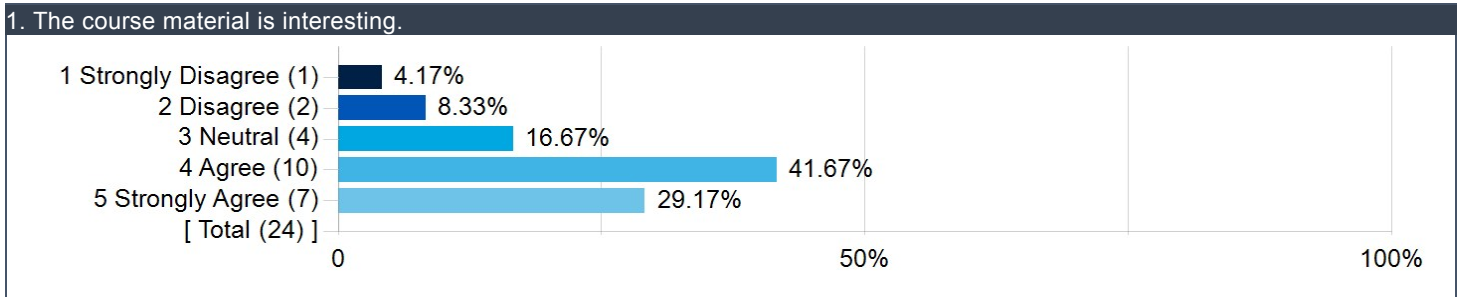
Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
67	23	34.33%	43.48%	3.35	0.40

The material is relevant to my professional needs.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
67	24	35.82%	87.50%	4.58	0.40

The course material is interesting.



Invited Count	Response Count	Response Rate	Favourable	Interpolated Median	Dispersion Index - Ordinal
67	24	35.82%	70.83%	4.00	0.56

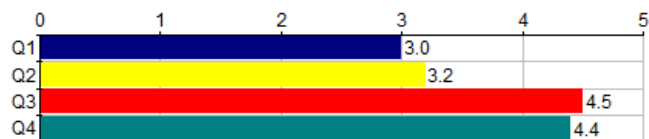
Open Ended Feedback

Comment on the things you appreciated about the course and provide suggestions for improvement.

Comments
the instructor is very responsible
The way the course is plan with the workshops and the lab report help getting a better understanding of the concepts and learn teamwork skills
-
The course was very interesting and relevant. It helped develop useful skills relevant to my future career. Lab manuals were very vague however.
I like the fact that Dr. Verrett replies to each email really fast. Please keep this going in the future.
We improved our lab skills and learned how to use those apparatus. The calculations for these labs can be clearer.
Appreciated: good TAs, clear instructions in the lab manual, quick reply time from instructors Improvement: check in on groups about the team dynamic midway through the semester in person
I enjoyed working with and learning about the different experiments in the lab. Unfortunately, some of the labs were incredibly boring (the extended fin).
The excel files were useful in my learning and understanding the material.
Both the instructors are great! Thanks for helping us students out whenever we asked for help!
Dr. Verrett is awesome. I have noticed improvements in his teaching since last year as well. One of the best instructors in CHBE.
Maybe videos would be helpful before the lab or a better description of experimental setup before going into the lab.

A.1.8 CHBE 376 2017W2 Student Evaluations

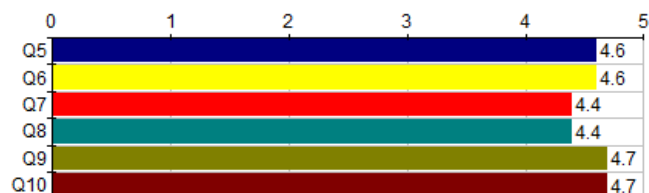
Course: CHBE 376 201 - Computer Flowsheeting and Fluid Properties Estimation	Department: CHBE
Responsible Faculty: Jonathan Verrett	Responses / Expected: 65 / 128 (50.78%)



Course	CHBE 376 - 201										
	Responses					Course					
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev	
Q1	The assigned workload for the course was heavy.	1	16	31	17	0	65	3.0	3	3	.75
Q2	The course material is rather advanced.	0	8	39	15	3	65	3.2	3	3	.71
Q3	The material is relevant to my professional needs.	1	0	3	22	39	65	4.5	5	5	.73
Q4	The course material is interesting.	0	0	5	30	30	65	4.4	4	4,5	.62

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

Category Instructions: Based on a 5-point scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree, please rate your instructor on the following:



University Module	Verrett, Jonathan										
	Responses					Individual					
	SD	D	N	A	SA	N	Mean	Med.	Mode	Std Dev	
Q5	The instructor made it clear what students were expected to learn.	0	0	2	25	38	65	4.6	5	5	.56
Q6	The instructor communicated the subject matter effectively.	0	0	1	26	37	64	4.6	5	5	.53
Q7	The instructor helped inspire interest in learning the subject matter.	0	0	7	25	33	65	4.4	5	5	.67
Q8	Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	0	0	6	25	31	62	4.4	4.5	5	.66
Q9	The instructor showed concern for student learning.	0	0	2	14	49	65	4.7	5	5	.51
Q10	Overall, the instructor was an effective teacher.	0	0	1	17	47	65	4.7	5	5	.49

Responses: [SD] Strongly Disagree=1 [D] Disagree=2 [N] Neutral=3 [A] Agree=4 [SA] Strongly Agree=5

Question:	Comment on the things you appreciated about the course and provide suggestions for improvement.
Response Rate:	61.54% (40 of 65)
1	course is in a very good order and taught at a good pace
2	Would like to see a real world example of an Aspen flowsheet
3	Very useful course in chemical engineering.
4	Very practical course. Dr. Verrett is an excellent professor.
5	Very much appreciated all the practice we got for the course, especially in a course like this one, practice is the main form of learning
6	Very engaging in class and helpful with projects, office hours, extensions, etc
7	Thorough exploration of a program used in industry. No particular complaints.
8	This course is extremely interactive, which I really enjoy. The examples gone over in lecture are very instructive on how to use Aspen and how to simulate on Aspen.
9	The in class examples helped to understand the material Clarify the term project requirements better and maybe given a list of possible processes to simulate to avoid students from picking a process that takes an excessive amount of time to get it to accurately simulate in aspen
10	The course material was well presented
11	The course materials are very organized and guides students on how to use Aspen through the detailed step by step screenshots. I think the theory section during lectures can be made into screencasts ti be watched so before lecture so that the instructor can go through more examples in class.
12	The bonus assignments in class really helped my learning
13	The assignments and tutorials were fantastic. I would just suggest maybe incorporating a small 15-20% midterm to take some weight off of the final.
14	Marking for assignments seemed inconsistent at times.

15	Make the project rubric/criteria more clear in what is expected and what can be substituted/compensated for should things go awry.
16	Loved the in class activities, they were super helpful to my learning.
17	It was very easy to learn Aspen in the style this course was taught, with the instructor going through examples with us in class that we follow along with. CHBE 230 should be taught this way, instead of the way it is currently taught.
18	I liked that the lectures focused mostly on examples and the material was communicated very effectively.
19	I liked that the course merged what we were learning in school with industrial processes. I don't think that a final exam is the best way to test one's cumulative understanding of the course - perhaps making the term projects individual rather than group-based could be a substitute for a final exam
20	I liked that we did an exercise almost every class. It really helped solidify the information presented in the lecture portion.
21	I liked the tutorials which were pretty good to cement our understanding. Maybe the grading system should be changed because the TAs mark it as all or nothing. Maybe user defined models should be included in the course.
22	I liked the structure of the classes and tutorials. I liked how the classes were based on actively building simulations along with the prof, it was much more conducive to learning than just sitting and listening to a lecture. I liked how the tutorials (At least the first few) had clear instructions, but left some parts for us to think about and complete on our own. It was a good balance of structure and free problem-solving. I appreciated a term project instead of a midterm exam. Not everyone is best evaluated by exams, so having a term project instead of a midterm, but also a final exam, gives different types of students a chance to show their knowledge and skills. Some of the tutorial questions were too complicated to complete and submit in the given time. Jonathan tries his best to help everyone, but having a TA, or even just a top student from that class, sharing the work of assisting in tutorials would be really helpful.
23	I liked how this course has a very tangible connection to techniques and skills that are needed in real-world industry.
24	I liked all the in class practice and the way the tutorials were setup. The take home project was quite difficult and it would've been nice to have a help session.
25	I learned how to use the Aspen Plus software, it's pretty cool I think the work load was good and the tutorials/class problems were useful
26	I appreciated how the multiple examples set up for each block of the course had thorough explanations, and the bonus assignments acted as very good regular practice for each section of the course.
27	I appreciated the worked examples and posting solved bkps it allowed to to focus on what the professor was talking about instead of having to figure out what's going on in Aspen
28	I appreciate how the modules of this course are well defined and the exercises reflect on what we learned well. The guided exercises are good for learning the course as well.
29	I appreciated how the course improved my understanding of the considerations taken into designing real operations. The workload was reasonable and interesting.
30	I appreciated how the course ties all the knowledge we learned from previous courses and teaches us how to apply it in order to simulate an industrial chemical process. Before taking this course, everything we learned seemed somewhat disjoint from each other.
31	Highly appreciated the interactive nature of the lectures; encouraged to follow along in Aspen, taught for only half the lecture then worked on relevant exercises for half the lecture. The course was very hands on. Excellent teaching. Dr Verrett made it clear what we needed to know for the exam and tutorials and assignments were relevant. Lecture slides were clear and easy to follow.
32	Great assignments
33	Good stuffs: - review sessions - practice problems in class Suggestions: - More time to work on in-class problems if possible - More helpful TAs during tutorial sessions, it must be tiring for you to constantly move from one class to another as well.
34	Good practice in tutorials, easy to follow along in lecture, but I'm pretty scared for final exam because we've only done 2 practice ...
35	Good foundation/introduction course for this software Course is very structured and organized; it is easy to follow if you have to miss classes, which I think is a very relevant criteria for classes nowadays
36	Focus more on the economics
37	Excellent instruction and interesting material
38	Examples provided in class are helpful to go back to and re-learn PDF Lecture Block files are helpful, but sometimes missing information and explanation Exercises done in class help to see student's progress in the course
39	Assignments were very long.
40	A flipped class room would for sure be a better model for this course - in my opinion. I liked learning Aspen and how feel it has synthesized my knowledge of school well.

Faculty:	Verrett, Jonathan
Question:	Comment on what the instructor has done especially well in teaching the course and what he/she might do to improve it.
Response Rate:	70.77% (46 of 65)
1	response questions quickly and really helpful at all time
2	What a fantastic prof. If this class was slightly later in the day I wouldn't ever skip. Classes are informative and it truly shows that he cares about his students. I have never left his office not knowing the answer to my questions. Would do the class over again just for him. Very receptive to questions and suggestions and always ready to help, approachable
3	Excellent communicator, we know what is expected of us and when deadlines are Enthusiastic about the material

4	Very good and helping individual students with troubleshooting. Also very accessible for help outside of class.
5	The way the class was formatted was amazing. I'm thrilled with how it went. Sometimes I found the homework was significantly harder than what was done in class, but aside from that it was great.
6	The instructor put extra effort in conveying the material clearly through bonus questions in every single class for understanding the material effectively. His immense efforts stands out in terms of his dedication towards learning experience by students.
7	The entire class was structured well and executed well
8	Taught the material very well in a way everyone can understand
9	Professor Verret cares for students learning and always makes an effort to clarify students are following. He outlines expectations clearly. He encourages a deep understanding in students not simply answering questions but linking the questions to previous learnings and challenging the student to think of the solution themselves under his guidance. Professor Verret goes out of his way to answer students questions, in person and by email. He is constantly available in his office and graciously helps students anytime. Professor Verret bonded with students learning first names of students. He knows the curriculum well and facilitates a deep and enjoyable understanding of course material.
10	Pointed out specifically the key features/uses of each unit/feature to help students consolidate the information. His continuous request for feedback made a good impression on me since waiting for the term-end course surveys doesn't help students who are currently having difficulty. I also appreciate how willing and patient he was with helping students.
11	Overall teaching was good, but only one thing might be improved, which is more emphasis on Fortran statements.
12	Lectures are very straightforward, well use of slides and in class activities (Bonus)
13	Lecture format is pretty good. It would be better to have ipeer evaluations for group members for assg/tutorials and term project.
14	Jonathan was a good teacher, his slides and examples were very clear
15	Jonathan is always kind and non-judgmental. He takes time to help you patiently. He makes sure to give us a lot of hands on practice. Occasionally we covered something that hadn't yet been covered in our unit operations class which was a bit confusing so perhaps a little more communication with Tony.
16	Jonathan has been an amazing professor. He is always available for the students and maintain an open door policy if the students have concerns. Not much improvement is required of him! He continuously asks during lectures if the students are following and if they need more time, as well as provides students multiple opportunities to give him feedback on the course. Such a great professor!
17	Jonathan Verrett has consistently gone above and beyond in this course, dedicating much of his time to his students learning, trying to help solve problems with them to create a safe and effective learning environment.
18	Jonathan Verrett is very concerned for students' learning and he is quite easily available for questions and help. The course was very interesting and well-done. I appreciate how he would go through the simulation with us at the same time.
19	Jonathan Verret is a great example for a excellent UBC professor. So far in my 4 years at UBC, I have not seen many like Jonathan Verret. He truly cares about the students and their learning.
20	Instructor was incredibly helpful in all aspects of the course, very approachable and knowledgeable.
21	Instructor was always available for questions about the material. In class examples were very useful.
22	I would suggest for the Calculator Block/Optimization section of the course to have more examples and more in depth explanations because that was probably the most difficult section.
23	I love you.
24	His lecture notes were very well organized and did a good job at helping student. it was a great semester jonathan! :)
25	He's very approachable and he's always happy to answer questions whenever I get stuck.
26	I've emailed him a couple of times and he doesn't take more than 24 hrs to reply
27	He made himself very available to students for questions and office hours.
28	He explains things very clearly. He could slow down a little bit when going through examples.
29	He actually cares a lot about his students. He is always willing to adapt his course to better help our learning. He is always available to answer our questions and is super fast at replying to us on Piazza. He has done a great job in teaching courses to us for the first time. One of the best profs in CHBE for sure.
30	Great job of providing many relevant examples. Good work: - Incorporating in-class problems where students can ask problems. - Setting up piazza - Showing how to setup flowsheets and specifications
31	Good -Doesn't just feed us answers to our questions, rather helps us arrive at the conclusion on our own -Realistic and flexible when it comes to goals and time constraints -Values problem-solving, and other transferable skills over just getting the answer -accessible when we need help or have questions Needs Improvement : -Nothing I can think of!
32	Excellent communication; answered questions effectively; encouraged hands on learning
33	Examples are very thorough. Understands the material very well and can answer questions.
34	Everything was done especially well! Jonathon cares so much about his student learning and always make sure we have all the resources we need to succeed! His lectures are very interesting and easy to follow along! The inclass activities are very helpful as well and give us a chance to practise what we learn in that class! He is the best professor at ubc in my opinion!
35	Easy to contact and quick to respond. Overall cool dude that made the course enjoyable

36	Dr. Verrett is very good at engaging students and enforcing topics learned in class with activities. The tutorials are very helpful, but the difficulty level fluctuates between assignments/tutorials, which makes it hard to anticipate how much time is needed to work on them.
37	Dr. Verrett taught the course at a good pace. He answered questions clearly and made the material interesting. Thank you for your hard work!
38	Dr. Verrett did a good job of teaching the material.
39	Dr. Verrett was a great prof as usual. He always shows support for students, knows almost all of them by name, and is flexible with the needs of the students. He did a really good job teaching this course.
40	Dr. Verrett was an excellent instructor. The notes he provided were comprehensive and organized, and were very useful in helping me learn the course material. He was very engaging in class, and I learned a lot after every lecture. We were provided with several practice problems every lecture, and Dr. Verrett always posted what he went through in-class so that we could catch up if we missed a class. This was something I really appreciated as a commuter. Dr. Verrett was also extremely responsive on Piazza and was always willing to help out students whenever he was available.
41	Dr. Verrett is very approachable and is very helpful to students. He takes feedbacks well and cares about student learning. I think he can improve the course by making screencasts for the theory section of the lectures that students can watch before lectures. This will allow more time to go through more problems during lecture, since Aspen best learnt by going through more problems.
42	Answering questions outside of class with Piazza doesn't really help. Choose a different platform? Lectures are well-understood, questions are answered clearly in class
43	Always there for support, very helpful
44	Always available to help! Never got turned away by him when I showed up unannounced to his office. Really appreciated his enthusiasm - one of the better teachers that I've had in university.
45	- Always responding quickly - Organizes the course and each lecture well - Cares about student's learning
46	+ Active learning in class + Dr Verrett is an extremely interesting lecturer - Final project is a fairer basis for evaluation than project+final.

A.1.9 CHBE 376 2018W2 Student Evaluations

Project Title: 2018W2 UBC Student Evaluation of Teaching

Course Audience: 129
Responses Received: 70
Response Ratio: 54.26%

Report Comments**Recommended Minimum Response Rates**

Class Size	Recommended Minimum Response Rates based on 80% confidence & $\pm 10\%$ margin
< 10	75%
11 - 19	65%
20 - 34	55%
35 - 49	40%
50 - 74	35%
75 - 99	25%
100 - 149	20%
150 - 299	15%
300 - 499	10%
> 500	5%

Creation Date: **Wednesday, June 5, 2019**

University Module Questions

University Module Questions

Question	N	n	SD	D	N	A	SA	N/A	IM	DI	Mean	STDEV
The instructor made it clear what students were expected to learn.	129	70	0	0	0	8	62	0	4.94	0.10	4.89	0.32
The instructor communicated the subject matter effectively.	129	70	0	0	0	9	61	0	4.93	0.11	4.87	0.34
The instructor helped inspire interest in learning the subject matter.	129	69	0	0	4	15	50	0	4.81	0.25	4.67	0.59
Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	129	70	0	2	2	13	47	6	4.82	0.28	4.64	0.70
The instructor showed concern for student learning.	129	70	0	0	0	13	57	0	4.89	0.15	4.81	0.39
Overall, the instructor was an effective teacher.	129	70	0	0	0	8	62	0	4.94	0.10	4.89	0.32

Question	%Favourable
The instructor made it clear what students were expected to learn.	100.00%
The instructor communicated the subject matter effectively.	100.00%
The instructor helped inspire interest in learning the subject matter.	94.20%
Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	93.75%
The instructor showed concern for student learning.	100.00%
Overall, the instructor was an effective teacher.	100.00%

Faculty Questions

Course Questions

Question	N	n	SD	D	N	A	SA	N/A	IM	DI	Mean	STDEV
The assigned workload for the course was heavy.	129	69	4	14	35	16	0	0	2.97	0.43	2.91	0.82
The course material is rather advanced.	129	68	1	9	36	22	0	0	3.17	0.36	3.16	0.70
The material is relevant to my professional needs.	129	68	1	1	3	16	47	0	4.78	0.32	4.57	0.78
The course material is interesting.	129	68	0	2	6	28	32	0	4.43	0.38	4.32	0.76

Question	%Favourable
The assigned workload for the course was heavy.	23.19%
The course material is rather advanced.	32.35%
The material is relevant to my professional needs.	92.65%
The course material is interesting.	88.24%

Open ended feedback

Comment on what the instructor has done especially well in teaching the course and what he/she might do to improve it.

Comments
An instructor who genuinely seems to care about student learning. Slides are straightforward and easy to follow.
The instructor held classes in a very effective manner. I liked the use of lots of work time in class, through the in class examples, bonus assignments, and tutorial assignments. The instructor also always laid out things in a very neat and organized manner, and the use of a time table on the front of the canvas page was very helpful. The whole canvas page for this course was well laid out, filled with lots of useful information, and very helpful. Classes can sometimes be a little dry, however, especially when covering material that seems somewhat more technical than what this class handles.
Dr. Verrett answers email really fast and gives very helpful suggestions. It would be better if he can go through the course material a bit slower in class since it is always really hard to follow up with him in class.
Jonathan Verrett is by far the best professor that I have had in my 4 years at UBC. He puts in the effort to know each student (which is not an easy task) and genuinely cares that the students learn the material. Not only that but he is also very effective at teaching the material and will always go at a pace which we can understand everything fully. On top of that, he utilizes technology effectively within the classroom which makes it easier on the students.
He was fair, explained things well and seemed to care about teaching. I'm not sure what he could improve on.
While we were learning specific blocks, I did not understand why we would use them. Especially the columns, I did not understand in class and had to figure out in the tutorial. I understand the bases of the columns, but I am still missing the parts about the heavys, lights, and ratios. I understand the class is about aspen but most of the students did not know what a column is, so simulating one did not mean much, it took a lot to learn. I would like some more explanation about what these are, where they could be used.
good
Dr.Verrett is one of the most dedicated teachers in CHBE hands down. He cares so much about student learning and if we actually understand the materials. He treats us like adults and takes our inputs or criticism seriously unlike other teachers. He is always open to feedback and is very approachable. Before taking this course, I was so worried that I am gonna fail it, but after knowing that he is teaching this course I felt like I was gonna cruise through it because he is an amazing teacher. I wish he teaches every single course in CHBE :) Thanks Dr.Verrett, you are someone I aspire to be :)
Great lecture style and reasonable assignments
Creating the bonuses as kind of check points to make sure everyone understands that block and what is expected to be applied from it. The length of the tutorials/assignments were reasonable and of a good difficulty level.
The instructor has done an excellent job teaching this course, especially for a programming course that we have no understanding of before doing it. The assignments and tutorials are marked pretty harsh and we have to provide ~30 images in order to show how we got to our final answer. It would have been more beneficial if we also went over some more in depth example questions in the class to get a better understanding of everything that Aspen is capable of, but I understand the time crunch. Overall it was a great course, and one of my favourites.
Jonathan has been a fantastic instructor this semester. The course is very well organized, the material was well delivered, and the homework/tutorials helped immensely with our learning.
Dr.Verrett is extremely organized, directs the course well and answers questions effectively.
He is always available to offer help when needed
You are a great instructor and I loved the bonuses.
The instructor is very effective and helpful! Overall great professor, very happy to be taught by him.
Best course ever.
Dr. Verrett is a great instructor who really cares about student learning. The course was really well taught and enjoyable. Definitely my favourite prof in CHBE and favourite course this semester!

Comments
Very well structured and prepared.
The way that the course is structured (assignments, tutorials and homework) is very systematic; this course is a perfect example of how an engineering course should be structured. Jonny V also shows great concern for student learning, being very prompt with email queries and Piazza questions.
Jonathan Verrett is an overall outstanding instructor. Through all my three years at UBC, he is my far the most dedicated and effective instructor that I have ever had. He puts in the extra effort to learn student's names, forming real relationships that make students feel safe asking questions or making mistakes in class. His class formats are very interactive and focused on LEARNING, which I feel many other classes are lacking. He is so knowledgeable in this course and is able to help students excel in all of their individual projects. I don't think that I would be as inspired to learn Aspen or be as comfortable with the program if it wasn't for Jonathan. I cannot speak more highly of him as an instructor and I think he has the ability to make CHBE a better department overall. Everyone in this class wishes that other courses in CHBE were taught as effectively as this one.
Done well: Chose a good room for lectures, went slow enough for us to follow along, emailed back promptly, very knowledgeable when answering questions, very accomodating for exam room and laptop troubles
Improve: Have TAs that are more knowledgeable because Tutorials are stressful with the time crunch and waiting for you to be free so we can ask a question
-
Lots of attention to student questions, setting up a piazza is immensely helpful and appreciated
Provided an incentive for students to stay on top of the material with bonus material. No need to improve in any part of the course. It was well taught and a pleasure to participate in
This professor is probably one of the best I have had during my undergrad. He shows legitimate concern for students, is open to suggestions throughout the semester, is understanding of our course load, and presents the material in a way that allows for higher understanding. He provides a significant amount of feedback throughout the semester and has constructed the syllabus so that we can learn while being encouraged to follow along in class and learn the techniques immediately after they have been taught. He is always available to ask questions in his office and responds to e-mails quickly allowing for us to voice our concerns and receive a response. This professor works hard throughout the semester to ensure that we have the best possible experience while gaining an understanding of the course material. I thoroughly enjoy this class simply because of the professor and hope that he will receive more placements in future courses and continues to succeed within the department.
Dr. Verrett is an extremely effective instructor. He has exceptional communication skills and shows great care to student learning. He is always open to suggestions and improves the course flow accordingly. The courses he teaches are constantly being improved over the years through student feedback. He always tries to make time for students and addresses their concerns. His passion and skills in teaching are highly appreciated by students.
Very helpful when asked questions.
Dr. Verrett presented the course material perfectly, his slides are very detailed and he follows them to a T at a very reasonable pace. He also asks if everyone is with him every few minutes and is very willing to give more time if the class is moving slower than he is. He also emphasizes learning and does not focus as much on grades which is a nice change. Every course that Jonathan teaches is so much more enjoyable and motivating than any other course I've taken, this school needs more professors like Dr. Verrett.
The whole class was structured very well. Having interactive as well as regular lecture portions of the class periods made it very simple to catch onto concepts taught. He makes the course material interesting and it is easy to pay attention for the hour and a half lectures with the class style. I have had Jonathan Verrett for multiple courses over my CHBE degree and every time the class is amazing. He is a great professor who cares about the students and I am always so thrilled when I find out he is the professor in a class I am taking.
The instructor is incredible. He cares about our learning, answers questions and concerns promptly, students feel comfortable approaching him with problems, and he communicates effectively. Honestly nothing to improve upon, a great teacher!!
Professor Verrett is the best professor in CHBE and potentially at UBC. His teaching style, concern for students and explanation of course content is incredible.
Jonathan has been the most effective instructor I have been taught by so far. He sparks interest in the course by discussing various real world applications to the ASPEN software, which by itself is very fun to learn! He gives well-thought of instructions that are very clear. Overall makes this course fun and very interactive. His bonus assignments have for sure helped me and my peers stay in track with the material as it is sometimes alot to grasp (long lectures) but the step-by-step bonuses allow us to solidify the material we learnt. Shorter bonuses would be nice though, as sometimes we lack time
Regular bonus questions which helped to stay up to date on course material.

