



KWANTLEN
POLYTECHNIC
UNIVERSITY

Brewing and Brewery Operations Program Review Self-Study Report

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Table of Contents

List of Acronyms	1
Memo from Dean/Associate Dean	2
1. Introduction	4
1.1. Overview of the Program(s)	4
1.2. Program Department	5
1.3. Program Purpose	5
1.4. Issues for Program Review	5
2. Curriculum Review	6
2.1. Pathways for Graduates	6
2.2. Program Learning Outcomes.....	7
2.3. Essential Skill Development.....	10
2.4. Curriculum Assessment	12
3. Program Relevance and Demand	15
3.1. Relevance	15
3.2. Faculty Qualifications and Currency.....	20
3.3. Student Demand.....	22
4. Effectiveness of Instructional Delivery	27
4.1. Instructional Design and Delivery of Curriculum.....	27
4.2. Student Success	40
5. Resources, Services, and Facilities	43
6. Conclusions and Recommendations	45
6.1. Summary of Program’s strengths, weaknesses, opportunities, and challenges	45
6.2. Recommendations	46
7. Appendices	49

List of Acronyms

CLO: Course Learning Outcomes

KPU: Kwantlen Polytechnic University

PLO: Program Learning Outcomes

BBO: Brewing and Brewery Operations

Memo from Dean/Associate Dean

The Diploma in Brewing and Brewery Operations (BBO) is a marquee program within the Faculty of Science and Horticulture. It provides a unique credential that plays a specific and high-profile role in terms of FSH's relationship with industry and the community. It is a key differentiator for our Faculty and something that sets us apart in the local post-secondary landscape. And it generates a substantial amount of earned media and marketing for FSH broadly.

KPU is the first and only Canadian institution recognized by the Master Brewers Association of the Americas for a standard of excellence in brewing education. And while that MBAA recognition is no longer being offered, that our program received it remains a point of pride. Beers produced from this program have won provincial, national, and international awards. Our brewery was even named the Brewery of the Year at the BC Beer Awards in 2019.

These achievements are impressive, and demonstrate that this is an important and high-achieving program that proverbially punches well above its weight. However, it has also experienced a slow decline in enrollment for the past four years. The present review highlights some of the challenges within the program, and provides an ample amount of survey data to show where it is aligning with industry need, and where there are opportunities for improvement.

Some of the recommendations of this review are directly actionable, while others will require strategic decision-making and trade-offs. For example, the review suggests expanding into new types of brewing, such as ciders and non-alcoholic beverages. Our shared goal is to provide a high-quality education to students and to positively impact communities and industry. We best accomplish that objective when we have healthy enrollment and are reaching a large number of students. Expanding into additional niches may enable us to attract new pools of students.

That said, must provide ample tools and supports to gives students the experience and training they deserve. It was noted throughout that students desire more hands-on brewing opportunities. Additionally, the review makes some specific suggestions about where targeted investment could expand the capabilities of the BBO program. For example, yeast propagation is not currently possible within our programs, and developing this as a teachable skill would require new equipment. Furthermore, investment in writing-intensive training was noted as a potential avenue for improvement.

It was noted in the report that the gender balance of this program strongly skews male, and this may be a consequence of the male-dominated industry. I understand that, but would challenge the department to find ways to tilt this balance towards equity. As educators, we develop programs that meet the needs of industry, but I also believe we should aim to induce change in progressive, equity-building directions. How can we better serve women in the sector? How can we make our programs more welcoming and what barriers currently exist? The department will have my full support in trying to answer these questions and implementing new approaches to broaden the appeal of our programs.

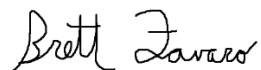
The report references new collaborations between the brewing program and the Applied Genomics Centre (AGC). This represents an exciting direction and fits within the concept of the value chain that our agriculture and horticulture offerings represent within the FSH. Our faculty seeks to have training and research that covers the full food production chain – from the healthy environment that underpins cultivation, to production, to processing (in this case, brewing), and ultimately to the sale of these products at market. Connecting these links through teaching and research is a key opportunity for the FSH and I very much support this department in exploring and developing further such connections.

One area the report did not reference was continuing and professional studies. It is often the case that, in industry-focused programs, there is substantial unmet demand for short, part-time, targeted courses that can either serve as entry pathways into bigger programs, or can stand alone as upskilling opportunities for people currently working in industry. I believe we should look seriously at this potential for brewing and related programs, as it seems like a natural fit.

I very much support the growth and evolution of the BBO program. I look forward to the results of the completed program review process, as it will help provide guidance as we determine next steps. I look forward to working with the department moving forward.

Best regards

Sincerely

A handwritten signature in cursive script that reads "Brett Favaro".

Brett Favaro, Ph.D, R.P.Bio
Dean, Faculty of Science and Horticulture

1. Introduction

1.1. Overview of the Program(s)

Program(s) Under Review

Diploma in Brewing and Brewery Operations (BBO)

Academic Level:

Undergraduate

Credential Granted:

Diploma

Start Date:

Fall (September)

Intake Type:

Limited

Minimum Credits Required:

62

Curriculum Effective Date:

The first intake for the Brewing and Brewery Operations (BBO) program was in September 2014. The most recent revisions to the course outlines list an implementation date of September 2017. For a list of courses please see **Appendix A**.