Comments
Dr. Verrett is a very effective prof, his lectures are well organized and I left each one feeling as though I learned something new about Aspen that I could implement. Coming in nervous about the course being computer based, his method of teaching helped me to enjoy working on Aspen and applying the information I am learning in other courses.
Johnathan was a great instructor as always.
Great slides and great follow-along lectures.
You can really tell that Dr. Verrett is an instructor and not a research professor. His course is meticulously structured, is also the only one that actually follows the syllabus. Nothing caught me by surprise, since I read the syllabus on the first day and basically the entire term was planned start to finish. The grading for the homeworks was however quite harsh, and it would have been useful if he had clarified that screenshots of the simulation setup were needed for full points even if the .bkp was submitted. I do believe he has rectified this since, and adjusted his grading accordingly.
Class were extremely fun and engaging
Everything about this course was wonderful, the teaching method of having us follow along through examples in class and following it up with our own time to figure out the Aspen blocks was perfect and I think worked very well for most people. Keep doing what you're doing for this course, it was a pleasure to take the course.
Dr. Verrett is a great instructor. He presents information very clearly and is clear about the expectations for the class. I appreciate how willing he is to help students out and answer questions.
The material taught was very organized and easy to follow. Overall, it was a good learning experience, especially coming from a student that has never touched ASPEN before the course.
Professor Verrett collects our ideas on how to make this course effectively at the beginning of this course. He makes the course more effective and easy learning. He always would like to give help and answer questions clearly.
Professor Verret is the best prof I've had at UBC so far. I've had him for two courses now and he always shows concern for his students' academic experience. This course was really great. We were able to do many examples, so we always had a good idea of how to put our learning into practice.
Fantastic.
Jonathan Verrett is one of, if not the, best instructor I've had at UBC to date. Every course he teaches or supervises runs smoothly, the content of the course is communicated effectively, and every student in the room is attentive and learning the material well. My only recommendation is that he keep doing what he's doing.
He did very well in going over the examples in class, by showing all the steps in a very detailed way, which facilitates the learning process. However, some of the topics covered were related to other course subjects and the link between them was very weak. Sometimes we could find the answer but not analyzing it.
He is consistently the best professor we have. He cares for students and their learning and is very evidently committed to helping us succeed. He is selfless with his time and would never tell a student he is too busy to help with a project.
Dr. Verret is a very effective presenter who inspires interest in the material. He did an outstanding job of ensuring evaluations were fair by quickly responding to student concerns regarding marking.
His power points were easy to follow, and the bonus assignments assigned every lecture helped me stay engaged to the course. He should keep up with what he's doing :).
No issues regarding the instructor, however course layout could be improved – project particularly.
The bonus questions at the end of every lecture were really helpful to gain a better understanding of the material. Also, we really appreciate the detailed and easy to follow lecture slides.

Comment on the things you appreciated about the course and provide suggestions for improvement.

Comments
Final project could have a more specified rubric and guideline
I enjoyed how tutorial assignments were set up, and that all work could be done in groups. I personally think the way the tutorials were done is the most effective ways to hold tutorials for most classes. Having to navigate through the groups page to join a new group for every assignment did get a bit tedious, however I understand this is more of something on IT's side. What was expected of us on assignments and on other work was slightly confusing, however, as there was clearly a disconnect there. I think a sample

Comments
assignment might of done a lot to help students understand the type of format and presentation on that was expected of them on assignments. The bonus assignments were very useful in helping my understanding, and I liked that they were small enough to ignore if you were overworked but easy enough to do and not stressful. Guided examples is another that most classes could benefit from, and this class put them to good use.
It would be better if the bonus assignments can worth a bit more credits.
I really enjoyed the structure of the class. The bonus assignments each class are a great way of knowing where you're at and what you need to work on. The assignments and tutorials were also a good level of difficulty and the load of work for the course was sufficient but not hard. The only suggestion I have is that the prof and TA clarify at the beginning what they would like to see for the assignments in order to succeed. The rubric given doesn't explain how detailed the assignments should be and the majority of the students did poorly on the first and second assignment as we were not sure what was being asked of us.
Dr. Verrett is one of the best teachers I have ever had.
good
Keep it the way it is! You are amazing and doing a great job! I LOVE YOUR TEACHING METHOD :) PLS SHARE YOUR WAY WITH OTHER PROFESSORS PLSSS :)
A midterm might have been useful in order to get some individual feedback prior to the final (although doing the assignments and tutorials in pairs is very helpful).
Loved the course, and it will definitely helped me later on. I will be taking HYSIS because of Dr. Verrett.
Thank you for being an understanding, responsive, and fair instructor. Your course has been one of the best this semester! For future improvements, my only suggestion is to set the due time for the tutorial assignments slightly later, so students have time to join groups and upload submissions online.
Amazing course
Bonus assignments could be worth more although doing them did help with learning.
Great balance between projects, assignments and tutorials.
Recommendations: Please make the bonuses worth more.
Different classroom set up.
Thank you for your hard work throughout the term! I really liked the way ASPEN is taught and the ratios of assignments, tutorial assignments, and bonuses were well balanced!
I appreciate all the effort Dr. Verrett puts into making this class amazing.
Each lesson was clear and the deliverable for the course were clear. The interactive aspect of lectures was very helpful along with tutorials and HW assignments. The TA's were highly ineffective and were not able to answer questions during tutorial, if they could come better prepared the course would be perfect.
I really appreciated the high organization and quality of the powerpoint slides. The bonus assignments were very helpful and useful. Thanks again for a great term!
The bonus assignments are very helpful for the mastery of the learning objectives.
The course is currently set up very well. The bonus assignment really solidifies student learning. If we were to choose our project topics earlier, we may be able to focus more on the classes that directly apply to our projects. The TAs during tutorials do not always offer the most help, but with Jonathan circulating we can usually always finish on time. Selecting groups on canvas for bonus assignments, homework, and tutorials is a HUGE hassle. It can take up to 15 minutes to just load all the groups and really cuts into time of other tasks. If a solution to this could be found, I think next year's class would have an easier time.
Appreciated: everything posted online (bkps and pdfs)
Improvement: Have solutions to all bonuses and assignments after the deadline
-
Bonus material to help students stay on top of the material. Piazza was also a great help. No need for improvement anywhere
Dr. Verrett tries to incorporate more advanced processes in course material. The end-of-term project allows students to freely explore the areas of interest using ASPEN plus,

Comments
which may well inspire students to explore independently yet with sufficient support from the instructor. I personally cannot think of more to improve in this course.
The course is designed very well. The bonus assignments at the end of every class really help a student keep up with course content taught in class.
The course structure is set up to reduce stress and improve motivation because of the light course load and lack of midterm exams. The emphasis is very much on learning and trying your best as opposed to being drowned by unnecessary assignments. I have no recommendations for improvement.
As much as I don't love computers and working with simulations, Verrett made it easy to follow and did a nice, independent final project to make it more interesting!
I appreciated the bonus assignments, the presentations with lots of screenshots to follow along later at home when feeling stuck and the flow diagrams to help us pick units in aspen. I often refer to these resources when stuck on an assignment or when practicing. I appreciate, so very much, the instructor checking up on the students progress every few minutes to make sure they're on track with the material and not lost. Please do continue to do that as I have found it very helpful in times when I was behind to catch up. A suggestion for improvement would be shorter (if possible) tutorials that can easily fit into 2 hours as sometimes it takes the class longer. Overall, this has been a great class, as the material has been very interesting and the instructor very involved.
The bonuses should be given more weight, say 5% or more even. Thanks for structuring the course very well.
Keep up the great work Dr. Verrett, your teaching is greatly appreciated
This course felt super relevant to my career which was a very nice change.
Really just the grading of the homeworks. The tutorials and bonuses were incredibly helpful in developing my comfort in using Aspen Plus, which is really the only way one can "learn" Aspen.
TA graded quite harshly and were not well informed in tutorials
I appreciated the project being a process that occurs in industry and having to figure out the details ourselves, it was very engaging and a great way to apply what we learnt throughout the semester.
I found that going through examples in class was useful, although sometimes it was a bit slow. I think the bonus assignments are a good idea since they are good practice; however, it might be a good idea to increase their worth or include the marks as part of the assignments portion of the grade (or something similar) to provide more incentive to complete them.
ASPEN is one of the many things that I think is very useful towards future careers. It provides a simulation of what we have been taught from second year in the Chemical and Biological Engineering department.
This course is quite related to chemical engineering. It provides us a general idea about how to design and analyze a chemical process.
Fantastic.
More time could have been devoted to troubleshooting the process simulations.
The instructor is very good but sometimes but the way the material was presented was not always very engaging.
This is the only class we have that inspires a conceptual understanding. Problem solving is the reason I joined engineering, and this class fulfills that criteria and helps reassure me that this major isn't that useless.
The bonus assignments were an excellent way to ensure we were staying on top of the material by breaking it into digestible chunks. The assignments are thought-provoking and made me feel as though I was making real engineering decisions. Overall the content was excellent.
I appreciate how we are introduced to a simulation program that might be useful in our career.
appreciated: – bonuses, tutorials, and assignments were very helpful improvement: – maybe a couple more unguided things? I don't think I know how to do anything on ASPEN without being guided through it
The particular subject matter seems rather specialized. Sure it will be rather useful to students in industry, but when only a small fraction of students will benefit from the course, should it be a degree requirement?

Comments

The way the course is taught is very engaging and makes students think regarding many of the industrial processes.

One suggestion would be extend the deadline of tutorial assignments. Instead of making it due end of class, maybe allow 30 minutes of extra time.

Explanatory Note

Percent Favourable Rating

This is the percentage of respondents who rated the instructor a 4 or 5 (Agree or Strongly Agree).

Interpolated Median

The data collected for Student Evaluations of Teaching (SEoT) are ordinal in nature, with a natural order (from 1 to 5). While the mean may be used as a measure of central tendency for such data, it is not an appropriate or accurate representation of SEoT data (cf. Stark & Freishtat, 2014). The usual measure of central tendency for ordinal data is the median. As a result, we have been reporting the mean and the median for the last several years. After considerable thought and data modeling, we now believe that the interpolated median is the best representation of the data, since it takes the frequency distribution into account.

Consider the following example from 2015W, the two classes have identical mean (3.8). However, the instructor in class 2 received 77% favourable (4-5) ratings, compared to 53% for the instructor in class 1. The Interpolated median values of (3.7 and 4.2), much better reflects the distribution of the scores above and below their respective median. Furthermore, the interpolated median is better correlated with percent favourable rating; such that an interpolated median of 3.5 on a Likert scale of 1 to 5, corresponds to 50% favourable rating.

Frequency Distribution

Response for UMI	Class 1	Class 2
5 = Strongly agree	5	5
4 = Agree	3	5
3 = Neither agree nor disagree	6	0
2 = Disagree	1	2
1 = Strongly disagree	0	1
Mean	3.8	3.8
Median	4.0	4.0

Interpolated Median	3.7	4.2
Percent favourable rating	53%	77%

Dispersion Index

The dispersion Index is a measure of variability suitable for ordinal data (Rampichini, Grilli & Petrucci 2004). This dispersion index has values between zero and 1. A zero dispersion index indicates that all students in the section gave the same rating to the instructor. An index value of 1.0 is obtained when the class splits evenly between the two extreme values (Strongly Disagree & Strongly Agree), a very rare occurrence. In SEoT data at UBC, the index rarely exceeds 0.85, and mostly for evaluations not meeting the minimum recommended response rate.

A.1.10 CHBE 376 2019W2 Student Evaluations

Project Title: 2019W2 UBC Instructor Evaluations

Course Audience: 110
Responses Received: 36
Response Ratio: 32.73%

Report Comments**Recommended Minimum Response Rates**

Class Size	Recommended Minimum Response Rates based on 80% confidence & $\pm 10\%$ margin
< 10	75%
11 - 19	65%
20 - 34	55%
35 - 49	40%
50 - 74	35%
75 - 99	25%
100 - 149	20%
150 - 299	15%
300 - 499	10%
> 500	5%

Creation Date: **Monday, May 4, 2020**

University Module Questions

University Module Questions

Question	N	n	SD	D	N	A	SA	N/A	IM	DI	Mean	STDEV
The instructor made it clear what students were expected to learn.	110	36	0	0	0	6	30	0	4.90	0.14	4.83	0.38
The instructor communicated the subject matter effectively.	110	36	0	0	0	7	29	0	4.88	0.16	4.81	0.40
The instructor helped inspire interest in learning the subject matter.	110	36	0	0	0	9	27	0	4.83	0.19	4.75	0.44
Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	110	36	0	0	1	11	20	4	4.70	0.26	4.59	0.56
The instructor showed concern for student learning.	110	35	0	0	0	7	28	0	4.88	0.16	4.80	0.41
Overall, the instructor was an effective teacher.	110	36	0	0	0	4	32	0	4.94	0.10	4.89	0.32

Question	%Favourable
The instructor made it clear what students were expected to learn.	100.00%
The instructor communicated the subject matter effectively.	100.00%
The instructor helped inspire interest in learning the subject matter.	100.00%
Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	96.88%
The instructor showed concern for student learning.	100.00%
Overall, the instructor was an effective teacher.	100.00%

Faculty Questions

Course Questions

Question	N	n	SD	D	N	A	SA	N/A	IM	DI	Mean	STDEV
The assigned workload for the course was heavy.	110	36	0	13	14	7	2	0	2.86	0.47	2.94	0.89
The course material is rather advanced.	110	36	3	4	14	11	4	0	3.29	0.57	3.25	1.08
The material is relevant to my professional needs.	110	36	0	0	1	7	28	0	4.86	0.20	4.75	0.50
The course material is interesting.	110	36	0	0	0	12	24	0	4.75	0.22	4.67	0.48

Question	%Favourable
The assigned workload for the course was heavy.	25.00%
The course material is rather advanced.	41.67%
The material is relevant to my professional needs.	97.22%
The course material is interesting.	100.00%

Open ended feedback

Comment on what the instructor has done especially well in teaching the course and what he/she might do to improve it.

Comments
The title of "best prof in CHBE" circulated amongst students is definitely well earned and well deserved! I enjoyed having clear rubrics and expectations and a prof who showed care for student learning and students' lives. Something that I sadly wish was shared amongst other professors!
Verrett was a great professor! Very understanding of us and was always available to help. Classes were well organized.
No improvements, fantastic learning experience. I was so excited to go to class and learn every lecture. Dr. Verrett is truly an inspiration for CHBE.
Helped the students with the materials and answered questions. Took time to do ASPEN classwork so that students could catch up.
The lessons were great, instructor was very helpful whenever asked for help. Regularly made himself available even on weekends, and dealt with the transition to online classes exceptionally well. My favourite professor, and many others agree.
Very understanding of course load and assignments duration.
Was again one of my best instructors. Super organized which made it a lot easier to learn content. Helped out students very well. Understandable he was nominated for teaching award.
Dr. Verrett's lectures were very clear and concise, and showed clear and logical organization. Furthermore, the teaching style and activities were appropriate for the course.
Always answered students questions. Easy to relate to. Very approachable. Just a straight beauty. Best prof!
I love how you explain thoroughly in class while showing doing the simulation together with us. Definitely helped me to understand the content faster and efficiently
The instructor was extremely clear in what was expected and use very clear examples to educate the class. One thing that could be done better is to increase the difficulty and technicality. I found I often did not know how to do things in my project and went to the internet for help. This course is great for introduction, but I wish it was somewhat more rigorous.
Literally one of the few most organized Professors in the department! He was always such a great support, ever ready and quick to answer questions and always open to feedback to improve!!! Thank you Dr. Verrett!!! #ICONIC
Jonathan is one of the best, if not THE best, instructor that I have had in CHBE. He presents the essential points in his lectures in a clear and concise manner, leads us through example problems, and leave us enough time for us to go through practice problems on our own while he walks around and takes questions. This give us an opportunity to learn the common mistakes through practice and keeps the class well-engaged. Outside the classroom, Dr. Verrett always put lots of office hours, answering emails and posts on Piazza at lightning speed, making help easily accessible for anyone in need. It's clear that he really wants students to excel.
Absolutely awesome job being clear and communicating materials to us. Provided excellent resources for us to learn and understand the course well.
Really liked the lecture format, made it easy to follow and pickup the ASPEN software. Liked the use of the bonus assignments to test lecture knowledge in a way that still allowed students leeway as to whether it was needed or not. The transition to online wasn't great but that's hardly professor Verrett's fault, would've preferred use of ASPEN rather than just a quiz but that's about it. No complaints otherwise
He was excellent at teaching the content and providing activities that made sure we understood the content. In addition, he was excellent at transitioning to online learning and was always helpful when asking for help.
Very fair and understanding when it comes to overall grading of the students. He is very approachable when it comes to meeting outside of class. He is willing to answer and help as many students as possible.
I love how Jonathan can keep track of all the projects and still provide quality feedback. Thanks for the extensions too!
Bonuses are a great idea, gives us a break in the middle of the class and gives us hands on experience. Project deliverables were great and made us not rush to write the report. Giving us feedback earlier would be better but you know that already. Collaborative tutorials that are worth a decent amount are good, and doesn't put too much weight on a midterm.

Comments
<p>Working on almost everything in group was really good. Maybe allow us to join one group for bonuses/assignments and change if we want, rather than create one for every assignment.</p> <p>You are amazing, thank you!!</p>
<p>Verrett is extremely caring for student learning. He's always available and explains things clearly and adequately. I don't think there's anything to improve on; it was great.</p> <p>As always, the best instructor in CHBE. Always cares about student learning and always provides focused solution to individual.</p>
<p>This course is taught exactly the way it needs to be – hands on application with ASPEN. Unfortunately, that had to be changed for the last half of the course due to the transition to online classes. Dr.Verrett did his best to accommodate us and that's all I can ask for.</p>
<p>Jonathan adapted to online format very well. I appreciated him listing notes from last year as well as this year.</p>
<p>I mean the specific classes work and learning is facilitated quite well and focused on areas that are important to the course, Just confused why now that we're home, why is ASPEN not a necessary thing to have on your computer like solidworks or the other complex programs we've been made to run? IDK how the final will look so this isn't a major dent in the course, just why?</p>
<p>1)Well organized Resources were available chronologically, examples and solutions were clear and available and I found that constant help provided through Piazza, emails, updates on progress made a difference in the end.</p>
<p>2) The structure and methodology for the Term Project deliverables The fact that it was made in a format that we could build on made the final delivery less stressful. These milestones really helped me to plan through the course and gave me a better structure in organizing things.</p>
<p>3) Interesting material in class It was really interesting to work with material and cases that is close to real life applications of chemical engineering. I really appreciated the variety of concepts and examples we were presented with in class. Lectures were engaging, I looked forward to go to class.</p>
<p>4) Understanding of circumstances Professor Verrett has been very empathetic before and after going online. It has been really helpful to know your professor understand how the brisk transition into online classes affected our mental health and academic performance.</p>
<p>5)Fast to make accommodations to suit everyone's needs Its also important to point out Professor Verrett went out of the way to virtually change the entire course and way of making examinations to account for the students who didn't have access to Aspen. It's not easy yet its really appreciated.</p>
<p>Dr. Verrett has been an amazing Professor. His classes has been interesting and effective and Dr. Verrett has been extremely kind and understanding about the workload. It has been a pleasure to be a student in his class.</p>
<p>Prof Verrett made it very clear from the beginning about the course material. He was always available for any queries that had risen. He was accommodating regarding test and exam concerns.</p>
<p>Very good professor, but I think this course can be delievered through online teaching.</p>

Comment on the things you appreciated about the course and provide suggestions for improvement.

Comments
Perhaps the project could be started a bit earlier, I feel that the project is tough to finish at the end of the term along with all the other work that arises nearing the end of classes.
Bonus Assignments helped with practice.
I appreciated the bonus questions as a way to keep us regularly engaged in short activities that didn't consume too much time, but still made us think. I think midterm weightings were fair, and I learned a lot from the term project, although it was rather complex and a source of frustration. Overall it was great, would appreciate more relation to when and where Aspen is used in industry.
Have more practice question with the current online exam testing situation
Perhaps having a run-through of all the units in ASPEN and the course notes posted before the lectures could help with the aspen term project.
Different than other courses as its all on the computer.
I appreciate learning this because I have more understanding of how simulation important as a chemical engineer. I also glad that i learned this from you!
The professor made themselves available and cared very much for our learning.
Great course, a bit unfortunate that exam style had to be adjusted to be doable without Aspen with the course moving only. The original style of the exam is more practical and closer to real engineering problem solving I feel. But Jonathan is doing the best he could to make our learning experience enjoyable and accessible for all, and I really appreciate that.
Amazing course and instructor who really genuinely cares about student learning, my favourite prof. Thank you Dr. Verrett
I really appreciated the format of the course and having the bonus assignments.
I enjoyed the simulation aspects of the class and I enjoyed that the exams were based on simulating processes. Unfortunately, the finals had to be theory based which I find more difficult but it is an unforeseen circumstance.
ASPEN is fun to learn and great to work with. Doesn't change the fact that so many things need to be taught, and the errors that appear are mostly incomprehensible. Most of the time errors are dealt with by tweaking every part until something works, so not very helpful for understanding concepts.
Great course!
This course is already great.
I really liked the project – it was super fun and really helped me learn the material. The tests should not be done without ASPEN (again couldn't be helped this time round).
I think a better classroom would have been better.
Very interesting course. Jonathan is amazing. The only problem is that we learnt a lot from the bonus assignments, but the grade weight is only 1%.
I actually really enjoyed the term project as well as the deliverable format for it. It helped keep my partner and I on track throughout the semester. The project was easily the most interesting thing I worked on this semester.
Good course, Not too heavy (for an engineering course) and yet with bonus assignments the option to keep working is always there, the project aswell provides scaling levels of difficulty.
Keep it up this course was so excellent!!!!!! Thank you!!
Showing both the simulation and the slides was very effective. Thank you!
The course actually had insight on professional development. this is the only course that I felt would be helpful in professional work life.

Explanatory Note

Percent Favourable Rating

This is the percentage of respondents who rated the instructor a 4 or 5 (Agree or Strongly Agree).

Interpolated Median

The data collected for Student Evaluations of Teaching (SEoT) are ordinal in nature, with a natural order (from 1 to 5). While the mean may be used as a measure of central tendency for such data, it is not an appropriate or accurate representation of SEoT data (cf. Stark & Freishtat, 2014). The usual measure of central tendency for ordinal data is the median. As a result, we have been reporting the mean and the median for the last several years. After considerable thought and data modeling, we now believe that the interpolated median is the best representation of the data, since it takes the frequency distribution into account.

Consider the following example from 2015W, the two classes have identical mean (3.8). However, the instructor in class 2 received 77% favourable (4-5) ratings, compared to 53% for the instructor in class 1. The Interpolated median values of (3.7 and 4.2), much better reflects the distribution of the scores above and below their respective median. Furthermore, the interpolated median is better correlated with percent favourable rating; such that an interpolated median of 3.5 on a Likert scale of 1 to 5, corresponds to 50% favourable rating.

Frequency Distribution

Response for UMI	Class 1	Class 2
5 = Strongly agree	5	5
4 = Agree	3	5
3 = Neither agree nor disagree	6	0
2 = Disagree	1	2
1 = Strongly disagree	0	1
Mean	3.8	3.8
Median	4.0	4.0

Interpolated Median	3.7	4.2
Percent favourable rating	53%	77%

Dispersion Index

The dispersion Index is a measure of variability suitable for ordinal data (Rampichini, Grilli & Petrucci 2004). This dispersion index has values between zero and 1. A zero dispersion index indicates that all students in the section gave the same rating to the instructor. An index value of 1.0 is obtained when the class splits evenly between the two extreme values (Strongly Disagree & Strongly Agree), a very rare occurrence. In SEoT data at UBC, the index rarely exceeds 0.85, and mostly for evaluations not meeting the minimum recommended response rate.

A.1.11 CHBE 453/454 2018W1/2 Student Evaluations

Project Title: 2018W2 UBC Student Evaluation of Teaching

Course Audience: 106
Responses Received: 28
Response Ratio: 26.42%

Report Comments**Recommended Minimum Response Rates**

Class Size	Recommended Minimum Response Rates based on 80% confidence & $\pm 10\%$ margin
< 10	75%
11 - 19	65%
20 - 34	55%
35 - 49	40%
50 - 74	35%
75 - 99	25%
100 - 149	20%
150 - 299	15%
300 - 499	10%
> 500	5%

Creation Date: **Wednesday, June 5, 2019**

University Module Questions

University Module Questions

Question	N	n	SD	D	N	A	SA	N/A	IM	DI	Mean	STDEV
The instructor made it clear what students were expected to learn.	106	27	0	2	9	11	5	0	3.73	0.46	3.70	0.87
The instructor communicated the subject matter effectively.	106	27	0	1	10	10	6	0	3.75	0.45	3.78	0.85
The instructor helped inspire interest in learning the subject matter.	106	26	0	1	8	12	5	0	3.83	0.42	3.81	0.80
Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	106	27	0	3	1	11	6	6	4.09	0.48	3.95	0.97
The instructor showed concern for student learning.	106	27	0	1	8	11	7	0	3.91	0.45	3.89	0.85
Overall, the instructor was an effective teacher.	106	27	0	1	9	10	7	0	3.85	0.46	3.85	0.86

Question	%Favourable
The instructor made it clear what students were expected to learn.	59.26%
The instructor communicated the subject matter effectively.	59.26%
The instructor helped inspire interest in learning the subject matter.	65.38%
Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	80.95%
The instructor showed concern for student learning.	66.67%
Overall, the instructor was an effective teacher.	62.96%

Faculty Questions

Course Questions

Question	N	n	SD	D	N	A	SA	N/A	IM	DI	Mean	STDEV
The expectations for project-based learning and for the project itself, were clearly stated.	106	28	2	7	7	11	1	0	3.21	0.56	3.07	1.05
The instructor/supervisor was available for consultation with students and responded to questions and feedback in a helpful and respectful manner.	106	27	0	0	3	12	12	0	4.38	0.35	4.33	0.68
The instructor/supervisor created a course environment that encouraged the participation of all students.	106	28	2	4	2	12	8	0	4.00	0.64	3.71	1.24
The instructor/supervisor demonstrated an adequate knowledge of the theory, processes and methods required to support the learning objectives associated with the project.	106	28	1	1	4	16	6	0	4.00	0.44	3.89	0.92
The teaching team (instructor/supervisor, technicians, teaching assistants, etc.) contributed positively to the progress of the project.	106	28	2	4	3	12	7	0	3.92	0.64	3.64	1.22
Students were provided with appropriate and sufficient resources (shop, laboratory, materials, computers, software, etc.) as well as timely and helpful feedback to achieve the learning objectives associated with the project work.	106	28	1	4	7	10	6	0	3.70	0.59	3.57	1.10

Question	%Favourable
The expectations for project-based learning and for the project itself, were clearly stated.	42.86%
The instructor/supervisor was available for consultation with students and responded to questions and feedback in a helpful and respectful manner.	88.89%
The instructor/supervisor created a course environment that encouraged the participation of all students.	71.43%
The instructor/supervisor demonstrated an adequate knowledge of the theory, processes and methods required to support the learning objectives associated with the project.	78.57%
The teaching team (instructor/supervisor, technicians, teaching assistants, etc.) contributed positively to the progress of the project.	67.86%
Students were provided with appropriate and sufficient resources (shop, laboratory, materials, computers, software, etc.) as well as timely and helpful feedback to achieve the learning objectives associated with the project work.	57.14%

Open ended feedback

Comment on what the instructor has done especially well in teaching the course and what he/she might do to improve it.

Comments
Timely and committed to the group. Extremely helpful. May improve by challenging the team more (eg more detailed design, ask hard questions, challenge the team's design choices)
Was the marker of our group however did not attend first term final presentation, did not gain an understanding for our project material.
Provided good criticisms, and fair scoring on presentations.
Dr. Verrett was not my instructor for this course
He was our main capstone professor, and he was very supportive in making sure we were on the right track for our project. His communication was great and he really cares about seeing us do well in capstone, and after graduation.
Didnt work much with Jonathan
N/A
His genuine care for student learning stands out. Did not work with him directly in this course but his helpfulness is well known.
I did not have this professor for the course.
He is always attentive
Very approachable, interacted with him minimally but was always helpful.
Hard marker, but very thorough however
Dr. Verrett was by far the best part of the entire capstone course. He was effective at communicating expectations with students, he wanted us to succeed and was always helpful when we had questions. He also gave constructive feedback that helped us to improve our project and become better students and engineers. His door was open when we had questions, and he made himself available when our group wanted to meet with him outside of the regular capstone times. I can't say enough good things about Dr. Verrett and I am so thankful he was assigned to our group as it made what was overall a horrible experience with capstone (not surprisingly) a lot better. I hope that he gets tenure one day, keep him around because he's a shining light in what is potentially the most garbage engineering faculty in existence.
Dr. Verrett was extremely helpful to our capstone group. He attended every meeting we had, including unscheduled meetings, and was an incredibly valuable resource to our capstone group.

Comment on the things you appreciated about the course/project/lab and provide suggestions for improvement.

Comments
What is expected is not clearly stated
CHBE capstone course is well-structured and it has many tasks to be done so that it has a lot to learn and to discover. You'll not only learn a lot about new material based on plant and process design, but also drafting software like Visio, solidworks and autocad etc. One will need review all the course material learned, such as mass and energy balance, thermodynamics, Aspen simulation, engineering econ and so on. Although you won't have a prototype to showcase, you will still get a chance to simulate your caostone in 4th year PBL lab. It is a great opportunity in terms of chemical engineering training before entering the real industry.
Really a great course. Should be implemented earlier in the degree.
Often frustrating to find technical experts on a team's chosen process. I believe the requirements are much too relaxed. I did not feel the instructors challenged our team very much; therefore, more constructive criticism and engagement from the faculty could improve this course.
An area for improvement would be to increase the individual portion of the Capstone mark, perhaps by increasing the weight of the weekly portfolios and interviews in the overall capstone mark (changing it to 50 personal, 50 group mark). I realize that learning to work in a group is important, but some members of the group had work ethic that was

Comments
frustratingly poor. Holding them accountable through the increased weight on individual assessments would help to alleviate this issue.
I appreciated the freedom of the course, and one thing that could be better is a bit more detailed lecture slides.
I really appreciated the fact that our Capstone touched on different aspects that are important to industry (HAZOP, Econ, Start-up Shut-down, etc.). Even though the reports we completed were not entirely representative of the quality of work industry would expect, it was useful to get exposed to the vocabulary.
One issue I have is that the course can be very constraining (especially for Bio students) compared to other department's Capstones. For instance, we have to design a process that has N unit ops and must contain a bioreactor. This severely limits the projects we can develop. I understand that this is more an issue with the accreditation system for CHBE students, I just wish it were slightly different. It would be nice to be able to really do a deep dive on designing a piece of equipment that is novel, rather than an entire process.
Really enjoyed the whole process of going through front end engineering from process development to plant layout and everything in between. I think though for students who want to do a project within a particular industry, maybe grouping people per industry would result in better experience for students who have no choice but to join a group with people they don't know and a topic they don't like.
This course was good, but I feel like there could have been more support from professors (not hand holding, but information transfer) to better solidify capstone due dates. Most of the time, I check announcements for the due date, and need to scroll through Lee's messages, instead of having a master list on canvas with all of the due dates (every single one, not just the major ones). I feel like if that was done, and that list was updated whenever revisions occur, it would relieve a lot of tension in planning.
The course was good overall but I wish the soft deadlines could be established sooner. I also feel like some of the material should have been covered/previewed in previous years, which would allow us to do a more thorough job with some of the components of the project. For example, HAZOP and environmental regulations could have easily been introduced in second or third year, which would allow us to attain a high level of detail when completing the related reports this year.
I appreciated how the project was very open ended, but as we had never experienced something to this degree before, it made the project much more challenging.
Please have an Autocad workshop so the students are all on the same page! Please pair Bioprocess students with a Bioprocess professors! Please keep Sergio Berretta as he is very valuable!
The self guided nature of the project was fun and the workload was appropriate. Often times it felt like we didn't know what we were supposed to be doing, but thats just life.
Move design day to a different day
The only reason I put "Agree" for supervisors being available was because Dr. Verrett and Sergio were available and always willing to help. As for theory related to processes, Sergio was the main reason for this (and also Dr. Verrett), thankfully they are involved with the course.
My friend who graduated in 2018 described capstone with the following statement "Capstone is like the s*** cherry on top of the s*** cake that is CHBE as a whole". And I hoped, I so badly hoped, that this wouldn't be true. But it was. More so than I could have imagined. Expectations were not clear. Rubrics were hidden at the end of PowerPoint presentations. There was more than one rubric for something MORE THAN ONCE. No one knows what is going on. How is this course so poorly organized when it happens literally EVERY YEAR. I am going to be so happy on April 12th when we hand in our report and never have to deal with this joke of a course and waste of 8 months.
To summarize: Dr. Verrett was amazing. Give him tenure. Learn from him. He cares about students and is a wholesome human being who wants us to succeed. Dr. Smith, Dr. Baldwin, and Dr. Lim should not be involved with the course, and to continue with the cake references, Dr. Smith takes the cake as being the worst of the three BY A LONG SHOT. "Show some initiative" and get rid of him. Dr. Posarac cares about students learning and is a great guy too. Sergio brings relevant industry knowledge to the course and to CHBE among disconnected profs that think their theoretical knowledge and years out of industry are still relevant and meaningful.
I hope that there were more real-life projects involved in the capstone project.
For some aspects such the pid pfd, the hazo. Would it be an option to have student sitting in front of computers in the computer room workign on these problems wit hthe instructor? It may be beneficial reevaluate what you want to teach and what you want students to figure out on their own and then focus on the formaer.
I would strongly suggest a "standards" reference resource. Including standards for reports, presentations, and technical drawings.

Explanatory Note

Percent Favourable Rating

This is the percentage of respondents who rated the instructor a 4 or 5 (Agree or Strongly Agree).

Interpolated Median

The data collected for Student Evaluations of Teaching (SEoT) are ordinal in nature, with a natural order (from 1 to 5). While the mean may be used as a measure of central tendency for such data, it is not an appropriate or accurate representation of SEoT data (cf. Stark & Freishtat, 2014). The usual measure of central tendency for ordinal data is the median. As a result, we have been reporting the mean and the median for the last several years. After considerable thought and data modeling, we now believe that the interpolated median is the best representation of the data, since it takes the frequency distribution into account.

Consider the following example from 2015W, the two classes have identical mean (3.8). However, the instructor in class 2 received 77% favourable (4-5) ratings, compared to 53% for the instructor in class 1. The Interpolated median values of (3.7 and 4.2), much better reflects the distribution of the scores above and below their respective median. Furthermore, the interpolated median is better correlated with percent favourable rating; such that an interpolated median of 3.5 on a Likert scale of 1 to 5, corresponds to 50% favourable rating.

Frequency Distribution

Response for UMI	Class 1	Class 2
5 = Strongly agree	5	5
4 = Agree	3	5
3 = Neither agree nor disagree	6	0
2 = Disagree	1	2
1 = Strongly disagree	0	1
Mean	3.8	3.8
Median	4.0	4.0

Interpolated Median	3.7	4.2
Percent favourable rating	53%	77%

Dispersion Index

The dispersion Index is a measure of variability suitable for ordinal data (Rampichini, Grilli & Petrucci 2004). This dispersion index has values between zero and 1. A zero dispersion index indicates that all students in the section gave the same rating to the instructor. An index value of 1.0 is obtained when the class splits evenly between the two extreme values (Strongly Disagree & Strongly Agree), a very rare occurrence. In SEoT data at UBC, the index rarely exceeds 0.85, and mostly for evaluations not meeting the minimum recommended response rate.

A.1.12 CHBE 453/454 2019W1/12 Student Evaluations

Project Title: 2019W2 UBC Instructor Evaluations

Course Audience: 122
Responses Received: 28
Response Ratio: 22.95%

Report Comments**Recommended Minimum Response Rates**

Class Size	Recommended Minimum Response Rates based on 80% confidence & $\pm 10\%$ margin
< 10	75%
11 - 19	65%
20 - 34	55%
35 - 49	40%
50 - 74	35%
75 - 99	25%
100 - 149	20%
150 - 299	15%
300 - 499	10%
> 500	5%

Creation Date: **Monday, May 4, 2020**

University Module Questions

University Module Questions

Question	N	n	SD	D	N	A	SA	N/A	IM	DI	Mean	STDEV
The instructor made it clear what students were expected to learn.	122	28	0	0	4	11	13	0	4.41	0.37	4.32	0.72
The instructor communicated the subject matter effectively.	122	28	0	0	3	13	12	0	4.35	0.34	4.32	0.67
The instructor helped inspire interest in learning the subject matter.	122	28	0	0	4	14	10	0	4.21	0.35	4.21	0.69
Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	122	28	0	0	4	9	10	5	4.33	0.39	4.26	0.75
The instructor showed concern for student learning.	122	28	0	0	1	9	18	0	4.72	0.26	4.61	0.57
Overall, the instructor was an effective teacher.	122	28	0	0	1	15	12	0	4.37	0.28	4.39	0.57

Question	%Favourable
The instructor made it clear what students were expected to learn.	85.71%
The instructor communicated the subject matter effectively.	89.29%
The instructor helped inspire interest in learning the subject matter.	85.71%
Overall, evaluation of student learning (through exams, essays, presentations, etc.) was fair.	82.61%
The instructor showed concern for student learning.	96.43%
Overall, the instructor was an effective teacher.	96.43%

Faculty Questions

Course Questions

Question	N	n	SD	D	N	A	SA	N/A	IM	DI	Mean	STDEV
The assigned workload for the course was heavy.	122	28	0	3	4	15	6	0	3.97	0.45	3.86	0.89
The course material is rather advanced.	122	28	1	0	8	13	6	0	3.88	0.46	3.82	0.90
The material is relevant to my professional needs.	122	28	0	0	3	11	14	0	4.50	0.35	4.39	0.69
The course material is interesting.	122	28	2	0	2	13	11	0	4.27	0.49	4.11	1.07

Question	%Favourable
The assigned workload for the course was heavy.	75.00%
The course material is rather advanced.	67.86%
The material is relevant to my professional needs.	89.29%
The course material is interesting.	85.71%

Open ended feedback

Comment on what the instructor has done especially well in teaching the course and what he/she might do to improve it.

Comments
Dr. Verrett is a good teacher because he really listens to his students and wants them to succeed. He responds quickly and always makes sure to follow up with you if you have any concerns.
I think Dr. Verrett recognizes how crucial creating connections with students is. Our group for example the sources of information directly related to our topic that he went out of his way to find and send to us directly resulted in a more detailed final project.
Jonathan always shows he cares about students. I think it may have been helpful to have more meetings in the beginning of the course with multiple professors on each project. I got the feeling everyone was figuring it out as we went and profs were not always on the same page. Perhaps meetings with all 4 profs and each group would've helped you all gain an understanding of each others expectations as well.
The professor, as always, shows concern and appreciation for students. However, I think there could be a lot of improvements in the structured learning and marking of the course. Given that there are many different profs teaching students under the same course, there should be significantly more standardization. My group found it so difficult to know how we were doing throughout the year or if we were doing anything correctly because our professor was not useful in providing guidance. We felt we were at a disadvantage. Thus, if there could be additional standardization and rubrics for each deliverable we would find it a lot more useful to tell if what we submit is aligned with the expectation of the course versus our profs expectations.
I thought that Jonathan had very clear communication throughout the entire year. He regularly sent out announcements that often answered any questions we may have had. Even though he wasn't the advisor assigned to our group, he was always more than willing to help us both during and outside tutorial time, and was always very responsive to questions over email. He was always understanding of any issues and willing to work with students to best accommodate them fairly.
Dr. Verrett was great as usual, he took an interest and was eager to give advice even on projects he didn't advise on, which is awesome. He also took feedback and criticism about the course from students very well and did his best to integrate it.
Dr. Verrett offered very useful feedback throughout the term and did an admirable job of coordinating complex events while effectively communicating expectations for evaluation. His announcements were always prompt and informative.
Dr. Verrett is one of the most compassionate and caring instructors I have had over the course of my career at UBC. In this course, he showed genuine care for student learning and ensured all students voices were heard and he was always accessible when we needed help. The course was well structured and provided students guidance over the two terms on expectations and schedules for deliverables. Although rubrics and marking guides were not always clear, Dr. Verrett always made an effort to understand what was lacking from students to ensure that we always understood the expectations of the course. Dr. Verrett provides very clear lectures, very clear organization of course material, and always supplements our learning with additional course material he believes may be helpful. He always advocates for students and our learning. Thank you for everything Dr. Verrett! My UBC experience would not have been the same without your guidance and instruction over the course of my 4 years in CHBE. From CHBE 241 to CHBE 454 it was great to see how you changed as an instructor and how you improved and took to heart student comments and really took it upon yourself to shape the course to student needs. Your compassion for teaching and for student learning has changed my perspective on instructors and is something that I will always remember.
Dr. Verrett was very fair and took all the students' opinion into account. The switch onto Collaborate Ultra was smooth and easy for us thanks to Dr. Verrett's efforts. However, after the discussion on April 9th 2020, I believe that the course should be structured such that ipeer evaluations are weighed more. I appreciate Dr. Verrett giving us all a chance to explain our sides but at the end of the day, our ipeers should be more representative of the person's contribution to prevent the specific member from riding on the group members' work.
Jonathan has always been a really good prof and is effective at communicating material. Jonathan gave us feedback after our presentation and how we can improve it even when he wasn't our supervisor which we really appreciated.
He shows that he cares a lot about the students and he is very good at communicating with the class. The rubrics and expectations for assignments could be more clear for future classes.
Dr. Verrett is a great instructor who really cares about his students. He made our capstone experience exciting and assisted us a lot along the way!
Dr. Verrett was very quick and thorough when answering questions and responding to team-specific requests for clarification on deliverables.

Comments

Dr. Verrett did well leading the course and being accommodating to students' concerns.

Dr. Verrett was our group's advisor. He was extremely helpful whenever we had tutorials, and always responded to questions and provided feedback in a timely manner. We can see he really cares for his students, their progress and well-being. We would like to thank him for all his hard work!

Jonathan was a great advisor for the capstone project. He always asked for students opinions and was very receptive to feedback. He marked a little harder than the other profs.

Jonathan was great as always. Friendly and easy to approach and ask questions. Worked through any concerns in a kind manner.

Comment on the things you appreciated about the course and provide suggestions for improvement.

Comments

Capstone is definitely the most difficult course I've come across to date but it was very interesting and I learned a lot from it that I think will be relevant in my future career. I would have liked if we had multiple instructors over our group because I understand that some are more hands-on than others. I would also have liked to receive specific feedback on all the deliverables – my group had a hard time with a lack of feedback especially at the beginning of the course but it did get better as it went on. I would have liked if there were more resources available to bio groups – we had a very difficult time working through our process on excel and I'm sure it would have been easier had we been able to use a process simulator. Also, I would have liked more time spent on learning how to create a P&ID. Not everyone in my group took the control course so it was not easy to explain these all the time. All in all, I had a positive experience with this course though I found some things lacking. Thank you all for your hard work!

I feel the final presentations should be before the interviews. We would have a couple weeks off from the course to work on it, plus have more to talk about during the interviews. More importantly though there is such a short turn around between presentations ending and the final report being due the way its setup now, that if any issues are pointed out during the final presentation feedback it is very difficult to implement a proper solution. I will use my group as an example there were 2 big issues pointed out to us and coupled with all the other papers/projects/finals I dont believe we will be able to fix both with a solution we are satisfied with/actually solve the problem.

While general expectations were communicated very clearly by Jonathan, it seemed like there was less communication amongst the instructors. We often received conflicting information. Generally though, this course was taught well. I liked the industry experience Sergio brought to the lectures. However, I did not like this course mainly because of issues with our advisor for our project. I also suggest increasing the weight of the iPeer evaluations, because some groups members contributed essentially nothing to the project. One huge suggestion I have for this course is to completely separate the course for students in processing vs. bio. I found that a lot of course material is catered to processing students. Also the way we are evaluated in this course significantly favours process students. For example, a lot of work is done on Aspen, but for bio students, everything has to be done by hand. This is fine, but I feel like expectations and deadlines needs to be adjusted accordingly.

All of the advisors need to be on the same page, because many times there was conflicting information with the only reliable source being Dr. Verrett. Rubrics or outlines for deliverables should be posted, as many times we wanted to start a deliverable to get ahead without even knowing what was expected. Additionally, modifications need to be made for bio groups. Bio groups are at an unfair disadvantage since we can't do our whole simulation on Aspen like 99% of process groups, and because of this we have so many calculations we had to write out by hand for the report. Also, a 40–page limit for a year long project is unreasonable. Even though we limit the body of the report to 40 pages, we have to include all of the information we cut out in the appendices, which the advisors STILL need to read. I understand the importance of making concise reports, but least a 60–page limit would be nice considering it has to encompass 8 months of work.

This course has taught me so much, and I absolutely appreciate how lectures are provided as guidance to completing a deliverable. I especially appreciate Dr. Posarac's time and effort to ensure that we understood as much as possible while delivering excellent work. My suggestion would be to reduce the number of members for each group to give everyone more opportunity in really getting involved in each section and avoid conflicts of team contribution

I appreciated that this course gave me the opportunity to accomplish a tangible feat of engineering with tremendous room to develop specialized skills and teamwork. There is really no other course like it. The lectures were very useful and I'm sure I will refer to them throughout my career.

I think that more industry involvement would be of tremendous benefit, especially in the project selection stage, to help guide the development of projects that are both manageable and engaging. I also think that more guidance and teambuilding frameworks should be provided before the term even begins. This will help to facilitate the establishment of quality projects with good "company cultures." It isn't always the case that people are well-connected to those who have similar technical interests, and this can really impact the kind of project you end up working on. for instance, I thought I was joining a pharma group and ended up working on water treatment. I rolled with it, but I was resentful of the derailment from my ambitions. Polling people for interest and sorting them into industry categories would give others useful insights into the technical direction their project may go with a given team.

Comments
<p>Examples of company culture and typical design team roles would also be useful to have early on, especially for those who haven't done coop. There are a lot of ill-understood subtleties in the organization of a company that help it to operate efficiently – like good data management practices and division of labor. For example, in my group, I don't believe we really captured the essence of a project manager in any of our attempts. It was mostly just someone to assign excess work to and didn't involve much organization. There is also something to be said for a set of guidelines vis-a-vis good project management practices.</p>
<p>I was overall very disappointed about the way this course was ran. The groups of 8 people are not advantageous whatsoever, a lot of group members were riding off of others and it is extremely sad that they will get the same grade. This course is meant to help with my future career but it did not feel like it. With a lot of group members slacking off it made my overall course load extremely heavy as I had to pick up the slack for those group members or my grade would be impacted. There was a girl that was put at random into my group that did nothing throughout term 1 and when we approached the instructors about this they were no help. They reiterated that she would receive the same grade as us and that we would basically have to baby sit her. This individual does know anything about engineering and did not care enough to pay attention in meetings or follow simple instructions. All her work had to be redone, even at the end of this course she did not know the flow rates of our product. It is extremely sad to know that this is how this course works where I can just join a group do nothing the entire term and still get the same grade as my peers that did all the work. I would strongly advise to make stricter rules to make everyone accountable for their work and to ensure that they get the grade they truly deserve. As of right now this individual will graduate with a grade that she doesn't deserve. Overall, I really thought I would enjoy this course but it only brought me stress and lost my confidence in the instructors running it as I knew they wouldn't have my back.</p>
<p>I love capstone! i think its one of the most interesting courses we take throughout CHBE and it has direct impact on Industry. During my coop experience, I have done very similar project work and i really believe capstone equips us better to enter the real world! As for the structure, i like how CHBE lets us choose our own groups and our own topics. I think this should be carried forward to later years too. However, i do have an issue with the lack of importance given to ipeer. In other faculties of engineering, ipeer is weighted against the group where say a student got less than 50% on their ipeer, but the group got an 80% as a whole; the student would still fail as their mark would be $0.5 \times 80 = 0.4$ so 40%. I wish CHBE would employ something similar as the way the structure stands currently, members who do not perform enough to even get a passing grade end up with a good mark because of their group's hardwork.</p>
<p>After COVID-19, the course seemed to be very disorganized (understandably). I found it hard to understand what the new deliverables are and what was expected of us. Also in Term 1, lectures that explained a certain deliverable need to be done at least two weeks ahead of the deadline for the deliverable to give students enough time to work on it.</p>
<p>I think this project should be done in smaller groups. In our group of 8, three of us did most of the work throughout the entire year. Some people did literally no work at all. When we approached the professors about this, we were essentially left to deal with it ourselves. I don't believe it is fair for people who have done no work in a course to receive the same grade as those who have worked extremely hard all year. It devalues the rest of our degrees when these people are allowed to pass classes having completed no work.</p>
<p>I appreciated all of the things that we got exposed to, but it would be nice to have clearer rubrics and expectations for assignments. More lectures could be tailored towards the students in the biological option as well as the course was almost 100% process related.</p>
<p>Clearer statement of deliverables: minimum requirements and/or a statement of the flexibility of a given deliverable.</p>
<p>The only thing I can think of to improve the course is to assign more than one instructor to interact with a design team. For example, for Bio teams only Dr. Baldwin was supervising us. I wished we had instructors with expertise in other areas come and interact more with us to uncover areas that need more work. That way we can figure out design flaws early in the term rather than waiting until end of term presentations to get feedback from all the instructors. Thank you.</p>
<p>The course is well designed, and it is very clear what is expected of students. The scheduling is well set up, and we really appreciated the soft deadlines during midterm seasons. We also appreciate the extensive library of sample deliverables in Canvas. One notable issue for Biological groups was the tight schedule for handing in the Mass & Energy Balance calculations; since most of these groups could not use Aspen or Hysys to generate these numbers, we had to set up and calculate them in Excel, which takes a significantly larger amount of time.</p>
<p>I do believe that CHBE 454 and 453 have different course codes for a reason. The process and bio stream should be separated. The process streams spend a great deal of time modelling their processes but are never graded on their model. For example there is very little incentive to optimize the model. I feel that if the process groups were separated from the bio groups then more of the course weight can be pushed onto the model. Similarly during presentation time there would be less presentations to watch and this time could be allocated elsewhere (I'm sure the profs don't enjoy watching 20 presentations either).</p>
<p>Groups of 8 are far too big... should be 6 max. Half the group ended up doing twice the work of the others due to their knowledge of the project.</p>
<p>I enjoyed the soft deadlines and Jonathan gave us a lot of feedback on our work, however, a lot of the second semester assignments were more work than learning. What was the</p>

Comments

point of the cause and effect matrix? Also creating data sheets for each piece of equipment was redundant... a lot of the numbers are just wrong.

Capstone felt like a major challenge for the bio groups. It would be great to have an instructor with a little more experience within biotech industries and modelling of bioreactors. This course needs to continue to be pushed more in the direction of making improvements for the bio students.

Explanatory Note

Percent Favourable Rating

This is the percentage of respondents who rated the instructor a 4 or 5 (Agree or Strongly Agree).

Interpolated Median

The data collected for Student Evaluations of Teaching (SEoT) are ordinal in nature, with a natural order (from 1 to 5). While the mean may be used as a measure of central tendency for such data, it is not an appropriate or accurate representation of SEoT data (cf. Stark & Freishtat, 2014). The usual measure of central tendency for ordinal data is the median. As a result, we have been reporting the mean and the median for the last several years. After considerable thought and data modeling, we now believe that the interpolated median is the best representation of the data, since it takes the frequency distribution into account.

Consider the following example from 2015W, the two classes have identical mean (3.8). However, the instructor in class 2 received 77% favourable (4-5) ratings, compared to 53% for the instructor in class 1. The Interpolated median values of (3.7 and 4.2), much better reflects the distribution of the scores above and below their respective median. Furthermore, the interpolated median is better correlated with percent favourable rating; such that an interpolated median of 3.5 on a Likert scale of 1 to 5, corresponds to 50% favourable rating.

Frequency Distribution

Response for UMI	Class 1	Class 2
5 = Strongly agree	5	5
4 = Agree	3	5
3 = Neither agree nor disagree	6	0
2 = Disagree	1	2
1 = Strongly disagree	0	1
Mean	3.8	3.8
Median	4.0	4.0

Interpolated Median	3.7	4.2
Percent favourable rating	53%	77%

Dispersion Index

The dispersion Index is a measure of variability suitable for ordinal data (Rampichini, Grilli & Petrucci 2004). This dispersion index has values between zero and 1. A zero dispersion index indicates that all students in the section gave the same rating to the instructor. An index value of 1.0 is obtained when the class splits evenly between the two extreme values (Strongly Disagree & Strongly Agree), a very rare occurrence. In SEoT data at UBC, the index rarely exceeds 0.85, and mostly for evaluations not meeting the minimum recommended response rate.

A.2. Peer Evaluations of Teaching

Below are copies of peer reviews of teaching conducted by tenured faculty over the past four years. This includes CHBE 220 (2019W), CHBE 220 & CHBE 453/454 (2019W), CHBE 376 (2019W, 2018W) and CHBE 241 (2017W, 2016W).

A.2.1 CHBE 220 2019W Review

**THE UNIVERSITY OF BRITISH COLUMBIA
FACULTY OF APPLIED SCIENCE**

PEER REVIEW OF TEACHING (for ARPT purposes)


Instructor: Jonathan Verrett

Course: CHBE 220

Dates, Duration of Observation: 19 Nov 2019, 80-minutes

Teaching Format: Lecture

Reviewer Name (please print): Louise Creagh

Reviewer Signature: 

CHBE Criteria Framework for Peer Review of Teaching

This framework is intended to serve as a guide for the criteria that may apply to assess teaching for data sources ranging from classroom observations to course or curriculum design to student mentoring. Both the list of criteria and the questions illustrating exemplary practices described under each heading are not meant to be exhaustive nor rigid. The form may be modified to meet the specific review context.

For each criterion, (i) indicate whether teaching effectiveness is very evident, mostly evident, partially evident, or not evident in the observations of this criterion in the instructor's teaching practice, and (ii) provide comments describing the evidence to justify the assessment.

1. **Organization/Structure:**

Score: Very evident / Mostly evident / Partially evident / Not evident

Does the organization or structure of the course provide an effective learning environment for students? Are specific objectives and learning outcomes clearly communicated? Does the structure of the course material and delivery respect diversity in learning styles?

The structure of CHBE 220 is very conducive to effective learning as students are applying natural and engineering science concepts in the context of chemical process design. The learning objectives are clearly presented in the course syllabus. Students are engaged in both individual and team work throughout the course. During the term, each student group works through the design steps on an assigned process; they learn the fundamental concepts and apply them immediately to their design problem. This has the effect of making the course material very relevant to the students. They have a greater understanding of the field of Chemical & Biological Engineering and a greater appreciation of the value of fundamental sciences in engineering design.

Dr. Verrett's lecture on November 19th was very well organized. He began the lecture on time and spent the first 2 or 3 minutes reviewing the schedule for the week ahead. He then clearly stated the learning objectives for the lecture being given that day on Process Safety and explained how it fit into the overall goals of the course. Dr. Verrett used PowerPoint slides on one screen and a document camera on a second screen. He wrote notes on the doc-cam at a pace appropriate for the students, many of whom were taking notes. His slides were very clear and easy to read. At the end of the lecture Dr. Verrett reviewed the learning outcomes to reinforce the concepts.

2. **Learning Goals/Outcomes:**

Score: Very evident / Mostly evident / Partially evident / Not evident

The learning goals/outcomes are appropriate for the course and encompass acceptable academic rigor. Clear, high expectations are communicated.

The learning outcomes are appropriate for the course, which is an introduction to Chemical & Biological Engineering with emphasis on the physical sciences. The theory is introduced and then immediately applied to industrially relevant systems. The course learning outcomes broadly follow the steps in the design of a chemical process. This lecture was an introduction to Process Safety, which is one of the last topics covered in this course. During the lecture, the students were provided with a good understanding of safety terminology and statistical calculations, and gained a good appreciation of the importance of this subject and how it fits into design of chemical plants.

3. **Content:**

Score: Very evident / Mostly evident / Partially evident / Not evident

The course material is of high quality with respect to currency, relevancy, appropriate breadth and depth of content matter. It builds on prior knowledge and provides for coherence in learning experiences and ongoing practice of learned skills.

The course material builds on 1st year Chemistry, Physics and Math to introduce students to more advanced Physical Chemistry and its application to industrially relevant problems. The material presented in this lecture was clearly placed in context of the course at the beginning of the lecture. The content was of high quality and appropriate breadth for an introductory course. Several examples were provided to illustrate various concepts and the link between the Engineering Code of Ethics and Process Safety was clearly illustrated.

In preparation for the tutorial session later in the week, Dr. Verrett assigned students to view a video about a safety incident at a refinery; during the tutorial students analyse process safety for a unit in the process they have been designing during the term. This made the lecture material very relevant to students; there was a strong link between the lecture and the tutorial.

4. **Teaching Strategies:**

Score: Very evident / Mostly evident / Partially evident / Not evident

The teaching strategy matches the content and objectives. The instructor uses a variety of strategies to address the diversity of learning styles, and to encourage active learning and critical thinking. The delivery is effective in facilitating attainment of learning outcomes by students. Time on task is adequate.

Dr. Verrett encouraged active learning and different learning styles by using a combination of delivery methods. Two screens were used for the lecture, PowerPoint slides were presented on one screen while the notes he wrote were projected on a second screen using a document camera. The blackboard was also used occasionally to clarify points during the lecture. Additionally clicker questions were posed at three different times during the lecture. Students were encouraged to discuss the clicker questions with their neighbours before selecting an answer. The lecture pace was appropriate and students were provided with sufficient time to understand the concepts.

5. **Communication & Interaction:**

Score: Very evident / Mostly evident / Partially evident / Not evident

The instructor establishes effective communication, interactions and rapport with the students. He/she encourages questions and suggestions. He/she conveys enthusiasm for the subject matter. Does he/she show concern for students' learning?

Dr. Verrett is a very approachable lecturer; the material was delivered very clearly and questions from the students were encouraged throughout the lecture. His enthusiasm for sharing his knowledge of Chemical and Biological Engineering clearly shows in his interactions with students.

6. **Indicators of Student Involvement and Engagement:**

Score: Very evident / Mostly evident / Partially evident / Not evident

Are students engaged in active learning, participation, note-taking, discussions, or other activities? Is collaborative/team learning encouraged?

Although the lecture took place in a large lecture hall, CHBE 101, the students were actively engaged, even those at the back of the hall. Most students were taking notes and all participated in clicker questions. Team learning was encouraged when clicker questions were given; students were given several minutes to discuss the various options with their neighbours before selecting an answer.

7. **Evaluation/Assessment:**

Score: Highly effective / Effective / Satisfactory / Unsatisfactory

Based on your observations, how would you rate the candidate in terms of overall teaching effectiveness? Please justify your assessment.

I would rate Dr. Verrett as a highly effective and dedicated teacher. His lectures are clear and methodical and he shows great concern for student learning. I have frequently observed him after class or during office hours patiently explaining concepts to students. I therefore support, in the strongest possible terms, his re-appointment to the position of Instructor I.

A.2.2 CHBE 220 & CHBE 453/454 2019W Review

THE UNIVERSITY OF BRITISH COLUMBIA FACULTY OF APPLIED SCIENCE

PEER REVIEW OF TEACHING (for ARPT purposes)


Instructor: Jonathan Verrett

Course: CHBE 220 & CHBE 453/454

Dates, Duration of Observation: Nov 15, 2019, 1h. (CHBE 220) Sept. 10 –
Nov. 26, 2019 (1h/week) (CHBE 453/454)

Teaching Format: Lecture

Reviewer Name (please print): Susan A Baldwin

Reviewer Signature:  _____

CHBE Criteria Framework for Peer Review of Teaching

This framework is intended to serve as a guide for the criteria that may apply to assess teaching for data sources ranging from classroom observations to course or curriculum design to student mentoring. Both the list of criteria and the questions illustrating exemplary practices described under each heading are not meant to be exhaustive nor rigid. The form may be modified to meet the specific review context.

For each criterion, (i) indicate whether teaching effectiveness is very evident, mostly evident, partially evident, or not evident in the observations of this criterion in the instructor's teaching practice, and (ii) provide comments describing the evidence to justify the assessment.

1. **Organization/Structure:**

Score: Very evident / **Mostly evident** / Partially evident / Not evident

Does the organization or structure of the course provide an effective learning environment for students? Are specific objectives and learning outcomes clearly communicated? Does the structure of the course material and delivery respect diversity in learning styles?

Material was well organized on Canvas with specific learning objectives and outcomes described. Rubrics for marking and the format expected for reports are spelled out clearly. Since all the material can be assessed from the Canvas course website, different learning styles are accommodated. Dr. Verrett is accessible and available to his students for those who prefer one-on-one interactions.

2. **Learning Goals/Outcomes:**

Score: Very evident / **Mostly evident** / Partially evident / Not evident

The learning goals/outcomes are appropriate for the course and encompass acceptable academic rigor. Clear, high expectations are communicated.

The learning goals and outcomes are appropriate for the courses that I evaluated. Clear expectations are communicated. I did not witness high expectations being communicated in the particular lectures that I attended.

3. **Content:**

Score: Very evident / **Mostly evident** / Partially evident / Not evident

The course material is of high quality with respect to currency, relevancy, appropriate breadth and depth of content matter. It builds on prior knowledge and provides for coherence in learning experiences and ongoing practice of learned skills.

The courses that I evaluated were product and process engineering design courses that teach students to follow rigorous but fairly standard procedures. Content is consistent with what is expected in such courses.

4. **Teaching Strategies:**

Score: **Very evident** / Mostly evident / Partially evident / Not evident

The teaching strategy matches the content and objectives. The instructor uses a variety of strategies to address the diversity of learning styles, and to encourage active learning and critical thinking. The delivery is effective in facilitating attainment of learning outcomes by students. Time on task is adequate.

Dr. Verrett employs a lecturing pace and style that makes it easy to take in the material. He incorporated active learning in his lectures by having the students perform short exercises during the class time.

5. **Communication & Interaction:**

Score: **Very evident** / Mostly evident / Partially evident / Not evident

The instructor establishes effective communication, interactions and rapport with the students. He/she encourages questions and suggestions. He/she conveys enthusiasm for the subject matter. Does he/she show concern for students' learning?

Dr. Verrett's communication style is very effective. He is approachable but also establishes a culture of professionalism. He is outgoing and enthusiastic. From his evaluations, the students clearly appreciate Dr. Verrett.

6. **Indicators of Student Involvement and Engagement:**

Score: Very evident / **Mostly evident** / Partially evident / Not evident

Are students engaged in active learning, participation, note-taking, discussions, or other activities? Is collaborative/team learning encouraged?

Students are mostly engaged, although attendance was low in CHBE 220. The cause for this is unknown. Those students present were engaged and Jonathan encouraged them to collaborate by working as teams on particular projects.

7. **Evaluation/Assessment:**

Score: **Highly effective** / Effective / Satisfactory / Unsatisfactory

Based on your observations, how would you rate the candidate in terms of overall teaching effectiveness? Please justify your assessment.

Overall Dr. Verrett's lecturing style and communication excellence make him a very effective teacher. The courses that I observed were being taught by Dr. Verrett for the first time, and I am sure that as he becomes more familiar with the course material, his delivery and engagement with students will improve.

A.2.3 CHBE 376 2019W Review

THE UNIVERSITY OF BRITISH COLUMBIA FACULTY OF APPLIED SCIENCE

PEER REVIEW OF TEACHING (for ARPT purposes)

Instructor: Dr. Jonathan Verrett

Course: CHBE 376 Computer Flowsheeting

Dates, Duration of Observation: February 26, 2020, 1 hour

Teaching Format: Lecture and Tutorial

Reviewer Name (please print): Dusko Posarac

Reviewer Signature: *Dusko Posarac*

CHBE Criteria Framework for Peer Review of Teaching

This framework is intended to serve as a guide for the criteria that may apply to assess teaching for data sources ranging from classroom observations to course or curriculum design to student mentoring. Both the list of criteria and the questions illustrating exemplary practices described under each heading are not meant to be exhaustive nor rigid. The form may be modified to meet the specific review context.

For each criterion, (i) indicate whether teaching effectiveness is very evident, mostly evident, partially evident, or not evident in the observations of this criterion in the instructor's teaching practice, and (ii) provide comments describing the evidence to justify the assessment.

1. **Organization/Structure:**

Score: Very evident

The organization and structure of the lecture I have visited provided an effective learning environment for students. The objectives and learning outcomes were clearly communicated. Delivery of the content demonstrated high respect for diversity in learning styles.

At the beginning of the lecture the instructor presented background information regarding the design and rating of distillation columns—McCabe-Thiele diagrams, q-line, and typical values of reflux ratios as functions of minimum reflux ratio. This was followed by a demonstration of a shortcut distillation column simulation in a commercial simulator, Aspen Plus. The students have this program on their computers, so this was an interactive session where they built the simulation following the instructor's presentation. The students often asked questions about some finer points and concepts. The final part was a tutorial where the students were given the problem description and asked to develop a complete simulation of a distillation column using a real-life process example.

2. **Learning Goals/Outcomes:**

Score: Very evident

The learning goals/outcomes are appropriate for the course and encompass acceptable academic rigor. Clear expectations are communicated to the student.

The software used in this course (Aspen Plus) is the most widely used simulation software in chemical engineering. It is used in the 4th year capstone course to develop material and energy balances, select utilities (steam, cooling water, refrigeration etc.), perform sensitivity analyses, optimization, sizing and costing, and economic evaluation. As such, this course prepares the students for today's job market where use and full understanding of specialized software is an advantage.

3. **Content:**

Score: Very evident

The course material is of high quality with respect to currency, relevancy, appropriate breadth and depth of content matter. It builds on prior knowledge and provides for coherence in learning experiences and ongoing practice of learned skills.

The course builds on many previously taken courses, including Material and Energy Balances, Computational Methods, Thermodynamics, Unit Operations, and Reactor Design. The knowledge gained in these disciplines is combined when developing a simulation of a single unit or a complete chemical plant.

4. **Teaching Strategies:**

Score: Very evident

The teaching strategy matches the content and objectives. The instructor uses a variety of strategies to address the diversity of learning styles, and to encourage active learning and critical thinking. The delivery is effective in facilitating attainment of learning outcomes by students. Time on task is adequate.

The teaching strategy is well adapted to the course content and objectives. As already mentioned, the instructor uses a variety of strategies both to address the diversity of learning styles, and to encourage active learning. For this type of course, the mixture of background information discussed first, followed by a demonstration of the software use, and concluded by individual work on one or more tutorial problems, works really well. As a result, time on task is adequate.

5. **Communication & Interaction:**

Score: Very evident

The instructor establishes effective communication, interactions and rapport with the students. He/she encourages questions and suggestions. He/she conveys enthusiasm for the subject matter. Does he/she show concern for students' learning?

The session objectives were made clear, with the carefully structured session. For the entire length of the session there was a good flow, keeping students engaged. The instructor demonstrated an excellent understanding of the material, and a capability to communicate it clearly to the students. The students were interested in the material being taught and active in class asking questions.

6. **Indicators of Student Involvement and Engagement:**

Score: Very evident

Are students engaged in active learning, participation, note-taking, discussions, or other activities? Is collaborative/team learning encouraged?

In addition to asking questions, students were engaged in developing simulations, note-taking, discussions with their peers and the instructor. During the tutorial part of the session, the instructor was walking around, answering the more detailed questions that a student or a group had. Collaborative/team learning happened "naturally"—the students compared their procedures and results with their peers and discussed various ways to get the desired results.

7. Overall Evaluation/Assessment:

Score: Highly effective


Based on your observations, how would you rate the candidate in terms of overall teaching effectiveness? Please justify your assessment.

The instructor displayed a thorough knowledge of the subject which he effectively delivered to the students through a well-prepared, thoughtful, and interesting lecture, illustrated with relevant examples. His rapport with students was well developed. The instructor demonstrated strong commitment to teaching and showed great enthusiasm.

A.2.4 CHBE 376 2018W Review

**THE UNIVERSITY OF BRITISH COLUMBIA
FACULTY OF APPLIED SCIENCE**

SUMMATIVE REVIEW OF TEACHING (for ARPT PURPOSES)

Instructor: Jonathan Verrett
Course: CHBE 376 (Computer Flowsheeting & Fluid Properties Estimation) - Core
Dates, Duration of Observation: April 2, 2019 : 11am to 12:30 pm
Teaching Format: Lecture – Hennings 200
Reviewer Name(s) (PRINT): David Wilkinson (CHBE)
Reviewer Signature(s): 

Indicate whether you have provided the instructor with a copy of this report.

Yes No

All reports for ARPT purposes will be made available to the instructor.

Indicate whether the instructor was informed in advance of the scheduled visit.

Yes No

Indicate whether the instructor was given an opportunity in advance of the observation session to provide background information about the course and the specific class(es) to be visited

Yes No

Teaching Dossier Assessment

Confirm that you have examined the teaching dossier prior to the in-class visit

Yes No

I have been aware of Dr. Verrett's teaching dossier since the summer of 2016 when he was hired as an Instructor 1 in our Department to enhance design and laboratory experience for the students. Dr. Verret came with a strong teaching background

7. Overall Evaluation/Assessment:

Score: Highly effective

Based on your observations, how would you rate the candidate in terms of overall teaching effectiveness? Please justify your assessment.

The instructor displayed a thorough knowledge of the subject which he effectively delivered to the students through a well-prepared, thoughtful, and interesting lecture, illustrated with relevant examples. His rapport with students was well developed. The instructor demonstrated strong commitment to teaching and showed great enthusiasm.

from McGill where he was involved in a number of teaching initiatives during his PhD. He is always looking for ways to improve his approach to instruction and engage students more effectively, particularly in the large class setting. To this end he is actively involved with conferences and workshops on teaching pedagogy to improve and upgrade his teaching effectiveness.

In-Class Observation and Assessment

Strengths:

Dr. Verrett went right into the lecture after a brief introduction. This is a difficult course to teach as there is a lot of material for the time allotted, and the program simulations are demonstrated on the overhead while assistance is given to students who are having trouble carrying out the simulations on their own laptops. Dr. Verrett did an excellent job of keeping the flow of the class going over the 1.5 hours. During the lecture he discussed some bio and batch processing layouts, different reactor types, "Aspen Plus" and "Super Pro" programming, and got the class to switch batch reactor types and run simulations. During the student run simulations Dr. Verret circulated throughout the class to see how everyone was doing. The students sat in groups of about 4 to 6 students and appeared to be fully engaged in the instruction and running their simulations. The course appears to have clear objectives and is organized in a logical and systematic way.

Weaknesses:

I was not able to detect any issues in the course instruction which overall was done very well. However, one issue I noticed with respect to the course is that with a class of about 90 students it is very difficult for one instructor to answer all questions and help all students during class work on simulations.

Overall Assessment:

Dr. Verrett is an excellent instructor. I found no noticeable weaknesses in his teaching of this course. This course is difficult to teach because it involves carrying out simulations during teaching of the class. The quality of his teaching is certainly at the level of a senior instructor. In addition, Dr. Verrett brings a lot of energy and passion to the classroom which is important for engagement in large classes.

A.2.5 CHBE 376 2017W Review

THE UNIVERSITY OF BRITISH COLUMBIA FACULTY OF APPLIED SCIENCE

PEER REVIEW OF TEACHING (for ARPT PURPOSES)

Instructor: Jonathan Verrett
Course: CHBE 241 Material and Energy Balances
Dates, Duration of Observation: September 28, 2017 12:30-2:00 pm (90 minutes)
Teaching Format: Lecture
Reviewer Name(s) (PRINT): Dusko Posarac
Reviewer Signature: *Dusko Posarac*

Indicate whether you have provided the instructor with a copy of this report.

Yes No

All reports for ARPT purposes will be made available to the instructor.

Indicate whether the instructor was informed in advance of the scheduled visit.

Yes No

Indicate whether the instructor was given an opportunity in advance of the observation session to provide background information about the course and the specific class(es) to be visited

Yes No

Teaching Dossier Assessment

Confirm that you have examined the teaching dossier prior to the in-class visit

Yes No

After examining Dr. Verrett's teaching dossier, it became evident that he has demonstrated excellence in teaching, introduced and continues to introduce valuable innovations in the curriculum, gave great attention to detail and student feedback, and has excellent teaching evaluations. Dr. Verrett is focused on finding opportunities to continue to improve his own teaching practice and this is shown by his success in obtaining a Teaching and Learning Enhancement Fund (TLEF) grant to improve resources for student in CHBE 241. Dr. Verrett has also focused on finding opportunities to improve design education in the departments programs.

He actively supports and advises extra-curricular student design teams, such as Chem-E-Car which have expanded their membership as well as the number of projects they undertake. He has also been active in analyzing and seeking support for improving design experiences in the CHBE curriculum. This is evidenced by his active role in improving second year lab experiences as well as applying for support through the Centre for Teaching, Learning and Technology (CTLT) Faculty Associates Program.

In-Class Observation and Assessment

Strengths:

Dr. Jonathan Verrett was very well prepared for the lecture I have attended. He provide a theory behind reactive material balance and then went step-by-step through two examples to illustrate the concept. The students were encouraged to ask questions and as a result quite a few questions were asked and the overall atmosphere was very positive and relaxed.

Weaknesses:

It is difficult to identify a weakness with such an excellent and knowledgeable instructor as Dr. Verret. It is perhaps worth mentioning that his presentation was at moments a bit slow-paced, due to the medium used—Jonathan was writing the notes on a screen of a “tablet PC” connected to an LCD projector. This process is significantly slower than writing on overhead transparencies or using chalk/blackboard.

Overall Assessment:

This teaching evaluation is for a core course CHBE 241 Material and Energy Balances. The course is lecture-based with tutorials every second week. This course is a core course for CHBE and IGEN students. In addition, a few students from other Applied Science programs (e.g., Mechanical Engineering), take this course as a technical elective. The attendance was around 70% (140-150 out of 200 students). The visit was before the first mid-term exam.

The session objectives were made clear, with the carefully structured session. The session began with a discussion of the theoretical background, followed by two detailed and well-thought-out examples. The session topic (reactive mass-balances) fits the program objectives completely, covering the following graduate attributes:

Knowledge Base through the introduction of theory for solving reactive balances
Problem Analysis through the application of this theory to two relevant examples
Use of Engineering Tools through the presentation of relevant disciplinary diagrams for organizing calculations.

The session was both well planned and organized, with a thorough attention to detail. The reactive mass-balances, an important topic in chemical engineering, are strongly related to the Material and Energy Balances course aims. For the entire length of the session there was a good flow, keeping students engaged. The instructor demonstrated an excellent understanding of the material, and a capability to communicate it clearly to the students.

Jonathan Verrett is strongly committed to teaching, showing great enthusiasm. The students were interested in the material being taught and active in class asking questions.

As already mentioned, at moments the pace of the presentation was somewhat slower due to use of an electronic pen on a screen of a PC, compared to using a document camera or even a board and chalk. The amount of material was exactly right and nicely illustrated the content.

Dr. Verrett speaks clearly and audibly. Due to the large number of students (~200) and less than ideally-shaped classroom (CHBE 101), the use of microphone is mandatory. He has a good presentation skills and good rapport with the students. Jonathan was respectful and thanks to his attitude created a positive learning environment, responsive to students' questions.

Even without an "official" encouragement, the students were active and without hesitation asked questions. The two examples selected to illustrate the reactive material balances concept were illustrative with enough detail provided. This seemed an effective technique, giving an impression that the majority of students grasped the concept. The examples were from real life, easily connected with a situation that engineers would encounter in their professional practice.

Dr. Jonathan Verrett displayed a thorough knowledge of the subject which he effectively delivered to the students through a well-prepared, thoughtful, and interesting lecture, illustrated with relevant examples. His rapport with students was well developed. I can with confidence recommend Dr. Jonathan Verret be re-appointed to the rank of Instructor I.

A.2.6 CHBE 376 2016W Review

THE UNIVERSITY OF BRITISH COLUMBIA FACULTY OF APPLIED SCIENCE

PEER REVIEW OF TEACHING (for ARPT PURPOSES)

Instructor: Jonathan Verrett

Course: CHBE 241

Dates, Duration of Observation: November 22, 2016

Teaching Format: Lecture Hall (power point and document camera): CHBE 101

Reviewer Name(s) (PRINT): David Wilkinson

Reviewer Signature(s):

Indicate whether you have provided the instructor with a copy of this report.

Yes No

All reports for ARPT purposes will be made available to the instructor.

INSTRUCTIONS: (For reference only. Please delete instructions highlighted in red font prior to submission)

This peer review is intended for use for ARPT purposes. It will be used as one of several indicators provided to departmental, faculty and university committees to assess the overall teaching capability of the instructor teaching the course. The reviewer is expected to highlight the strengths and weaknesses of the teaching skills of the candidate and the learning environment he/she creates and to make an overall determination of the extent to which the candidate demonstrates the level of teaching competence or excellence required for each level of review. This review is not intended to be used to provide detailed formative guidance to the instructor being assessed.

Indicate whether the instructor was informed in advance of the scheduled visit.

Yes No

Indicate whether the instructor was given an opportunity in advance of the observation session to provide background information about the course and the specific class(es) to be visited

Yes No

Teaching Dossier Assessment

Confirm that you have examined the teaching dossier prior to the in-class visit

Yes No

Comment on the teaching dossier provided by the candidate with respect to philosophy and approach to teaching, evidence of teaching innovation and leadership, contributions to curriculum development, course design, planning and implementation, situation within the overall program, appropriateness and clarity of aims, objectives and content.

In-Class Observation and Assessment

Please provide detailed and illustrative commentary on observed teaching effectiveness. The appended guidelines provide suggested areas with which you may structure your narrative comments (as appropriate). Ensure that you substantiate your conclusions on observed strengths and weaknesses with illustrative examples from the teaching session(s).

Jonathan Verrett (Instructor 1) taught CHBE 241 (Material and Energy Balances) in Term 1 of the 2016 / 2017 year. This is a core CHBE course in which an introduction to Chemical and Biological Engineering units, stoichiometry, phase equilibria, material and energy balances is provided. The course is taught in a large teaching classroom (CHBE 101) with two screens and about 200 students.

I was asked to carry out a peer review to provide an opportunity for feedback on Dr. Verrett's teaching, and potential areas for improvement. I met with him after my attendance to discuss the course and my observations.

Strengths:

Dr. Verrett seemed relatively at ease in a large classroom teaching environment. He walks around a lot (even up the aisles) during the lecture which probably helps to make the class more attentive. His use of overheads in parallel with development of formulae and problem solving using the projector was well done and effective. The pace of development of the solutions and lecturing was at a reasonable pace for most of the lecture, allowing the class to follow the material and ask questions.

During the lecture I attended, Dr. Verrett taught the subject area of heats of reaction and formation. He made a very good comparison of the heats of reaction method versus the heat of formation method. This could be a very dry lecture for some students but Dr. Verrett engaged the students through thoughtful questions and real examples, and calculations to do in class.

Weaknesses:

I found no obvious major weaknesses in Dr. Verrett's teaching style or effectiveness. Perhaps, one suggestion for improvement would be not to finish/rush the material too quickly at the end of the lecture. Another suggestion would be to make sure that the students know how to use Excel and Excel Solver to solve problems in the course. It appeared that some students were struggling with the programming aspect of solving the problem(s). Class engagement is a challenge for all of us so it is always worthwhile to look for methods to improve this.

Overall Assessment:

Based on the assessment provided above, please provide an overall opinion as to the instructor's level of overall teaching effectiveness relative to the specific criteria for the rank under consideration. Note the terms underlined in Appendix B below.

My overall assessment of Dr. Verrett is that he is an excellent overall instructor. The nature of the lesson I attended in this core course was detailed and informative. Dr. Verrett set very clear objectives for the course and the lecture, organized the material in a very logical and systematic way, and he communicated the lecture in an effective and engaging way.

A.3. CHBE 241 Sample Resources

The following pages include sample resources from CHBE 241. These are:

- a syllabus with course schedule,
- a WeBWork screenshot and sample assignment.
- a sample of a supplementary study guide.

A.3.1 CHBE 241 Syllabus

University of British Columbia
Department of Chemical and Biological Engineering

CHBE 241: Material and Energy Balances –Winter 2018 Term 1– 3 credits

Instructor: Dr. Jonathan Verrett (Contact me preferably through Piazza, instructions for setup below, or at jonathan.verrett@ubc.ca), CHBE 427, (604)-827-5685 **Office Hours:** Wednesday, 11:00 – 12:00, in CHBE 427

Lectures: Tuesday/Thursday 12:30-13:50 in SWING 221 on Tuesday CHBE 101 on Thursday (starts Sept 6, ends Nov 30)

Tutorial: Wednesdays. 16:00-17:00 in CHBE 101 (starts Sept 5, ends Nov 30)

Teaching Assistants:

Name	E-mail	Office	Duties
Jun Sian Lee	jslee@chbe.ubc.ca	503	Assignment marking (A2, A6, A8), tutorials, answering general content questions, exam marking
Ruben Govindarajan	ruben.govindarajan@ubc.ca	641	Assignment marking (A1, A3, A5), tutorials, answering general content questions, exam marking
Robe Putra	berobe@chbe.ubc.ca	519	Assignment marking (A4, A7, A9), tutorials, exam marking

Online Contact: For **questions on grading**, please send an email to the instructor and include the TA(s) who are responsible for marking (if known). Please include “[CHBE241]” in the subject line so that I can easily know what course your email is about. **Questions on course content** can be posted through the PIAZZA system. You can login to PIAZZA through the link on the sidebar of the CANVAS website. This will create an account on the Piazza system with an anonymized forwarding email from UBC. You can use your actual name, or a pseudonym depending on your privacy preferences. Use of piazza for questions will ensure your questions get answered in a timely manner and allows other students to answer your questions as well as giving you the chance to post anonymously. You can also send private messages only visible to you and the instructor.

Who to Contact. You can consult with the instructor, TAs and fellow classmates, ideally through PIAZZA, regarding questions on the course material or interpreting assignments. Requests to re-grade exams or assignments should be done in writing within 7 days of date the item is graded and returned to the class. These should be given to the instructor. A short argument about why the specific exam or assignment questions should be re-graded must be included.

Course Text: There is no mandatory course text. However there are a variety of resources available to assist students, all structured similarly to follow the course structure, these include:

- R.M Felder, R.W. Rousseau, and L.G. Bullard, *Elementary Principles of Chemical Processes*, 4th Edition (Available in the bookstore or amazon). I find this book quite useful and well structured and have based our course organization off it. The 3rd edition has nearly identical problems and structure and can also be used. Whether you want a binder-ready version or a hard cover is up to you. My notes will follow this textbook and structure closely.
- Online guides and problem sets created by your colleagues, Victor Chiew, Siang Lim, Jamie Ngai To Lo, Said Zaid-Alkailani, and edited by Dr. Jonathan Verrett can be found at the link below, note that this link may be updated throughout the semester: <https://wiki.ubc.ca/CHBE241>
- LearnChemE.com hosted at UC Boulder has a variety of screencasts from their material and energy balances course, these can be accessed here: <http://www.learncheme.com/screencasts/mass-energy-balances>
- Previously this course has used Murphy, R. M. *Introduction to Chemical Processes: Principles, Analysis, Synthesis*, this is also a good text and can provide practice problems, however, I will not be following its structure for content.

Sample questions are available in the online modules as well as on the exam wiki found here: <https://wiki.ubc.ca/CHBE241>. Extra practice questions can also be found in the **End of Chapter Questions** in the Felder textbook provide a good resource for testing your knowledge with some of the numerical final solutions found at the back of the book. **Test Yourself** questions found in the textbook also provide a good set of questions to test your knowledge with all answers provided in the back of the textbook.

Course prerequisites: officially there are no prerequisites, however, you all have successfully completed the first year of an engineering program. This course draws on previous chemistry (CHEM 154), physics (PHYS 157) linear algebra (MATH 152) and calculus (MATH 100/101) courses.

Academic Calendar Entry: Introduction to Chemical and Biological Engineering; units; stoichiometry; phase equilibria; material balances; energy balances. *This course is not eligible for Credit/D/Fail grading.* [3-0-1]

Course Outcomes: By the end of the course, you should be able to **analyze** chemical and biological processes using appropriate material and energy balances to specify process streams. This is supported by the following outcomes:

- Solve stoichiometry and thermodynamics problems using process variables
- Identify known quantities, unknown quantities and assumptions in process engineering
- Retrieve or estimate information from engineering flow sheets and steam tables
- Analyze chemical & biological processes to determine appropriate solution strategies
- Create block flow diagrams (BFDs) and identify components in process flow diagrams (PFDs)

POLICIES AND PROCEDURES

- **Academic integrity.** The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment

or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences.

A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Academic Calendar at - <http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,286,0,0>
Guides on avoiding plagiarism can be found at the following link - <http://learningcommons.ubc.ca/resource-guides/>

In this course:

- **You can** work with others when solving assignment questions by sharing solutions strategies, however your solutions must be your own. Make sure you understand the material, copying may get you 100% on the assignment, but will not help when it comes to quizzes and exams, as well as the rest of your studies and your career. Directly copying solutions is considered cheating in this class.
 - **You can** discuss a strategy of how to solve a problem with others in the course, you cannot however copy their solutions. The goal of this is to promote learning and cooperation between individuals, if you simply copy an assignment you will learn much less than discussing and understanding a solution method and then attempting to implement it yourself.
 - **You cannot** collaborate with anyone during individual assessments such as the individual portions of exams.
 - If you have questions on any of these points it is your responsibility to clarify with the instructional team before undertaking any activity (you can ask on PIAZZA). If you think what you are doing may be inappropriate, **please ask** before submitting work.
-
- **WeBWork.** Will be completed through the online system and can be accessed through a link on Canvas. If you have any technical issues with this system, please contact the instructors through PIAZZA or email Jun Sian Lee (jslee@chbe.ubc.ca) while cc'ing Jonathan Verrett (jonathan.verrett@ubc.ca)
 - **WeBWork Submission Policies** WeBWork assignments cannot be submitted after the deadline since numerical solutions will be released after the due date. It is your responsibility to find the solution method by discussing with other students, the TAs or instructor.
 - **Exams.** There will be two midterm exams held in class during the semester and one comprehensive final exam. *All exams will be closed-book, with a formula sheet provided.* The formula sheet will be provided in advanced and it is recommended you use it to practice solving problems. No electronic devices other than a calculator are allowed during exams (including watches). A cell phone may not be used as a calculator.
 - **Missed Exams** If you miss an exam or assignment without either a certified medical excuse or prior instructor approval, you will receive a mark of 0 on that exam. Midterm exams missed with certified medical excuses or prior instructor approval will have half the weight moved to the final exam and the other half moved to the other midterm. Assignments missed will have the weight redistributed to other assignments with an equal weighting.
 - **Tutorials.** We will focus on problem solving in the tutorials. Please bring your calculator, equation sheet, class notes, textbook (if any) and paper.

- **Laptop and cell phone use:** Technology can be useful in the classroom, but may also prevent learning by distracting you and others. Please refrain from using technology in the classroom for purposes such as messaging, playing games, social media, texting, etc. Acceptable uses of laptops include taking notes and looking up relevant course information. Please be considerate of your classmates as your laptop or phone may not only be a distraction for you, but also those around you. Please put your cell phone on silent when you are in the classroom.
- **Instructors' commitment.** You can expect me and the TAs to be courteous, punctual, well organized, and prepared for lecture and other class activities; to answer your questions clearly; to be available during office hours or to notify you beforehand if we are unable to keep them; to provide a suitable guest lecturer if I am away; and to grade uniformly and consistently.
- **Consulting with faculty.** I encourage you to discuss any academic or personal question you have by coming to office hours or through PIAZZA. I look forward to getting to know each of you.
- **Access and Diversity:** I hope to make UBC a welcoming and inclusive space for all students. Feel free to ask me questions on any issues and I will do my best to guide you to any resources which might be helpful. You can find a number of university resources at the access and diversity website: <http://students.ubc.ca/about/access>
- **Course Feedback:** You can give feedback on my teaching and the course at any time by a number of means listed below. If there is a constructive comment that can help improve your learning, please let me know before the end of the course and I will do my best to incorporate your feedback.
 - Face-to-face at office hours or after lectures.
 - As a message through PIAZZA
 - Anonymously, through the feedback link posted on the CANVAS homepage
 - During the middle of the term as an in-class activity
 - At the end of the course through formal course evaluations

Assessment Criteria and Grading

- The course is graded on a percentage basis, based on the standard UBC grading scheme. 50% or greater is required to pass the course. The course is **not graded based on a distribution** as all practicing engineers are expected to have adequate technical knowledge in their fields. Your performance depends only on how you do, not on how everyone else in the class does. It is therefore in your best interests to discuss and help your classmates, as this has been shown in literature to **improve your own learning as well as their learning**.
- Assignments (9 total, highest 8 count) - 10% of final grade - Completed individually – These will focus on practice problems and will be completed on both WeBWorK and on paper. You will also want to practice on your own time. The highest 8 assignment grades will be weighted equally and used to form the 10% of the course grade. The paper portion will be due by 4pm to the assignment dropbox near the CHBE office on the 2nd floor of the CHBE building and the WeBWorK portion will be due at midnight the assigned due date. Late submissions will not be accepted.
- Midterms (20% each) – 40% of final grade- 1.25 hours each- covers all material in the class up to a point that will be specified. These may have some multiple choice component as well as longer answer sections. Closed book with formula sheet provided.

- Final - 50% of final grade - 3 hours - covers all course content. Closed book with formula sheet provided. If you get higher on the final than on the midterms, I will use your final mark in place of any midterms that are lower. I recommend you still try as best you can on the midterms and not rely on the final.

Exam formats, in terms of number of question and type, will be released prior to the exams. Links to previous midterm and final exams will be made available online through Canvas as well as some already being available at the following link: <https://wiki.ubc.ca/CHBE241>

Draft Class Schedule

<u>DATE</u>	<u>READ</u> (Chapters in text)	<u>SUBJECT</u>	<u>DO (due date)</u>
Week 1 9/3-9/7	Syllabus, Course Policies,	Introduction to the course	Access CANVAS and PIAZZA (link on CANVAS homepage)
Week 2 9/10-9/14	Chapter 2, 3	Introduction to engineering calculations; process data representation and analysis Tutorial 1	
Week 3 9/17-9/21	Chapter 4.1 – 4.4 Add/Drop deadline without a W (Sept 18)	Fundamentals of material balances; Balances on multiple process units; Tutorial 2	Assignment 1 (9/17)
Week 4 9/24-9/28	Chapters 4.5 - 4.6	Recycle and bypass streams; Chemical reaction stoichiometry Tutorial 3	Assignment 2 (9/24)
Week 5 10/1-10/5	Chapter 4.7	Balances on reactive processes; Tutorial 4	Assignment 3 (10/1)
Week 6 10/8-10/12	Chapter 4.7-4.9; Chapter 5-5.2	Balances on reactive processes (cont'd); Combustion reactions; Liquids, solids and ideal gasses Tutorial 5	Assignment 4 (10/9 – changed due to Thanksgiving)
Week 7 10/15-10/19	Chapter 6-6.4	Single component gas-liquid Systems Tutorial 6	Assignment 5 (10/15) Midterm #1 (10/18) Up to & including CH. 5, In Class
Week 8 10/22-10/26	Chapter 6.5-6.7; Chapter 7-7.4	Multi-component gas-liquid Systems; solid-liquid, liquid-liquid and gas-solid systems; Introduction to Energy Balances Tutorial 7	
Week 9 10/29-11/2	Chapter 7.5– 7.6; Ch 8-8.2	Thermodynamic tables and applications of energy balances; Energy balance calculations and pressure changes Tutorial 8	Assignment 6 (10/29)

Week 10 11/5-11/9	Ch 8.3	Energy balance calculations and pressure changes Tutorial 9	Assignment 7 (11/5)
Week 11 11/12-11/16	Chapter 8.4 – 8.5	Phase change and heat of mixing Tutorial 10	Assignment 8 (11/13 – changed due to remembrance day) Midterm #2 (11/15) Up to & including CH. 8.3, In Class
Week 12 11/19-11/23	Chapter 9 - 9.3	Heats of reaction and formation Tutorial 11	
Week 13 11/26-11/30	Chapter 9.4 – 9.6	Balances on reactive processes and combustion Tutorial 12	Assignment 9 (11/26)
Final Exam Period			FINAL EXAM (TBD)

A.3.2 CHBE 241 WeBWork Screenshot and Sample Assignment

A Screenshot of a single question is below, see the following page for all questions in this problem set, including the open-ended problem which is the last question in the set (#5).

(6 points) local/setModule-1-Questions/Mod1_Q2

The Solvay process is used to produce soda ash (Na_2CO_3), which is used to make glass, paper, soaps, detergents and can be converted to baking soda to make delicious baked goods. The process consumes limestone ($CaCO_3$) and sodium chloride ($NaCl$) (known commonly as salt) and also produces calcium chloride ($CaCl_2$) as a byproduct. Assuming we wish to produce 1450 tonnes of soda ash per day in our plant, what are the required feed rates of limestone and salt, as well as the rate of production of calcium chloride in tonnes/day?

- Limestone feed in tonnes/day..... : * tonnes/day
- Sodium chloride feed in tonnes/day..... : * tonnes/day
- Calcium chloride byproduct in tonnes/day..... : * tonnes/day

If the current prices for bulk quantities of these materials are \$95 for sodium chloride ($NaCl$), \$89 for limestone ($CaCO_3$), \$114 for calcium chloride ($CaCl_2$) and \$248 for soda ash (Na_2CO_3) per tonne respectively. What is the gross economic potential in \$/yr of this process if the plant operates 330 days per year (it doesn't operate all 365 due to maintenance)? Assuming operating costs are \$100 per tonne of soda ash produced and the capital cost of the plant will be \$132,000 per tonne of soda ash capacity of the plant (\$ cost to build the plant per tonne of soda ash produced per day), what is the net economic potential, and return on investment?

- Gross economic potential (GEP)..... : * \$/year
- Net economic potential (NEP)..... : * \$/year
- Return on Investment (ROI)..... : * %/year (eg. 50.2% you would enter as 50.2)

Make sure to use the capital "E" for scientific notation.

CHBE 241 Complete WebWork Assignment (PDF rendering of online questions)

Jonathan Verrett
Assignment A2 due 09/24/2018 at 11:59pm PDT

Default_term_CHBE241

1. (2 points) local/setChapter-4-part1-Questions/Chap4part1_Q1.txt

Process Classification:

Consider this system: As part of the maple syrup production process. A dilute maple sugar solution is heated in an open tank, part of the water evaporates and leaves the system. This then creates a concentrated maple sugar solution (maple syrup) which is removed and the process can then be repeated.

a) Is the process of creating maple syrup from a dilute maple sugar solution a ...

- batch, transient state process
- semibatch, transient state process
- continuous, transient state process
- batch, steady state process
- semibatch, steady state process
- continuous, steady state process

b) Which term(s) in the general balance equation is/are relevant (meaning non-zero) to analyze the mass balance of water in the tank described above throughout one entire cycle of production, meaning the dilute solution entering the tank to maple syrup leaving the tank? Select all terms that are relevant.

- A. input
- B. output
- C. generation
- D. consumption
- E. accumulation

Answer(s) submitted:

-
-

(incorrect)

2. (2 points) local/setModule-1-Questions/Mod1_Qz1-1C.txt

Process Classification:

A pharmaceutical company uses bacteria to produce a drug for cancer patients. The process for production of the drug is to add bacteria and nutrients into a reactor and seal it. At some point in time later, another amount of nutrients are added to the reactor, with nothing removed, so the bacteria continue producing the drug. Following nutrient addition the reactor is again sealed

until it is eventually opened to recover the final product.

a) What process classification best describes this process?

- batch, transient
- semi-batch, transient
- batch, steady-state
- semi-batch, steady-state

b) Considering the point in time where the additional nutrients are added to the reactor, what would be the general balance equation that would have the terms that best apply to account for the mass in the reactor vessel at that point in time? All of the terms in the equation should be non-zero.

- Accumulation = In - Out
- Accumulation = In
- Accumulation = In + Generation - Consumption
- Accumulation = In - Out + Generation - Consumption

Answer(s) submitted:

-
-

(incorrect)

3. (1 point) local/setModule-1-Questions/Mod1_Qz1-1G.txt

A pharmaceutical company uses bacteria to produce a drug for cancer patients. The process for production of the drug is to add bacteria and nutrients into a reactor and seal it. At some point in time later, another amount of nutrients are added to the reactor, with nothing removed, so the bacteria continue producing the drug. Following nutrient addition the reactor is again sealed until it is eventually opened to recover the final product.

The company wants to assess the economics of scaling up its process. It estimates a new facility could produce 3.1 tonne of the drug per year and the drugs value would be \$100 per gram. This would use 470 tonnes of bacteria and 9.95E+04 tonnes of nutrients per year in the production. The bacteria are valued at \$100 per kilogram and the nutrients at \$1,000 per tonne. The value of other feeds or products in the process are not deemed to be significant. What is the approximate Gross Economic Potential (GEP) in millions of dollars per year?

Relevant Formulas: Gross economic potential (GEP) = value of products - value of feeds

GEP..... : * \$ ____ Million/yr

Answer(s) submitted:

•
(incorrect)

4. (6 points) local/setModule-1-Questions/Mod1_Q2

The Solvay process is used to produce soda ash (Na_2CO_3), which is used to make glass, paper, soaps, detergents and can be converted to baking soda to make delicious baked goods. The process consumes limestone ($CaCO_3$) and sodium chloride ($NaCl$) (known commonly as salt) and also produces calcium chloride ($CaCl_2$) as a byproduct. Assuming we wish to produce 1450 tonnes of soda ash per day in our plant, what are the required feed rates of limestone and salt, as well as the rate of production of calcium chloride in tonnes/day?

- Limestone feed in tonnes/day..... : * ____ tonnes/day
- Sodium chloride feed in tonnes/day..... : * ____ tonnes/day
- Calcium chloride byproduct in tonnes/day..... : * ____ tonnes/day

If the current prices for bulk quantities of these materials are \$95 for sodium chloride ($NaCl$), \$89 for limestone ($CaCO_3$), \$114 for calcium chloride ($CaCl_2$) and \$248 for soda ash (Na_2CO_3) per tonne respectively. What is the gross economic potential in \$/yr of this process if the plant operates 330 days per year (it doesn't operate all 365 due to maintenance)? Assuming operating costs are \$100 per tonne of soda ash produced and the capital cost of the plant will be \$132,000 per tonne of soda ash capacity of the plant (\$ cost to build the plant per tonne of soda ash produced per day), what is the net economic potential, and return on investment?

- Gross economic potential (GEP)..... : * ____ /year Net economic potential (NEP)..... : * ____ /year Return on Investment (ROI)..... : * ____ %/year (eg. 50.2% you would enter as 50.2)

Make sure to use the capital "E" for scientific notation.

Answer(s) submitted:

•
•
•

Generated by ©WeBWorK, <http://webwork.maa.org>, Mathematical Association of America

•
•
•
(incorrect)

5. (0 points) setHW1/paperA2.pg

This part of assignment 2 is the portion due in paper form. It is due Sept 24, 4pm in the CHBE 241 dropbox on the 2nd floor outside of CHBE 218 (towards elevators and women's wash-room). Note the problem here in WeBWorK may say "0" marks as it is not marked by the WeBWorK system. The marks associated with it are noted below.

Acetone is a common solvent that is used in the manufacture of many chemicals. Since it is a volatile organic compound, there are restrictions on the release of acetone vapour into the environment. A manufacturing company has asked your consulting firm to design an acetone recovery process. Your supervisor has asked you to draw a flowchart based off the following specifications provided to her by the manufacturing company. In this case the company may only emit acetone to the atmosphere in a vapour stream at a concentration of 1500 ppm by mole. In order to capture acetone, the waste vapour stream from the plant is contacted with pure liquid water in an absorption column. The plant's waste vapour stream contains Air (with air defined as 79% nitrogen, 21% oxygen, but you can consider air as one substance for simplicity), 3 weight % of acetone, 2 weight % of water and discharges at 1500 kg/h. The adsorber purifies the vapour and reduces its acetone concentration to 2/3 the emission limit to ensure compliance. Due to the contacting, the molar concentration of water in the purified vapour stream doubles from water's initial molar concentration in the plant's waste vapour stream. The purified vapour stream is then released to the atmosphere. The liquid stream is recovered, containing 19 mole percent acetone and the remainder as water and is further purified later in the process

Draw a block diagram (13 marks) for the absorber and **do a degree-of-freedom (DOF) analysis** (6 marks) to show that it can be solved. Indicate which variables from the flowchart are relevant for each of your items in the degree-of-freedom analysis as well as the species you could use for material balances. Note you do not need to solve for any flows to do this.

After you have completed the DOF **write out all the relevant material balances** (4 marks) using notation from your block diagram you could use to solve this problem using a molar basis.

A.3.3 CHBE 241: Supplemental Study Guide



CHBE 241: Material and Energy Balances
Department of Chemical and Biological Engineering
The University of British Columbia

Week 2-3 Guide

Learning Outcomes (LOs) for this module - By the end of this module you should be able to:

- 1.A **Relate** units of measure from various measurement systems and convert between them
- 1.B **Choose** appropriate units for variables based on dimensional consistency of equations
- 1.C **Classify** steady and unsteady state processes and process types
- 1.D **Apply** Mass, molar and volumetric flows and convert between them
- 1.E **Apply** the general mass balance equation to characterize systems
- 1.F **Construct** input-output and block flow diagrams for chemical processes
- 1.G **Analyze** overall process economics
- 1.H **Analyze** the degrees of freedom (DOF) of processes to understand whether they are under specified, adequately specified or over specified
- 1.I **Apply** a general procedure to organize process flow calculations

Timeline and Resources

Online is for the online course modules which can be currently found at: <https://chbe241.github.io/>

LearnChemE is for the screencasts provided on that site with regards to material and energy balances, they can be found here: <http://www.learncheme.com/screencasts/mass-energy-balances>

Felder is for the 4th or 3rd edition of the textbook available at the library, bookstore, amazon, etc. The full reference for the 4th edition is: R.M Felder, R.W. Rousseau, and L.G. Bullard, *Elementary Principles of Chemical Processes*, 4th Edition

LO	Lectures	Online	LearnChemE	Felder
A	11 Sept	1.1	Systems of units	2.2, 2.3
B	11 Sept		Dimensional Homogeneity	2.6
C	13 Sept	1.6		4.1
D	13 Sept	1.3	Density, Mass Flow and Volumetric Flow	3.1-3.3
E	13 Sept	1.8	General Balance for Material Balances	4.2
F	18 Sept	1.4	Flowchart Example	4.3a/b
G	18 Sep	1.9		
H	18 Sep	1.5	Introduction to Degrees of Freedom	4.3d
I	20 Sept	1.8	Material Balance Problem Approach	4.3e

A.4. CHBE 243 Sample Resources

Below is a sample of one of the five design exercises I created for the course to introduce students to chemical and biological engineering design. It includes:

- A pre-reading assignment and individual quiz performed online in advance of the tutorial to ensure students are adequately prepared
- The tutorial design exercise assignment that students work on in teams and submit by the end of the tutorial.

A.4.1 CHBE 243 Pre-class Reading and Preparedness Quiz

Please read pages 20 & 24 from Product and Process Design Principles: Synthesis, Analysis and Evaluation (4th ed.) by W. D. Seider, D. R. Lewin, J.D. Seader, S. Widagdo, R. Gani and K. M. Ng. This section introduces vinyl chloride manufacture.

There will be a quiz on this reading which will consist of 5 multiple choice questions and you will be given 5 minutes to complete the quiz. You will only get one attempt to complete the quiz and it should be completed before our CHBE 243 tutorial on Wednesday at 3pm. I recommend you read the article and then have it for reference with you when completing the quiz. The quiz should be completed individually with no assistance from others.

Once you complete the quiz the answers will not be shown.

CHBE 243 Preparedness Quiz

Q1: What is one of the most commonly manufactured products from vinyl chloride?

- a hydrochloric acid
- b polyethylene
- c polystyrene
- d polyvinyl chloride

Q2: What is a common byproduct of vinyl chloride manufacturing?

- a hydrochloric acid (HCl)
- b sodium chloride (NaCl)
- c carbon monoxide (CO)
- d polypropylene

Q3: What is one negative issue noted with the reaction pathway of "direct chlorination of ethylene"?

- a dangerously high pressures
- b need for expensive catalyst
- c large amounts of byproduct
- d environmental concerns

Q4: The chemical reaction pathway of "thermal cracking of dichloroethane from the chlorination of ethylene" involves how many reaction steps?

- a 3
- b 4
- c 1
- d 2

Q5: What is one favourable element noted for the reaction pathway of the "balanced process for chlorination of ethylene"?

- a high yield
- b safe and easily controlled reactions
- c low cost catalyst
- d converting both chlorine atoms to vinyl chloride

A.4.2 CHBE 243 Design Exercise Worksheet



CHBE 243: Introduction to Chemical Engineering Process and Technology
Department of Chemical and Biological Engineering
The University of British Columbia

CHBE 243 Design Exercise 1 Worksheet, Group # _____

Student name: _____ Student ID : _____

Student name: _____ Student ID : _____

Student name: _____ Student ID : _____

Student name: _____ Student ID : _____

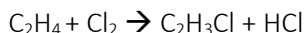
Student name: _____ Student ID : _____

Student name: _____ Student ID : _____

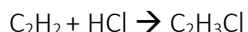
We read about five different reaction pathways that were found from literature (patents, scientific articles, etc.) to produce 800 million pounds per year of vinyl monomer. Brainstorm what factors we might consider to start narrowing down this selection of reaction pathways to the most promising of these pathways.

The following are the five reaction pathways, assumed costs of chemical purchased or sold in bulk quantities for the plant, as well as relevant physical properties. Can we use this information to narrow our selection of the reaction pathways? By the end of this session I want you to decide which reaction pathways we should continue to investigate as we move forward and provide evidence as to why?

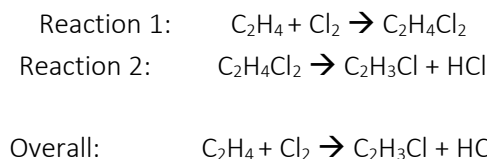
Reaction Pathway 1 – Direct Chlorination of ethylene



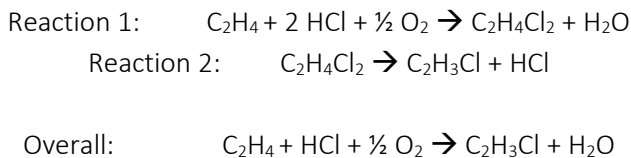
Reaction Pathway 2 – Hydrochlorination of acetylene



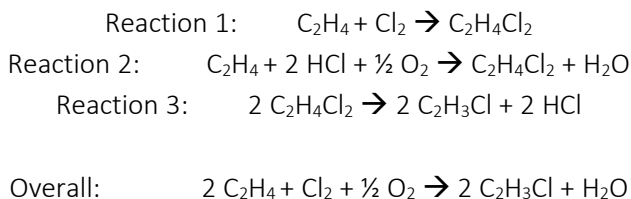
Reaction Pathway 3 – Thermal cracking of dichloroethane from chlorination of ethylene



Reaction Pathway 4 – Thermal cracking of dichloroethane from oxychlorination of ethylene



Reaction Pathway 5 – Balanced process for chlorination of ethylene



Compound	Formula	MW (g/mol)	Price (cents/lb)
ethylene	C ₂ H ₄	28.05	30
Acetylene	C ₂ H ₂	26.04	80
Chlorine	Cl ₂	70.91	18
Vinyl Chloride	C ₂ H ₃ Cl	62.50	35
Hydrogen Chloride	HCl	36.46	25

Water	H ₂ O	18.02	0
Oxygen (Air)	O ₂	32.00	0

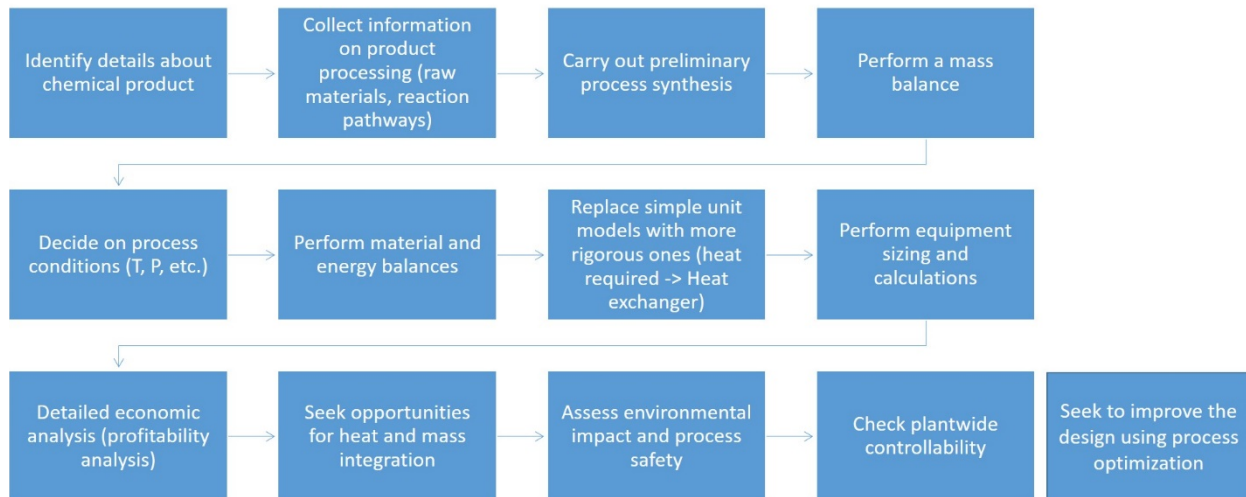
A.5. CHBE 220 Sample Resources

Below are samples of course resources I created for CHBE 220, this includes the following:

- A schematic of the chemical engineering process design course framework used in the course. This was used for both planning and instructional purposes to give the students a roadmap for the course.
- The syllabus for the course, the last page of which includes a schedule describing the tutorial deliverables each week.
- A sample tutorial assignment, one of eleven such assignments, including individual preparatory work, an individual online quiz done in advance and the tutorial assignment with a vinyl chloride example provided to students.

A.5.1 CHBE 220 Chemical Engineering Process Design Course Framework

The big picture – process design



CHBE 220
Adapted from: Product and Process Design Principles, 4th Ed.

3

A.5.2 CHBE 220 Course Syllabus

University of British Columbia
Department of Chemical and Biological Engineering

CHBE 220: Founding Principles in Chemical and Biological Engineering I – Winter 2019 Term 1– 4 credits

Instructor: Dr. Jonathan Verrett (Contact me preferably through Piazza, instructions for setup below, or at jonathan.verrett@ubc.ca), office: CHBE 427, (604)-827-5685

Office Hours: Tuesday, 15:00 – 16:00 and Thursday 9:30-10:30 in CHBE 427

Lectures: Tuesday/Thursday 8:00-9:30 CHBE 101 (starts Sept 5, ends Nov 28)

Tutorial: Thursday. 15:30-17:30 in MacLeod (MCLD) 202 (starts Sept 5, ends Nov 28)

Teaching Assistants:

Name	E-mail	Office	Duties
Emma Moreside	emoresid@mail.ubc.ca	CHBE 619	Tutorials, homework and exam marking
Blair Morgan	blair.morgan@alumni.ubc.ca	FSC 4301	Tutorials, homework and exam marking

Online Contact: For **questions on grading**, please send an email to the instructor and include the TA(s) who are responsible for marking (if known). Please include “[CHBE220]” in the subject line so that we can easily know what course your email is about. **Questions on course content** can be posted through the PIAZZA system. You can login to PIAZZA through the link on the sidebar of the CANVAS website. This will create an account on the Piazza system with an anonymized forwarding email from UBC. You can use your actual name, or a pseudonym depending on your privacy preferences. Use of piazza for questions will ensure your questions get answered in a timely manner and allows other students to answer your questions as well as giving you the chance to post anonymously. You can also send private messages only visible to you and the instructor.

Who to Contact. You can consult with the instructor, TAs and fellow classmates, ideally through PIAZZA, regarding questions on the course material or interpreting assignments. Requests to re-grade exams or assignments should be done in writing within 7 days of date the item is graded and returned to the class. These should be given to the instructor. A short written statement about why the specific exam or assignment questions should be re-graded must be included.

Course Text: There is no mandatory course text. This course incorporates a variety of topics and applies them to chemical process design. However, there are a variety of resources available to assist students, some of these are the textbooks below, others will be posted through the Library Online Course Reserves System, or on Canvas.

- T.M. Duncan, J.A. Reimer, *Chemical Engineering Design and Analysis*, 2nd edition (Available in the bookstore or online retailers). This book has many useful exercises on chemical engineering design at an introductory level. Some topics from the course will follow this textbook, but not all of them.
- J.R. Elliott, C.T. Lira, *Introduction to Chemical Engineering Thermodynamics*, 2nd edition (Available in the bookstore or online retailers). Examples from this book can be used for the energy balance portion of our course. This book is also used in CHBE 244 and CHBE 346, future chemical engineering courses that you will take.
- LearnChemE.com hosted at UC Boulder has a variety of screencasts on a wide variety of chemical engineering topics, I recommend some of these as supplementary materials. The full collection of screencasts can be found at: <http://www.learncheme.com/screencasts>

Course prerequisites: officially the pre-requisites are CHEM 154 and MATH 101, however you all have successfully completed the first year of an engineering program. This course draws on previous chemistry (CHEM 154), physics (PHYS 157) linear algebra (MATH 152) and calculus (MATH 100/101) courses and the introduction to engineering courses (APSC 100/101) if you took those.

Academic Calendar Entry: Introduction to Chemical and Biological Engineering profession and the physical sciences that form the founding principles of the discipline. *This course is not eligible for Credit/D/Fail grading.* [3-0-2]

Course Outcomes: By the end of the course, you should be able to **analyze** chemical process designs. This is supported by the following learning outcomes:

By the end of the course you will be able to:

- **Define** a problem and the purpose of a process design project
- **Identify, analyze and evaluate** process options
- **Draw** block flow diagrams (BFD) and process flow diagrams (PFD); **recognize** process and instrumentation diagrams (P&ID)
- **Identify and analyze** process hazards and assess environmental consequences of process operations
- **Apply** energy balances to closed and open systems and to process equipment
- **Apply** the first law of thermodynamics to industrially relevant problems
- **Describe** how molecular properties relate to thermodynamic functions and how molecular interactions govern structure and function of macromolecules and molecular assemblies
- **Apply** knowledge of molecular properties and interactions to solve industrially relevant problems
- **Use** rate laws of chemical kinetics to describe the progress of a chemical reaction; **describe** the effect of temperature on reaction rates; **describe** the relation between reaction mechanism and the rate law
- **Prepare** BFDs for processes based on chemical reactions describing transformation of raw material to desired product

POLICIES AND PROCEDURES

- **Academic integrity.** The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences.

A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Academic Calendar at - <http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,286,0,0>
Guides on avoiding plagiarism can be found at the following link - <http://learningcommons.ubc.ca/resource-guides/>

In this course:

- **You can** work with others when solving assignment questions by sharing solutions strategies, however your solutions must be your own. Make sure you understand the material, copying may get you 100% on the assignment, but will not help when it comes to quizzes and exams, as well as the rest of your studies and your career. If you simply copy an assignment you will learn much less than discussing and understanding a solution method and then attempting to implement it yourself. Directly copying solutions is considered cheating in this class.

- If you have questions on any of these points it is your responsibility to clarify with the instructional team before undertaking any activity (you can ask on PIAZZA). If you think what you are doing may be inappropriate, **please ask** before submitting work.
- **Exams.** There will be one midterm exam held in class during the semester and one comprehensive final exam. *All exams will be closed-book, with a formula sheet provided.* The formula sheet will be provided in advance and it is recommended you use it to practice solving problems. No electronic devices other than a calculator are allowed during exams (including watches). A cell phone may not be used as a calculator.
- **Missed Exams** If you miss an exam or assignment without either a certified medical excuse or prior instructor approval, you will receive a mark of 0 on that exam. Midterm exams missed with certified medical excuses or prior instructor approval will have the weight moved to the final exam. Assignments missed with excuse will have the weight redistributed to other assignments with an equal weighting.
- **Tutorials.** Will focus on group work, and you will need to complete the individual preparatory exercises in advance.
- **Laptop and cell phone use:** Technology can be useful in the classroom, but may also prevent learning by distracting you and others. Please refrain from using technology in the classroom for purposes such as messaging, playing games, social media, texting, etc. Acceptable uses of laptops include taking notes and looking up relevant course information. Please be considerate of your classmates as your laptop or phone may not only be a distraction for you, but also those around you. Please put your cell phone on silent when you are in the classroom.
- **Instructors' commitment.** You can expect me and the TAs to be courteous, punctual, well organized, and prepared for lecture and other class activities; to answer your questions clearly; to be available during office hours or to notify you beforehand if we are unable to keep them; to provide a suitable guest lecturer if I am away; and to grade uniformly and consistently.
- **Consulting with faculty.** I encourage you to discuss any academic or personal question you have by coming to office hours or through PIAZZA. I look forward to getting to know each of you.
- **Accessibility:** I hope to make UBC a welcoming and inclusive space for all students. Feel free to ask me questions on any issues and I will do my best to guide you to any resources which might be helpful. You can find a number of university resources at the accessibility website: <http://students.ubc.ca/about/access>
- **Course Feedback:** You can give feedback on my teaching and the course at any time by a number of means listed below. If there is a constructive comment that can help improve your learning, please let me know before the end of the course and I will do my best to incorporate your feedback.
 - Face-to-face at office hours or after lectures.
 - As a message through PIAZZA
 - Anonymously, through the feedback link posted on the CANVAS homepage
 - During the middle of the term as an in-class activity
 - At the end of the course through formal course evaluations

Assessment Criteria and Grading

- The course is graded on a percentage basis, based on the standard UBC grading scheme. 50% or greater is required to pass the course. The course is **not graded based on a distribution** as all practicing engineers are expected to have adequate technical knowledge in their fields. Your performance depends only on how you do, not on how everyone else in the class does. It is therefore in your best interests to discuss and help

your classmates, as this has been shown in literature to **improve your own learning as well as their learning**.

Individual portion (78%)

- Tutorial preparation quizzes (8 total, 0.5% each) – 4% of final grade – Before each tutorial (except the first and those where teams present) You will have some preparation materials to read over and a short online quiz on these materials on Canvas. This is to ensure you are ready for the tutorial session. The quiz should be completed individually.
- Presentations and peer feedback - 7% of final grade – You will participate in two presentations during the term, one will be your project proposal presentation, where each of your team members will present, and you will then present at one of the other presentations. You will be marked out of 1% of your final grade for your proposal presentation and 4% of your final grade for your second presentation. You will also grade and give feedback to other teams presenting and completing this will count for another 2% of your mark.
- Individual Assignments (7 total, 1% each) - 7% of final grade - Completed individually – These assignments will include five individual assignment exercises to help you practice for exams, completing two sets concept mapping exercises, one at the beginning of term and one at the end of term, and completing three iPeer evaluations during the term for your team.
- Midterm - 20% of final grade - 2 hours in tutorial- covers all material in the class up to a point that will be specified. These may have some multiple choice component as well as longer answer sections. Closed book with formula sheet provided.
- Final - 40% of final grade - 3 hours - covers all course content. Closed book with formula sheet provided. If you get higher on the final than on the midterms, I will use your final mark in place of any midterms that are lower. I recommend you still try as best you can on the midterms and not rely on the final.

Exam formats, in terms of number of question and type, will be released prior to the exams. There are no prior exams from this course as this is the first year it is running, but I will do my best to give you an idea of what exams will contain in terms of number of questions and question type.

Team portion (22%)

- Project deliverables (12 of these) - 12% of final grade – Each week there will be something that your team needs to submit corresponding to what we have seen in lectures. The tutorial time is an opportunity for you to work on this as a team, and likely get a large portion of this work completed. These will be due at 9pm on Monday the week following the tutorial
- Final Project Document - 10% of final grade – At the end of the term your team will submit a final project document composed of your individual project deliverables and the modifications you have made to these based on the feedback you have received. This will be submitted to both CHBE 220 and CHBE 201, and 2% of the final grade (i.e. 1/5 of the 10%) will be based on the mark from CHBE 201.

Note that you must pass the team portion of the course in order to pass the course, otherwise your grade will be capped at 49%. This is to ensure that you participate in team activities.

Draft Class Schedule

<u>DATE</u>	<u>Class</u>	<u>Tutorial</u>
Week 1 9/2-9/6	Course introduction	Team dynamics and project management & concept mapping
Week 2 9/9-9/13	Design project definition, market analysis and design basis memorandums & input-output diagrams, block flow diagrams (BFDs) and basic material balances	Design project definition and input-output diagrams
Week 3 9/16-9/20	Reaction rate laws	Reaction pathways
Week 4 9/23-9/27	Molecular structure, properties and interactions & physical properties relevant for separations	Proposal presentations
Week 5 9/30-10/4	Physical properties relevant for separations & energy balances	Separation options
Week 6 10/7-10/11	Energy balances and equipment	Energy balances and equipment
Week 7 10/14-10/18	Process Flow Diagrams (PFDs) and Process and Instrumentation Diagrams (P&IDs)	Process flow diagrams (PFD)
Week 8 10/21-10/25	Molecular properties and thermodynamic function	Progress presentations
Week 9 10/28-11/1	Unsteady state operations, startup and shutdown	Midterm
Week 10 11/4-11/8	Five common control loops & process economics	Process economics and control loops
Week 11 11/11-11/15	Environmental considerations & Plant Layout	Environmental considerations and plant layout
Week 12 11/18-11/22	Process safety analysis	Safety analysis
Week 13 11/25-11/29	Molecular properties and thermodynamic function	Final presentations
Final Exam Period	Final Exam	

A.5.3 CHBE 220 Design Exercise Tutorial Assignment

Tutorial 5: Separation

Preparatory Activities

Individually complete the quiz using on the pre-reading before the upcoming tutorial. This is to help get you prepared to work on the team deliverable which will be due on the following Monday.

- The library allows you access to an ebook copy of "Analysis, Synthesis and Design of Chemical Processes, third edition" by Turton, Bailie, Whiting and Shaeiwitz. You can access this through the Library Online Course Reserves on canvas, or by doing a search for the title in the library search engine. This should lead you to an online text version (through a company called O'Reilly) and will ask for your UBC email before giving you access.
- Read Section 12.3 of this book titled "Separation Section" up until the end of section 12.3.1 which is the section on "General Guidelines for choosing separation options". You **do not** need to read into section 12.3.2 on the sequencing of distillation columns. There will be some jargon in this text that you may not yet understand. Do not worry about understanding all the terminology and details, but try to focus on understanding general principles and the overall ideas. The questions will relate more to the overall ideas, or strategies for setting up separations rather than specifics.

Individually complete the canvas quiz on the above preparatory activities. The quiz consists of 5 multiple choice questions in 10 minutes. You can, and should, have the reading available to you when completing the quiz, and the quiz should be done individually.

CHBE 220 Preparedness Quiz

Q1: What are two questions that the separation section mainly attempts to address?

- a) What type of separation units should be used? How to sequence these units?
- b) What type of reactor to use? How to separate the reactor products?
- c) What type of distillation columns to use? How to sequence each distillation column?
- d) What type of separation units should be used? How large should these units be?

Q2: When separating two compounds in a fluids, when is an alternative to distillation considered?

- a) When the boiling points of the two compounds are very close
- b) When the boiling points of the two compounds are very far
- c) When the heat of fusion (melting) of the two compounds are very high
- d) When the heat of vapourization of the two compounds are very low

Q3: What unit operation is suggested to purify solids from a liquid solution?

- a) Crystallization
- b) Filtration
- c) Screening
- d) Centrifugation

Q4: If there is a trace dissolved contaminant in a liquid stream causing discoloration and we want to remove this contaminant, what would be the most plausible unit operation to do so based on the guidelines (heuristics) provided in the text?

- a) adsorption
- b) distillation
- c) filtration
- d) extraction

Q5: Which one of the following is NOT one of the guidelines for sequencing separation steps?

- a) overpurify streams
- b) remove the largest product streams first
- c) do the easy separations first
- d) remove hazardous or corrosive materials first

Tutorial 5: Separations

Problem Statement for the Tutorial

Your goal is to provide details for selecting a separation unit or units in one part of your process. This should build off of the reaction you have chosen in Tutorial 3. A list of key points for this tutorial submission are included below:

- You may need to summarize pertinent details about your reaction to introduce the reader to what compounds will need to be separated.
- Provide a material balance for the flow of materials entering into your separator based on your project specifications thus far (meaning the reaction you chose and desired product flow rate).
- Use the guidelines you read about to help select and if needed sequence separation units.

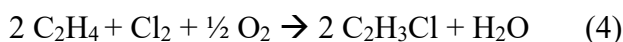
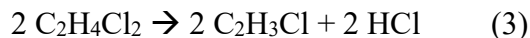
Remember as usual to:

- Select operating temperatures and pressures for your separation units if possible.
- Continue to use the scientific units that you will use throughout your project.
- Use this sample template below for formatting. This follows the same format as the CHBE Laboratory Courses Report Writing Guidelines.
- A list of references can be put on an additional page or pages.
- Limit your document to 2 pages (excluding title page or references)

Your document should be submitted to canvas as a word document by Monday at **9 pm**. Limit your document to 2 pages (excluding a title page or references). You only need to **submit this document to CHBE 220**. So if you have members in CHBE 201, they do not need to contribute to this document at this stage.

Separations: Vinyl Chloride Manufacture

The vinyl chloride (VC) production method selected for this project is the balanced process [1]. A summary of reaction steps and overall reaction can be found in reactions (1) to (4).



The first reaction (1), being the direct chlorination of ethylene, generally has conversions up to 100% and little side-product formation with selectivities of up to 99% for chlorine and ethylene. The second reaction (2), called the oxychlorination reaction, also has a relatively high conversion of up to 95%. The third reaction (3), known as the pyrolysis reaction, has a conversion of up to 60%. Conversions are not higher due to the danger of coking (formation of solid carbon) occurring, which can then lead to reactor blockages. This document will focus on developing a separation strategy for the product stream from the pyrolysis reaction.

Assuming a conversion of 60% and limited by-products (for simplicity at this point) the pyrolysis reactor product stream will contain a significant amount of unreacted dichloroethane (EDC) as well as the products of VC and hydrochloric acid (HCl). Our basis for production is 360,000 tonnes per year, and we will assume a standard operating year of 8,000 hours (a common assumption with chemical plants). This means our flow of VC per hour will be 45 tonnes/h. Performing a mole and mass balance based this flowrate with a 60% conversion in the reactor, the values shown in Table 1 are obtained for the exit stream of the pyrolysis unit.

Table 1: Flows into and out of pyrolyzer based on the production of 45 tonnes/h of VC.

Compound	Formula	Molecular weight (g/mol)	Flow into pyrolyzer (tonnes/hr)	Flow out of pyrolyzer (tonnes/hr)
EDC	C ₂ H ₄ Cl ₂	98.96	118.752	47.5008

HCl	HCl	36.46	-	26.2512
VC	C ₂ H ₃ Cl	62.5	-	45

The VC product needs to be separated from the unused EDC reactant as well as the HCl byproduct. Some relevant physical properties for separation of each compound at atmospheric pressure are shown below in Table 2.

Table 2: Properties relevant for separation of each compound

Compound	Boiling point (°C)	Heat of vapourization (kJ/mol)	Melting point (°C)	Heat of fusion (kJ/mol)
EDC [2]	84	35	-43	8.8
HCl [3]	-85	16	-112	-
VC [4]	-13	21	-154	4.9

These compounds initially exit the pyrolyzer at a temperature of around 500°C and the stream is rapidly cooled in an operation known as quenching to prevent side reactions. From the physical properties we can see relatively large differences (>20°C) in boiling points between compounds and these compounds are each flowing at relatively high rates (ie. none are trace impurities). Using general separation guidelines [5], this would lead us to consider distillation as a strong candidate for a technology used to separate these fluids (meaning gases or liquids) as we want purity of all product streams. We will assume that distillation columns have one entering stream and produce only two product streams (a common assumption for distillation columns). The guidelines advise separating the largest product streams first and for distillation to remove the product with the highest heat of vapourization first if possible. This would lead us to separate out the EDC first, as it has a high flow rate, and also a high heat of vapourization. It is the least volatile of all compounds (highest boiling point), so we would separate it in the bottoms stream of our first distillation column (where we have the heavier components). This first column would have operating temperatures between -13°C and 84°C to separate EDC from VC and HCl, assuming we are operating at atmospheric pressure. Exiting this first column we would have a light stream consisting of HCl and VC. We would separate these in a second distillation column with HCl in the light stream and VC in the heavy stream. This means our second column would operate

between -85°C and -13°C if operated at atmospheric pressure. These separation steps would then give us streams of purified VC, EDC and HCl, where the VC is our product stream, EDC is recycled back to our reactor and HCl is sent to the oxychlorination reaction.

NOTE THERE IS A 2 PAGE LIMIT (not including title page and references). Your submission should match this one in terms of style, with it being in 12-pt type font with 1.5 lines. Use IEEE reference style. All references used should be references in the text body.

References

- [1] J. A. Cowfer and M. B. Gorensek, "Vinyl Chloride," in Kirk-Othmer Encyclopedia of Chemical Technology, American Cancer Society, 2006.
- [2] "Ethane, 1,2-dichloro-."
<https://webbook.nist.gov/cgi/cbook.cgi?ID=C107062&Mask=4#Thermo-Phase> (accessed Oct. 02, 2019).
- [3] "Hydrogen chloride."
<https://webbook.nist.gov/cgi/cbook.cgi?ID=C7647010&Units=SI&Mask=4#Thermo-Phase> (accessed Oct. 02, 2019).
- [4] "Ethene, chloro-."
<https://webbook.nist.gov/cgi/cbook.cgi?ID=C75014&Units=SI&Mask=4#Thermo-Phase> (accessed Oct. 02, 2019).
- [5] S. B. Online, "Chapter 12 Synthesis of the PFD from the Generic BFD - Analysis, Synthesis, and Design of Chemical Processes, Fifth Edition."
<https://learning.oreilly.com/library/view/analysis-synthesis-and/9780134177502/ch01.xhtml> (accessed Oct. 02, 2019).

A.6. CHBE 362 Sample Resources

Below are samples of course resources from CHBE 362, this includes the following:

- A sample schedule from 2018W1
- Copies of Excel templates for data collection, analysis and grading. Data collected is inputted by students in the D file, their final calculation answers go in the A file, and these are compared against a correction template which calculates answers using their data, the C file.

A.6.1 CHBE 362 Lab Schedule

2018W																
Term 1																
CHBE 362 LAB SCHEDULE (2 sections)																
Week →	1	1	2	3	4	5	6	7	8	9	10	11	12	13		
Groups	05-Sep	04-Sep	11-Sep	18-Sep	25-Sep	02-Oct	09-Oct	16-Oct	23-Oct	30-Oct	06-Nov	13-Nov	20-Nov	####		
T u e s d a y s e c t i o n	1	L e c t u r e N o L A B C H B E	W3 2pm	W2 4pm	F i e l d T r i p		W1 2pm	A 2/4pm		B 2pm		C * 3pm				
	2		W3 2pm	W2 4pm			W1 2pm	A 2/4pm		B 2pm		C * 3pm				
	3		W3 2pm	W2 4pm			W1 2pm	A 2/4pm		B 3pm		C * 2pm				
	4		W3 2pm	W2 4pm			W1 2pm	A 2/4pm		B 3pm		C * 2pm				
	5		W3 4pm	W2 2pm			W1 4pm	A 2/4pm		B 2pm		C * 3pm				
	6		W3 4pm	W2 2pm			W1 4pm	A 2/4pm		B 2pm		C * 3pm				
	7		W3 4pm	W2 2pm			W1 4pm	A 2/4pm		B 3pm		C * 2pm				
	8		W3 4pm	W2 2pm			W1 4pm	A 2/4pm		B 3pm		C * 2pm				
	9		W2 4pm	W3 2pm				W1 4pm	A 2/4pm		C * 3pm			B 2pm		
	10		W2 4pm	W3 2pm				W1 4pm	A 2/4pm		C * 3pm			B 2pm		
	11		-													
	12		W2 4pm	W3 2pm												
	13		W2 2pm	W3 4pm					W1 2pm	A 2/4pm		C * 3pm			B 2pm	
	14		W2 2pm	W3 4pm					W1 2pm	A 2/4pm		C * 3pm			B 2pm	
	15		W2 2pm	W3 4pm					W1 2pm	A 2/4pm		C * 2pm			B 3pm	
	16		W2 2pm	W3 4pm					W1 2pm	A 2/4pm		C * 2pm			B 3pm	
F r i d a y s e c t i o n	17	07-Sep	14-Sep	21-Sep		05-Oct	12-Oct	19-Oct	26-Oct	02-Nov	09-Nov	16-Nov	23-Nov	####		
	18	W3 1pm	W2 3pm			W1 1pm	A 1/3pm		C 1pm			B* 2pm				
	19	W3 1pm	W2 3pm			W1 1pm	A 1/3pm		C 1pm			B* 2pm				
	20	W3 1pm	W2 3pm			W1 1pm	A 1/3pm		C 1pm			B* 1pm				
	21	W3 1pm	W2 3pm			W1 1pm	A 1/3pm		C 2pm			B* 1pm				
	22	2 pm	W3 3pm	W2 1pm		W1 3pm	A 1/3pm		C 1pm			B* 2pm				
	23	W3 3pm	W2 1pm			W1 3pm	A 1/3pm		C 1pm			B* 2pm				
	24	W3 3pm	W2 1pm			W1 3pm	A 1/3pm		C 2pm			B* 1pm				
	25	W2 3pm	W3 1pm			W1 3pm	A 1/3pm		C 2pm			B* 1pm				
	26	W2 3pm	W3 1pm			W1 3pm	A 1/3pm		B* 2pm				C 1pm			
	27	W2 3pm	W3 1pm			W1 3pm	A 1/3pm		B* 2pm				C 1pm			
	28	W2 3pm	W3 1pm			W1 3pm	A 1/3pm		B* 1pm				C 2pm			
	29	W2 3pm	W3 1pm			W1 3pm	A 1/3pm		B* 1pm				C 2pm			
	30	W2 1pm	W3 3pm			W1 1pm	A 1/3pm		B* 2pm				C 1pm			
	31	W2 1pm	W3 3pm			W1 1pm	A 1/3pm		B* 2pm				C 1pm			
	32	W2 1pm	W3 3pm			W1 1pm	A 1/3pm		B* 1pm				C 2pm			

A.6.2 Sample Data files (D file, A file, C file)

D file

Student Name:				
Student Number:				
Group Number:				

Constants and Experimental Parameters	
Acceleration Due to Gravity (m/s^2)	
Uncertainty in room temperature	
Falling Ball Viscometer	
Free Fall Distance Uncertainty (cm)	
Free Fall Time Uncertainty (s)	
Tube Diameter (cm)	

Particle diameter with micrometer (large particles only)

	Particle Diameter (cm)
Trial 1	
Trial 2	
Trial 3	
Trial 4	

Room temperature: pycnometer				
	Small Particles	Uncertainty	Large Particles	Uncertainty
Volume of SG Bottle (cm^3)				
Mass of SG Bottle (g)				
Mass of SG Bottle and Beads (g)				
Mass of SG Bottle, Beads and Water (g)				

Room temperature: graduated cylinder					
	Uncertainty	Small Particles		Large Particles	
		Trial 1	Trial 2	Trial 1	Trial 2
Mass of Cylinder (g)					
Volume of Beads (mL)					
Mass of Cylinder and Beads (g)					
Mass of Cylinder, Beads and Water (g)					
Total Volume (mL)					

Small Particles

	Particle Size		Mass of Tray g	Mass of Tray with Beads g
	Lower Limit μm	Upper Limit μm		
Sieve 1				
Sieve 2				
Sieve 3				
Sieve 4				
Pan				

Large Particles

	Particle Size		Mass of Tray g	Mass of Tray with Beads g
	Lower Limit μm	Upper Limit μm		
Sieve 1				
Sieve 2				
Sieve 3				
Sieve 4				
Sieve 5				
Pan				

Room temperature: falling ball			
Fluid	Trial	Free Fall Distance	Free Fall Time
		(cm)	(s)
Water	1		
	2		
	3		
	1		
	2		
	3		

A file

Student Name:					
Student Number:					
Group Number:					

		Value	Uncertainty	Possible Points
Average particle diameter with micrometer (large particles only) (cm)				1
Mass average particle diameter from sieve analysis (µm)	Small Particles			0.5
	Large Particles			0.5
Particle size distribution from sieve analysis Small Particles	Sieve 1			0.5
	Sieve 2			0.5
	Sieve 3			0.5
	Sieve 4			0.5
	Pan			0.5
Particle size distribution from sieve analysis Large Particles	Sieve 1			0.5
	Sieve 2			0.5
	Sieve 3			0.5
	Sieve 4			0.5
	Sieve 5			0.5
Pan			0.5	
Density of Particle Pycnometer	Small Particles			1
	Large Particles			1
Density of Particle Graduated Cylidner	Small Particles			1
	Large Particles			1
Bulk Density	Small Particles			1
	Large Particles			1
Porosity	Small Particles			1
	Large Particles			1
Measured Terminal Velocity	Fluid 1			1
	Fluid 2			1
Corrected Terminal Velocity	Fluid 1			1
	Fluid 2			1
Drag Coefficient	Fluid 1			0.5
	Fluid 2			0.5

C file (only one sheet of this file is shown, other sheets show calculation details for the instructor, but I have not included these in the dossier for the sake of brevity)

Key	Value
Name:	a, b, c, d
Student Number:	a, b, c, d
Group Number:	99

Key	Lab	Possible Points	Score	Percentage
Total	PARCHAR	20.5	20.5	100.0%

Key	Description	Possible Points	Score
1	Average particle diameter with micrometer (large particles only) (cm)	1	1
2	Mass average particle diameter from sieve analysis (μm) - Small Particles	0.5	0.5
3	Mass average particle diameter from sieve analysis (μm) - Large Particles	0.5	0.5
4	Particle size distribution from sieve analysisSmall Particles - Sieve 1	0.5	0.5
5	Particle size distribution from sieve analysisSmall Particles - Sieve 2	0.5	0.5
6	Particle size distribution from sieve analysisSmall Particles - Sieve 3	0.5	0.5
7	Particle size distribution from sieve analysisSmall Particles - Sieve 4	0.5	0.5
8	Particle size distribution from sieve analysisSmall Particles - Pan	0.5	0.5
9	Particle size distribution from sieve analysisLarge Particles - Sieve 1	0.5	0.5
10	Particle size distribution from sieve analysisLarge Particles - Sieve 2	0.5	0.5
11	Particle size distribution from sieve analysisLarge Particles - Sieve 3	0.5	0.5
12	Particle size distribution from sieve analysisLarge Particles - Sieve 4	0.5	0.5
13	Particle size distribution from sieve analysisLarge Particles - Sieve 5	0.5	0.5
14	Particle size distribution from sieve analysisLarge Particles - Pan	0.5	0.5
15	Density of ParticlePychnometer - Small Particles	1	1
16	Density of ParticlePychnometer - Large Particles	1	1
17	Density of ParticleGraduated Cylidner - Small Particles	1	1
18	Density of ParticleGraduated Cylidner - Large Particles	1	1
19	Bulk Density - Small Particles	1	1
20	Bulk Density - Large Particles	1	1
21	Porosity - Small Particles	1	1
22	Porosity - Large Particles	1	1
23	Measured Terminal Velocity - Fluid 1	1	1
24	Measured Terminal Velocity - Fluid 2	1	1
25	Corrected Terminal Velocity - Fluid 1	1	1
26	Corrected Terminal Velocity - Fluid 2	1	1
27	Drag Coefficient - Fluid 1	0.5	0.5
28	Drag Coefficient - Fluid 2	0.5	0.5

A.7. CHBE 376 Sample Resources

Below are samples of course resources I created for CHBE 376, this includes the following:

- The course syllabus including information on assessment changes due to COVID 19 and the intermediary deliverables for term projects.
- A sample worksheet for students to work through in class following a lecture.
- A solution provided to students for the worksheet following the submission deadline for their use for self-assessment and study.

A.7.1 CHBE 376 Syllabus



a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Chemical & Biological Engineering
Faculty of Applied Science

CHBE 376 [2019W–T2]
Computer Flowsheeting
(3 credits)

Instructor

Jonathan Verrett, *Ph.D.*

✳ Room CHBE 427

☎ 604-827-5685

✉ Prefer to be contacted through Piazza (see below) for content questions and email for grading questions, jonathan.verrett@ubc.ca

Teaching Assistant(s)

Arian Ebneyamini

Mahyar Mohaghegh Montazeri

✳ Room CHBE 639

✳ Room CHBE 603

✉ aebneyam@mail.ubc.ca

✉ mahyarmm@mail.ubc.ca

Class

Tuesday and Thursday

🕒 11:00 am – 12:30 am

✳ Room MCLD 202

Tutorial

Alternate Monday (starting Jan. 6, you are required to attend the first tutorial and it will be used to ensure you have access to Aspen Plus)

🕒 2:00 pm – 4:00 pm

✳ Rooms CHBE 314 & CHBE 318

Course Website

www.canvas.ubc.ca

Check the course web site regularly and frequently. The following material will be posted there as PDF documents: lecture notes, assignments, tutorial problems, notices and handouts.

Piazza

Content questions should be asked through the PIAZZA system. This will ensure your questions get answered in a timely manner and allows other students to answer your questions as well as giving you the chance to post anonymously. You can also send private messages only visible to you and the instructor. You can

login to PIAZZA through the CANVAS website. Note that PIAZZA is on servers in the U.S. and UBC does not share your email address with PIAZZA. If you wish to remain anonymous, please use a pseudonym and you can share this with me if you would like me to know who is asking questions. If you have any concerns about privacy please let me know.

Office Hours

Thursday, 3:30 – 4:30 pm and Friday 2:00 pm - 3:00 pm (also come by anytime my office door is open, or email to setup a meeting time)

Course Description

Process simulators provide a versatile tool for chemical engineers to estimate fluid properties, optimize and retrofit processes, improve equipment design and performance, and perform safety, energy and economic analysis of various (bio-)chemical processes. In this course, an introduction to modern computer flowsheeting using Aspen Plus V10, with many hands-on experiences, is offered. The topics covered include:

- Property Method Selection
- Property Estimation
- Mixers & Splitters
- Flash Separators
- Heaters & Coolers
- Pumps & Compressors
- Reactors
- Rating & Design of Heat Exchangers
- Distillation Columns
- Sensitivity Analysis
- Design Specs
- Calculator block

References



1. Aspen Plus: chemical engineering applications, by Al-Malah, K. I. M., John Wiley & Sons Inc, 2017. ISBN 1-119-13123-5. **Available online free through the UBC library.**
2. Aspen Plus User Guide, Aspen Tech®
3. Aspen Plus Unit Operation Models, Aspen Tech®
4. Aspen Plus Process Models V8.4 – Getting Started, Aspen Tech®
5. Product and Process Design Principles: Synthesis, Analysis and Evaluation, 4th Ed., by W. D. Seider, J. D. Seader, D. R. Lewin, S. Widagdo, R. Gani, K. M. Ng, Wiley, New Jersey, 2017. ISBN: 978-1-119-28263-1
6. Process Simulation and Control Using Aspen, by Amiya K Jana, PHI Learning Private Limited, New Delhi-110001, 2009

Learning Outcomes

After taking this course you will be able to:

- Select an appropriate property method for your process
- Create a computer flowsheet and simulate a complex chemical process
- Perform a systematic analysis to optimize and investigate effect of different parameters on your process

Pre-Requisites

CHBE 241 (Material and Energy Balances),

Other Courses CHBE 376 builds upon

Evaluation

CHBE 244 & 346 (Thermodynamics), CHBE 344 (Unit Operations I), CHBE 345 (Unit Operation II)

Note: This course is not intended to teach the working principles (chemical engineering concepts) behind the unit operations.

Tutorial/Assignments (3)	18 % (6% each)
Tests (2, in tutorial)	22 % (11% each)
Project	30 % (with intermediary deliverables)
Final Exam	30 % (can replace 1 test if grade is higher)
Bonus questions & quizzes	up to 1% (given in lectures, can be completed in between lectures as well)

- Tests and final exam is paper-and-computer based, closed book and strictly closed in terms of other computer (web)pages/apps.

CHANGES IN EVALUATION DUE TO COVID-19

Due to the difficulty in conducting online tests in a class on software where not everyone has access to the software, and based on recommendations from the APSC Dean and Department Heads, I will modify the grading scheme as follows. These modifications should only be beneficial to students (from what I can tell), I am hoping this reduced stress around online exams and only gives you a chance to improve your grade in the course.

Tutorials/Assignments (18%), Bonuses (up to 1% extra) and the Project (30%) remain the same with the same weights as originally outlined.

For the other 52 % of the course mark, I will take the highest of the following four options (note I cannot reduce a test/exam grade below 5% as I have recently learned):

1. Test 1 (42%), Test 2 (5%) and the final exam (5%)
2. Test 1 (36%), Test 2 (11%) and the final exam (5%)
3. Test 1 (11%), Test 2 (11%) and the final exam (30%)
4. Test 1 (17%), Test 2 (5%), the final exam (30%)

The final can also be used to replace 1 test grade if it is higher, I will still honour that.

You do not need to choose an option, I will award you whichever combination gives you the highest mark.

The final exam will be delivered in the same online format to Test 2 using Proctorio software. The exam will be open notes with no access to Aspen (same as Test 2). This will be held during the scheduled final exam time slot 12 noon to 2:00 pm, on Tuesday, April 14. The length will be similar to Test 2. If you have difficulties using Proctorio please reach out in advance and we will work to find a solution.

If you have any concerns about the above, please reach out.

Term Project

See course schedule for due dates, the idea behind these components is to give you feedback and ensure you are on track, the project components consist of:

1. Project topic and team selection (2%)
2. Project property package and component selection and justification (1%)
3. Reactor kinetic model (4%)
4. Separation model (4%)
5. Analysis or optimization (4%)
6. Final report (incorporates above components) (15%)
 - Team of one, two, or three students.
 - You have two options for your project (I am also open to other suggestions if you want to focus on something else):
 - i. *Educational Resource or Tutorial on an aspect of Aspen.*

Should relate to a topic covered in this course and include a process example different from that in the course notes. The content should be novel and should not infringe on any copyright, inspiration and ideas can be found in textbooks and other resources but the writing must be original. There are a variety of ways this can be presented, as a UBC Wiki page, video tutorial, etc. Ideally I would like these projects to be shared openly and licensed under a creative commons license for other students to use as study aids, but students may chose not to openly share their projects and submit them for course credit only.
 - ii. *Simulation of a Complex Process*
 - The process must have various unit operations AND recycle streams.
 - For approval, a one-page proposal and a block flow diagram should be submitted on canvas.
 - The final project report will not be returned after being marked, so keep a copy for yourself before submitting.

- The final report must be submitted on the course website (canvas) by the deadline. If the tutorial or resource is openly shared a document with a link to the resource should be provided on canvas.

Assignments & Tutorials

Tutorials are an essential part of the course – some course material may be covered during the tutorials so attendance is strongly recommended.

- During the tutorial you will work on the first part of the assignment and the remaining questions are due a week later as your homework.
- You are encouraged to work on your homework with a partner.
- You may work with a different partner for different set of assignments.
- Assignment files, preferably a single PDF file along with the .bcp file, should be submitted online (on canvas) as a group of at most 2 people.
- Your assignment should contain a cover page with your name, student number, course, assignment number, and due date. A sample cover page will be available on the course website.
- Make your assignment as organized and legible as you can. There will be marks for professionalism.
- Late assignments will receive a penalty for each day late (including weekend days). These penalties will be 10%, 30%, 60% and 100% for each day late respectively. No assignment will be accepted after 4 days.
- Assignments will be graded by the TA and **marks will be posted on canvas, at the latest, two weeks after the due date**. If you have questions about the grading, please see the TA first and if your issue is not resolved then contact the instructor.
- Your answers should provide all information for TAs to mark your assignment **without having to run the Aspen files**. The answers should include **(1) flowsheet, (2) inputs** of Setup, Components, Methods, Streams, Blocks, and other simulation setups, and **(3) results** of run status, block, stream and other simulation results, **(4) plots** and **(5) discussions** if applicable.

Guidelines & Policies

- The course uses a combination of lectures, in-class activities and tutorials. Attendance is strongly recommended for success in this course.
- Everyone is expected to behave in a respectful manner.
- Expectations for student conduct with respect to academic honesty is stipulated in UBC Policy 85 available [here](#).
- UBC Grading Policies are outlined on the following webpage: <http://www.calendar.ubc.ca/vancouver/?tree=3,42,96,0>

Your success is important.

If you are facing difficulties that put your academic success at risk, please reach out.

- Contact me or your TA by email, during office hours, before or after class
- Speak to an academic advisor
- Talk to a UBC counsellor or doctor if you are experiencing health difficulties. You can find a list of student services at: students.ubc.ca

I will do my best to support your success:

- If I have concerns about your academic progress or wellbeing, I may identify them through Early Alert. <http://blog.students.ubc.ca/earlyalert/>
- Early Alert can connect you advisors who offer support to help you get back on track.
- Only specialized UBC advisors would be able to access any concerns I may identify.
- Early Alert does not affect your academic record.

A.7.2 CHBE 376 Worksheet



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THE UNIVERSITY OF BRITISH COLUMBIA
Chemical & Biological Engineering
Faculty of Applied Science

CHBE 376: Computer Flowsheeting
B9 – RPlug and Design Spec

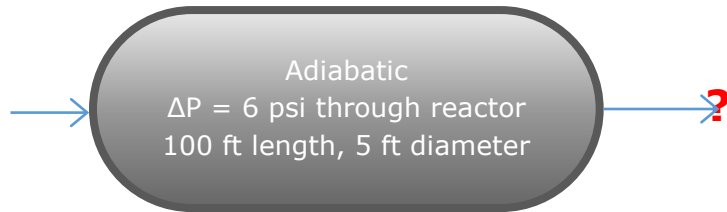
Name: _____

Name: _____

Using the bkp file of Ex. 8 from the reactors section plot the temperature, pressure and composition profiles along a PFR reactor for the conditions listed below.

500 psia / 1268 °F

Toluene 365.6 lbmol/hr
Hydrogen 4661.4
Methane 1773.91



Temperature and pressure profiles (copy these from Aspen):

Composition profiles (for all components, again copied from Aspen):

What length of reactor leads to 75% conversion of the entering toluene?

Why is this reactor length different from the length obtained using example 9 from class?

A.7.3

CHBE 376 Worksheet Solution



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THE UNIVERSITY OF BRITISH COLUMBIA

Chemical & Biological Engineering
Faculty of Applied Science

CHBE 376: Computer Flowsheeting
B9 – RPlug and Design Spec

Name: _____

Name: _____

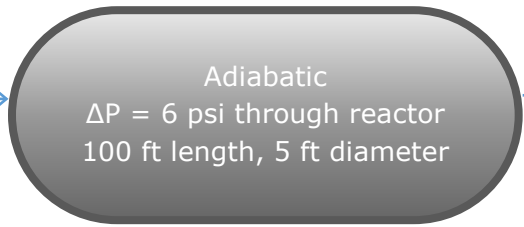
Using the bkp file of Ex. 8 from the reactors section plot the temperature, pressure and composition profiles along a PFR reactor for the conditions listed below.

500 psia / 1268 °F

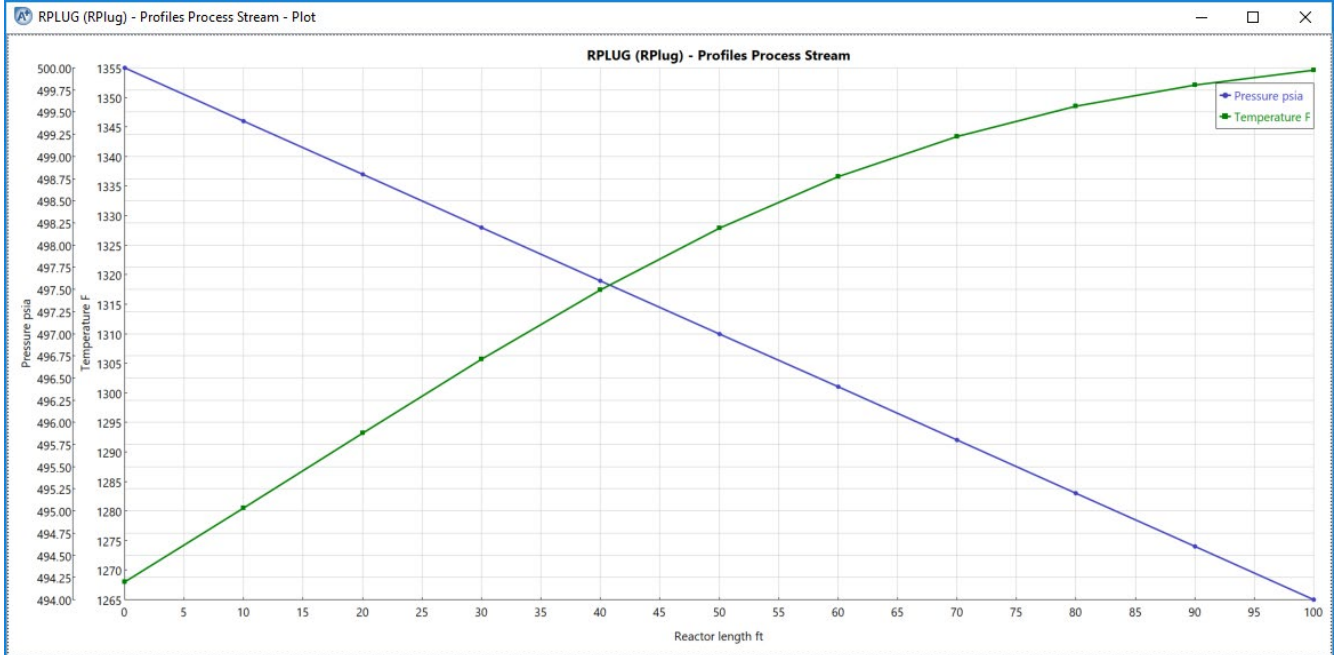
Toluene 365.6 lbmol/hr

Hydrogen 4661.4

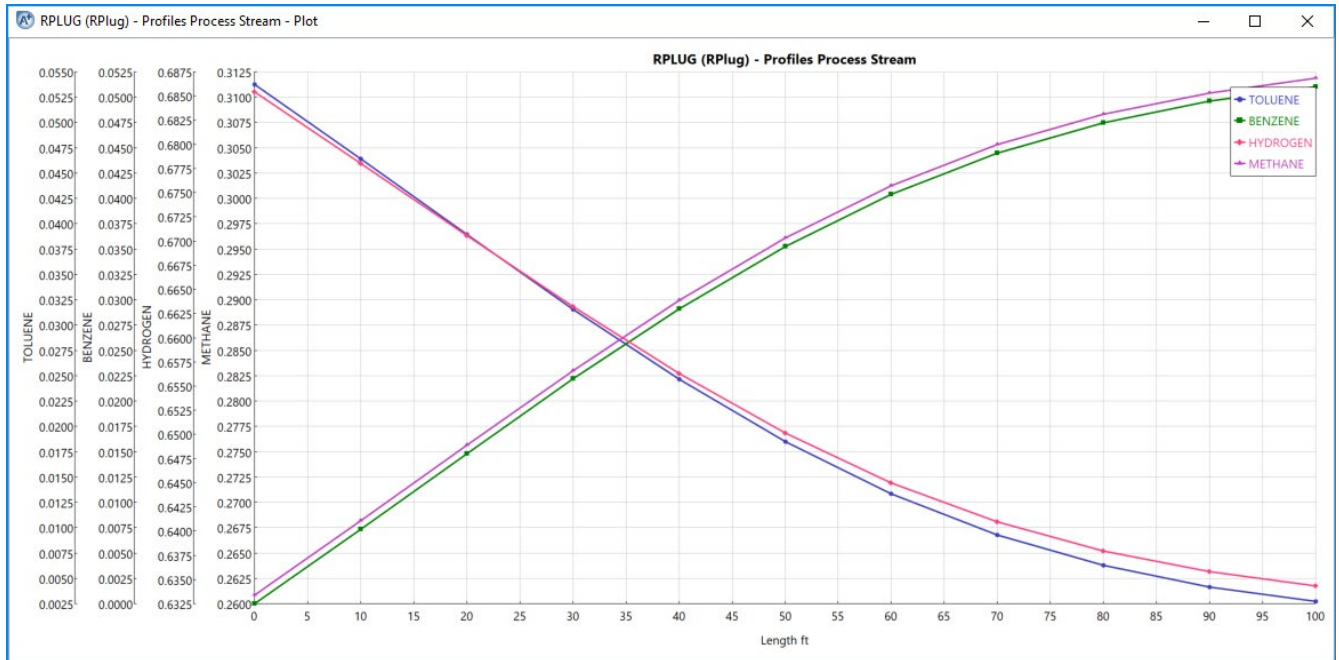
Methane 1773.91



Temperature and pressure profiles (copy these from Aspen):



Composition profiles (for all components, again copied from Aspen):



What length of reactor leads to 75% conversion of the entering toluene?

59.2 ft

Why is this reactor length different from the length obtained using example 9 from class?

Reactor is now adiabatic (leading to higher temperatures) and a higher reaction rate, so a smaller reactor length is required for the same conversion.

Pressure may also have some effect, as we are at a higher pressure at the start of the reactor, but kinetics are not very affected by this, temperature is a much stronger effect, so that should be the primary reason mentioned for this change.

A.8. CHBE 453/454 Sample Resources

Below are samples of course resources for CHBE 453/454, this includes the following:

- A course syllabus
- A sample course schedule.
- A sample

A.8.1 CHBE 453/454 Course Syllabus

Chemical and Biological Engineering CHBE 453/454

PROCESS AND PRODUCT DESIGN

Year 2019/2020 (2019W)

Course Description

Class Lectures

Term 1	Tuesday	11h00 – 12h00	MCLD 2.28
Term 2	Tuesday	11h00 – 12h00	CHBE 101

Team Meeting Times and Rooms

Terms 1 & 2	Tuesday	12h30 – 14h30	CHBE 3.18 & project rooms
Term 1	Friday	14h30 – 16h30	CHBE 3.18 & project rooms
Term 2	Friday	10h00 – 12h00	CHBE 3.18 & project rooms

Attendance at all class lectures and team meetings for the entire duration is mandatory

Instructors

Dr. Jonathan Verrett – course co-ordinator
CHBE 427
Email: Jonathan.verrett@ubc.ca

CHBE 431
Email: sergio.berretta@ubc.ca

Dr. Susan Baldwin
CHBE 217
Email: sbaldwin@mail.ubc.ca

Dr. Jim Lim
CHBE413
Email: jim.lim@ubc.ca

Consultant

Sergio Berretta, Adjunct Teaching Professor
ex-VP – NORAM and BCRI

Dr Dusko Posarac
CHBE 409
Email: posarac@mail.ubc.ca

Teaching Assistant:

Lee Rippon

Email: leeripp@chbe.ubc.ca

Note that consultations with Mr. Beretta are open to all groups and encouraged. Mr. Beretta also is not marking any part of the course, so you need not be concerned about asking him any questions you may have as this will not impact your group or individual mark.

I. Introduction

The Process and Product Design course (CHBE 453/4) is the capstone course of your undergraduate training in chemical and biological engineering at UBC. Process and product design involves converting a process concept into a set of specifications that can be used to build a functional plant. In this course, you will be required to apply the principles of process conception, material and energy balances, fluid dynamics, mass and heat transfer, thermodynamics, reaction engineering, unit operations, process control, process economics, materials of construction, and other engineering concepts to the solution of a large open-ended problem of relevance to industries. The course will also introduce you to new information, including project management, process design options identification and evaluation, methods for equipment specification, plant layout principles, and HAZOPS analysis, all of which are required to bring a design to reality.

Process and product design differs from your previous experience in this program, where each assigned problem tended to be fully specified and had only one correct solution. Process design involves the solution of underspecified problems with many possible solutions. Process design problems are essentially complex multivariable constrained optimizations for which the true "optimum" is extremely elusive. There is usually no single correct solution to a design problem. Rather, there are a few good solutions and an infinite number of bad solutions. Learning to solve such problems is a vital part of your education as an engineer.

All engineering designs also involve timely completion of tasks, teamwork, proper recording of progress, oral and written reports to supporting companies and supervisors, and accountability of each member of the engineering design team. This course therefore requires oral presentations from each student, written progress reports from each group, discussion records, minutes of group meetings, individual assessments and evaluations by both peers and supervisors.

Course Web Site

Notes and materials presented in class, as well as due dates and class schedules will be posted on the course web site at <https://canvas.ubc.ca/courses/33580>.

II. Course Outline

1. Design Project Proposal

The design class will be divided into teams of 8 members each (the students will have the option of forming the groups and selecting their team members, from within their own option). Each team is charged with the task of proposing a design project. The team will present and defend their design project proposals to the instructors and other students. Presentation slides must be handed in to the instructors prior to the presentations (depending on when you are scheduled). Refer to the rubrics provided on the course web-site for details on expectations for the project proposal. Using feedback from students and instructors in the class presentations groups will then submit a two-page summary of their proposal (see schedule for due date). Further feedback will be given from the instructors and the projects will then be refined and go forward to the full design phase.

Some suggestions for suitable projects are attached at the end of this course outline and will also be presented by industry sponsors on the first day of class. However, students are encouraged also to come up with their own ideas for projects. For example, students may make suggestions based on their work experience in chemical and biological engineering industries during summer jobs or COOP terms. The proposed project must satisfy the criteria outlined below:

1. The project must include chemical (for CHML) or biological (for CHBE) processes. In other words, there must be a chemical or biological reactor design aspect to the project.
2. The project must include 3-10 major unit operations (e.g., reactors, distillation columns, heat exchangers).
3. Aspects of process instrumentation and control must be included in the project.
4. In their proposals, groups must demonstrate that they will be able to access data required for their process design. Projects for which there is local support from industry or within the CHBE Department will be favored.
5. The proposed project must be relevant to the needs of today's society.

2. Design tasks and milestones

Upon the selection and refinement of the projects, students will begin the design process, which includes the following tasks. Each completed task will be described in the project deliverables and reports (deadlines and specifications for each report are given below).

A. Design progress report including (1st Term, also see marking rubric):

1. Letter of transmittal, title page, summary, table of contents/figures/tables, nomenclature, conclusion, acknowledgments and bibliography
2. Introduction and project charter. This is a statement that specifies the purpose of the design project, for example the amount of product to be made and to what final specification. Also the capacity of the plant must be stated.
3. Innovation map – presentation and analysis of process options
4. Evaluation of these process options leading to process conception.
5. Process description
6. Final process Flow Diagrams (PFD) and material balances.
7. Energy balances and utility requirements
8. Preliminary Equipment List and Specifications.
9. Preliminary Piping and Instrumentation Diagram (P&ID) and process control philosophy.

B. Final design report (2nd Term, also see marking rubric):

This report will describe all the above tasks plus the ones below, which will be accomplished in the 2nd term.

10. Final Piping and Instrumentation Diagram (P&ID) including process control schemes.
11. Final Equipment List and Specifications.
12. Equipment design and pipe sizing.
13. HAZOPS.
14. Plant layout.
15. Environmental impact analysis and permitting requirements.
16. Operating strategy including labor requirements and startup and shutdown procedures.
17. Process economics and viability.

3. Report specifications and due dates

All reports must be typewritten and available electronically on the course website. In the text portion of the reports and proposal, double-spaced **12 pt type and 2 cm margins** must be used (see templates provided). All reports must be prepared using a consistent standard engineering format for layout, referencing, tables, figures and nomenclature. Each report must begin with an executive summary of 300 words or less (this does not apply to the proposal). Note that each report and proposal must be clear and written in excellent English.

PFDs, P&IDs and equipment drawings must be prepared using computer software. The drawing programs, Visio and Solidworks, are available on CHBE computers for your use. Process flow streams and units must be clearly labeled on the flowsheets. Material and energy balances must be summarized in stream tables attached to the appropriate PFD. All critical design calculations must be included in numbered and well-organized appendices. All symbols must be clearly defined in the text and in a list of nomenclature, and all quantities must contain clearly specified and consistent units (preferably S.I.).

The proposal presentations will be 10 minutes each with 5 minutes of questions. All other presentations will be 20 minutes long with 5 minutes questions.

Report	Presentation dates	Written report due date	Maximum number of text pages in the main body of the report.
Project proposal	Oct. 1, Oct. 5,	Oct. 8, Soft copy submitted online (no hard copy)	2 pages written synopsis with 1 figure (BFD) included. References on additional pages
Progress report	Nov. 19, Nov. 22, Nov 26,	Dec. 6, Soft copy submitted online (no hard copy)	20 pages plus appendixes
Final Design Report	Mar 27, Mar 31, Apr 3, April 7, AND April 7, Design Day	April 14, 3:30pm hard copy to the Dep't Office Soft copy submitted online	40 pages plus appendixes

III. Mark Allocation

Marks will be given for initial proposals, written reports, oral presentations, an individual oral examination, and faculty and peer evaluations according to the following points distribution:

GROUP WORK:

Proposal report	2.5		
Proposal presentation		2.5	
Progress report	15		
Progress report presentation		2.5	
Final report		30	
Final report presentation		5	
Design day poster (visual only)	2.5		Group 60

INDIVIDUAL WORK:

Attendance/class quizzes		5 (1 excused absence per term, otherwise contact the TA)	
Presentation		10 (either progress or final presentation)	
Portfolio		10 (5 each term) 15 (5 in term 1, 10 in term 2)	
Peer review		10 (5 each term, weighted according to the group report grade for that term, see description in section VI)	
Interview	5		Individual 40
TOTAL		100	

Please note that each report must be accompanied by a page containing a short description from each student of his or her contribution to the project and report for that reporting period. Weighting factors may be applied to report marks for individuals if there is a marked discrepancy among group members in their contributions to the project and report.

IV. Minute Taking:

One of the key skills that you will learn in the design course is project management. Each group member will get a chance to participate in leading the design project for a period of 3-4 weeks. During this time, the designated leader will run the meetings, request reporting from each group member on their previously assigned tasks, stimulate discussion and decision making, and assign new tasks to each group member for the next reporting period. During the meetings, one member of the team will act as the secretary and his/her task will be to record minutes. Project management can be greatly facilitated through good practices in minute taking. Thus, as part of the course, each group is required to keep comprehensive minutes of all group meetings. Copies of these minutes must be posted on your website within 24 h of the meeting, and they will be assessed by the course instructors as part of your group mark. Good minutes should record at least the following:

1. Time, date and place of the meeting
2. List of those group members present at the meeting
3. Highlights of the report back from group members on their previous tasks
4. Discussion highlights
5. Decisions made
6. Future tasks and deliverables for the next reporting period, including who has been designated to complete and report on each task.

V. Portfolio of activities

Each student is required to record weekly self-evaluations that highlight their activities and contributions to the design for that week. A PDF version of this should be submitted (posted on the course/group website) at the end of each week. The students have the option (and if needed are encouraged) to provide supporting materials/documents to better demonstrate their involvement and contribution.

The self-evaluation and supporting materials will make up the activity portfolio of each team member and will be used to evaluate the student's overall contribution to the design project.

VI. Peer evaluation:

Peer evaluation will be carried out twice, once at the end of term 1 and again at the end of term 2. Your fellow group members will be evaluating the extent and quality of your personal contributions to the project. You are

strongly encouraged to participate in all meetings and carry out your share of responsibilities to completion in a timely manner. You are expected to communicate openly, and participate in generating ideas and making decisions. Good teamwork is essential for meeting deadlines and ensuring work of a high quality.

The peer evaluations will be used in assigning 5% of your final grade each term. The average of all peer evaluations for a group will be the same as the progress report grade in term 1 and the final report grade in term 2. An example is provided below for clarity:

Example of Peer Assessment for a team from term 1:

Term 1 progress report grade for team (group grade): 80%

Member	1	2	3	4	5	6	7	8
iPeer Raw Score (from other group members only)	700	630	770	840	560	875	525	700
iPeer Score (Normalized out of 1)	1	0.9	1.1	1.2	0.8	1.25	0.75	1
Term 1 iPeer grade out of 100% (average is the same as progress report grade)	80	72	88	96	64	100	60	80
Term 1 Peer review grade (out of 5%)	4	3.6	4.4	4.8	3.2	5	3	4

A.8.2 CHBE 453/454 Course Schedule

Date	Day	Topic	Presenter	Items due	Time	Location
9/3/2019	Tuesday	Imagine Day - no class				
9/6/2019	Friday	Intro lecture - project proposals from sponsors	J. Verrett		14:30-15:30	CHBE 101
9/10/2019	Tuesday	Library Resources	K. Lindstrom		11:00-12:00	MCLD 228
9/13/2019	Friday	An overview of the design process	S. Beretta		14:30-15:30	CHBE 101
9/17/2019	Tuesday	Design Basis Memorandum	S. Beretta		11:00-12:00	MCLD 228
9/20/2019	Friday	-				
9/24/2019	Tuesday	Project Management	S. Beretta	Group meeting minutes and individual portfolio	11:00-12:00	MCLD 228
9/27/2019	Friday	-				
10/1/2019	Tuesday	Student proposals - 3.5 h (9 groups)			11:00-12:30 12:30-14:30	MCLD 228 CHBE 101
10/4/2019	Friday	Student proposals - 2h (7 groups)			14:30-16:30	PHRM 1201
10/8/2019	Tuesday	Process flow diagrams (PFDs) + Process and Instrumentation Diagrams (P&IDs)	S. Beretta	Proposals	11:00-12:00	MCLD 228
10/11/2019	Friday	PFD & P&ID tutorial	S. Beretta		14:30-15:30	CHBE 101
10/15/2019	Tuesday	No prepared lecture, use for group meeting time				
10/18/2019	Friday					
10/22/2019	Tuesday	No prepared lecture, use for group meeting time				
10/25/2019	Friday					
10/29/2019	Tuesday	P&ID tutorial (cont'd) - bring your P&ID sheets	S. Beretta		11:00-12:00	MCLD 228
11/1/2019	Friday			PFD		
11/5/2019	Tuesday	P&ID Process Control Strategies	S. Beretta		11:00-12:00	MCLD 228
11/8/2019	Friday	Progress Report Details (see presentation in advance and bring your questions)	D. Posarac	P&ID	14:30-15:30	CHBE 101
11/12/2019	Tuesday	Control Logic Documents	S. Beretta		11:00-12:00	MCLD 228
11/15/2019	Friday					

11/19/2019	Tuesday	Progress report presentation - 3.5 h (6 groups)			11:00-12:30 12:30-14:30	MCLD 228 CHBE 101
11/22/2019	Friday	Progress report presentation - 2h (4 groups)			15:00-17:00	PHRM 1201
11/26/2019	Tuesday	Progress report presentation - 3.5 h (6 groups)			11:00-12:30 12:30-14:30	MCLD 228 CHBE 101
11/29/2019	Friday	Last Day of class				
12/3/2019	Tuesday	Exams start				
12/6/2019	Friday	Progress report, group meeting minutes, individual portfolio, peer evaluations due		Progress report, meeting minutes, individual portfolio, peer evaluations		
12/10/2019	Tuesday					
12/13/2019	Friday					
12/17/2019	Tuesday	Exams end Dec 18				
12/20/2019	Friday					
12/24/2019	Tuesday					
12/27/2019	Friday					
12/31/2019	Tuesday					
1/3/2020	Friday	Classes start Jan 6				
1/7/2020	Tuesday	Design Heuristics	S. Beretta		11:00-12:00	CHBE 101
1/10/2020	Friday					
1/14/2020	Tuesday	Equipment Specifications	S. Beretta		11:00-12:00	CHBE 101
1/17/2020	Friday			Finalize P&ID for HAZOP		
1/21/2020	Tuesday	HAZOP	L. Parchomchuk		11:00-12:00	CHBE 101
1/24/2020	Friday					
1/28/2020	Tuesday	Start-up/Shut-down (1.5 hours)	D. Posarac & S. Beretta		11:00-12:30	CHBE 101
1/31/2020	Friday			HAZOP & Equipment list		
2/4/2020	Tuesday	Plant Layout & Economic Assessment (1.5 hours)	S. Beretta & J. Verrett		11:00-12:30	CHBE 101
2/7/2020	Friday			Start-up/Shut-down & Cause and effect Matrix		
2/11/2020	Tuesday	Environmental Analysis	M. Lachmann		11:00-12:00	CHBE 101
2/14/2020	Friday			Plant Layout		
2/18/2020	Tuesday	Mid-term break				
2/21/2020	Friday	Mid-term break				

2/25/2020	Tuesday	Final Report and Research day info	D. Posarac		11:00-12:00	CHBE 101
2/28/2020	Friday			Environmental Analysis		
3/3/2020	Tuesday	No prepared lecture, use for group meeting time				
3/6/2020	Friday			Economic Assessment		
3/10/2020	Tuesday	No prepared lecture, use for group meeting time				
3/13/2020	Friday	Individual interviews - 2 h (4 groups)				Design rooms
3/17/2020	Tuesday	Individual interviews - 2 h (4 groups)				Design rooms
3/20/2020	Friday	Individual interviews - 2 h (4 groups)				Design rooms
3/24/2020	Tuesday	Individual interviews - 2 h (2 groups)				Design rooms
3/27/2020	Friday	Final Presentations (ppt) - 4 groups			10:00-12:00	PHRM 1201
3/31/2020	Tuesday	Final Presentations (ppt) - 6 groups			11:00-12:30 12:30-14:30	CHBE 101 PHRM 1201
4/3/2020	Friday	Final Presentations (ppt) - 4 groups			10:00-12:00	PHRM 1201
4/7/2020	Tuesday	Final presentation (2 groups) + Design day posters (all groups)			11:00-12:30 13:30-17:00	CHBE 101 CHBE Lobby
4/14/2020	Tuesday	Final Report, meeting minutes, individual portfolio, peer evaluations due		Final Report, meeting minutes, individual portfolio, peer evaluations		
4/14/2020	Tuesday	Exams start				

A.9. Static CHBE Curriculum Map

Click on a course node on the image, or select a course below

- [All Courses](#)
- [apsc100](#)
- [encl112](#)
- [phys157](#)
- [apsc160](#)
- [math100](#)
- [chem154](#)
- [apsc101](#)
- [math101](#)
- [phys158](#)
- [phys159](#)
- [math152](#)
- [phys170](#)
- [chbe263](#)
- [chbe220](#)
- [chem250](#)
- [chem260](#)
- [math253](#)
- [chbe241](#)
- [chbe201](#)
- [chbe221](#)
- [chbe244](#)
- [chbe230](#)
- [chbe251](#)
- [chbe264](#)
- [math256](#)
- [chbe346](#)
- [chbe344](#)
- [chbe351](#)
- [chbe373](#)
- [stat251](#)
- [chbe362](#)
- [apsc278](#)
- [chbe376](#)
- [chbe355](#)
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- [chbe456](#)
- [chbe485](#)
- [chbe481](#)
- [chbe474](#)
- [chbe464](#)
- [chbe457](#)
- [chbe453](#)
- [chbe454](#)
- [chbe459](#)
- [apsc450](#)

Chemical and Biological Engineering Course Curriculum														
YEAR	TERM 1						TERM 2						KEY	
1 st	INTRODUCTION TO ENGINEERING I APSC 100	STRATEGIES FOR UNIVERSITY WRITING ENGL 112	INTRODUCTORY PHYSICS FOR ENGINEERS I PHYS 157	INTRODUCTION TO COMPUTATIONAL METHODS APSC 160	DIFF. CALCULUS WITH APPLICATIONS TO PHYSICAL SCIENCES AND ENGINEERING MATH 100	CHEMISTRY FOR ENGINEERING I CHEM 154	INTRODUCTION TO ENGINEERING II APSC 101	INTEGRAL CALCULUS WITH APPLICATIONS TO PHYSICAL SCIENCES AND ENGINEERING MATH 101	INTRODUCTORY PHYSICS FOR ENGINEERS II PHYS 158	INTRODUCTORY PHYSICS LABORATORY FOR ENGINEERS PHYS 159	LINEAR SYSTEMS MATH 152	MECHANICS I PHYS 170		KEY SHARED CHBE/CHML COURSES CHML COURSE CHBE COURSE COURSE CODE CHBE 362 PREREQUISITES CHBE 220 CHBE 241 CHBE 244 CHBE 344 CHBE 351 COREQUISITES INTERACTIVE MAP LEGEND SELECTED COURSE PREREQUISITES OF SELECTED COURSE COREQUISITES OF SELECTED COURSE COURSES THAT HAS THE SELECTED COURSE AS A PRE OR COREQUISITE
2 nd	CHBE LABORATORY AND PRACTICE I CHBE 263	FOUNDING PRINCIPLES IN CHBE I CHBE 220	INORGANIC CHEMISTRY CHEM 250	ORGANIC CHEMISTRY FOR ENGINEERS CHEM 260	MULTIVARIABLE CALCULUS MATH 253	MASS AND ENERGY BALANCES CHBE 241	INTEGRATED TECHNICAL COMMUNICATIONS CHBE 201	FOUNDING PRINCIPLES IN CHBE II CHBE 221	CHBE THERMO-DYNAMICS I CHBE 244	COMPUTATIONAL METHODS CHBE 230	TRANSPORT PHENOMENA I CHBE 251	CHBE LABORATORY AND PRACTICE II CHBE 264	DIFFERENTIAL EQUATIONS MATH 256	
Note* : PHYS 170/APSC 160/ENGL 112/Elective can be taken in either terms. Also recommended to take a Complementary Studies Elective (3 credits) in 1 st and 3 rd year.														
3 rd	CHEMICAL AND BIOLOGICAL ENGINEERING THERMODYNAMICS CHBE 346	UNIT OPERATIONS I CHBE 344	TRANSPORT PHENOMENA II CHBE 351	CHBE 373 CONTROL CHBE 373	ELEMENTARY STATISTICS STAT 251	PROCESS AND ENVIRONMENTAL ENGINEERING LABORATORY CHBE 362	ENGINEERING MATERIALS APSC 278	COMPUTER FLOWSHEETING CHBE 376	KINETICS AND REACTOR DESIGN CHBE 355	PROCESS AND DYNAMICS CONTROL CHBE 356	UNIT OPERATIONS II CHBE 345	BIOLOGICAL ENGINEERING LABORATORY CHBE 365	BIO-PROCESS ENGINEERING I CHBE 381	CHEMICAL ENGINEERING LABORATORY CHBE 366
4 th	PROCESS SYNTHESIS CHBE 457	HETEROGENEOUS CATALYSES AND ADVANCED REACTOR DESIGN CHBE 456	AIR POLLUTION PREVENTION AND CONTROL CHBE 485	BIOLOGICAL PROCESS ENGINEERING II CHBE 481	PROCESS CONTROL ENGINEERING CHBE 474	CHEMICAL AND BIOLOGICAL ENGINEERING LABORATORY CHBE 464	BIOLOGICAL PROCESS AND PRODUCT DESIGN CHBE 453	CHEMICAL PROCESS AND PRODUCT DESIGN CHBE 454	CHEMICAL AND BIOLOGICAL ENGINEERING ECONOMICS CHBE 459	PROFESSIONAL ENGINEERING PRACTICE APSC 450	COMPLEMENTARY STUDIES (3 CREDITS) ELEC-TIVE	TECHNICAL (6 CREDITS) ELEC-TIVE	Note* : Aside from 4 th year, it is recommended to take a Complementary Studies Elective (3 credits) in 1 st and 3 rd year to meet elective requirements.	