Admission Requirements

- In addition to KPU's General university admission requirements, including the undergraduate-level English Proficiency Requirements, the following program admission requirements apply:
 - English 12 (or equivalent) with a minimum grade of C+
 - Chemistry 11 with a minimum grade of C+ (or equivalent), and Level E1 as defined in the Math Alternatives Table
 - Pre-calculus 11 or Foundations of Mathematics 11 (or equivalent) with a minimum grade of C+

Portfolio Review including:

- Letters of reference or additional documents to enhance the application.

Cover Letter including:

- o Reasons for interest in the program
- o Career goals and how this program will factor in reaching these goals
- o Experience with brewing and the brewery or related industries
- o Why applicant is an ideal candidate for this program

Resume containing:

- o Work experience (particularly in the brewing, hospitality, or other related industries).
- o Post-secondary and/or Continuing Education
- Students are required to be a minimum of 19 years of age by the first day of classes.
- Recommendation by the Admissions Selection Committee.

Retrieved June 21, 2022, from <https://calendar.kpu.ca/programs-az/science-horticulture/brewing/brewing-brewery-operations-diploma/#requirements>

1.2. Program Department

The Brewing and Brewery Operations program is taught on the Langley campus by two full time faculty members, four part time contract faculty members, three full time staff laboratory instructors, supported by administration assistance and an events and communication coordinator. The Brewing and Brewery Operations Department is part of the Faculty of Science and Horticulture (FSH).

1.3. Program Purpose

The Diploma in Brewing and Brewery Operations is a two-year diploma where students study the science, production and business of brewing beer. The program combines building a solid foundation in brewing science with hands-on practical learning in the brewery and laboratory classrooms located on the Langley campus. The overall goal of the program is to provide education and training to permit a graduate to enter the brewing industry with the knowledge and skills to immediately become a valued member of the company's workforce.

1.4. Issues for Program Review

The program review will be used to ascertain:

1. If the learning outcomes for the Brewing and Brewery Operations program are still relevant to the industry
2. If the training provided by KPU meets the needs of the students and the employers
3. Where improvements could be made that would improve the program delivery and course learning outcomes (CLOs)
4. If the enrolment for the program is sustainable
5. If the program needs to diversify its course offerings with other fermented beverages such as distilling, cider, ready to drink or non-alcoholic products.

The program review will use the feedback provided by the students, alumni, discipline/sector representatives and faculty surveys to determine where improvements or adjustments need to be made. It is to be noted that due to the small response rate of some of the surveys the data collected may not be representative of all the students, the alumni, and the brewing industry. It is hypothesized by the department that the low response rate on some of the surveys might be introducing a nonresponse bias. Further explanations are given in section 3.1 of this report.

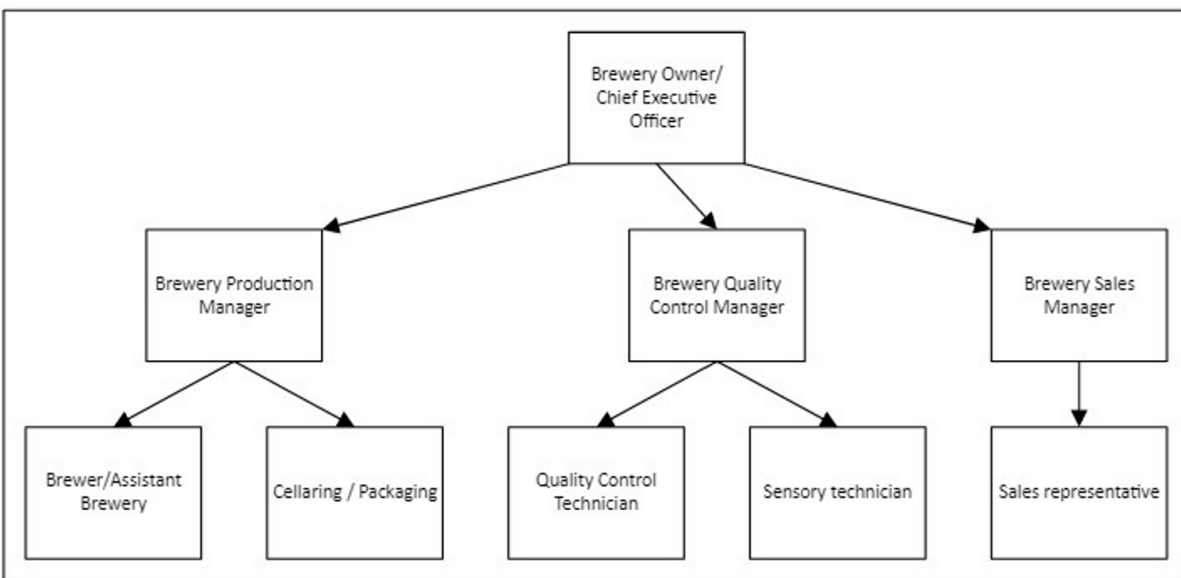
2. Curriculum Review

2.1. Pathways for Graduates

Pathways to Employment

The aim of the Brewing and Brewery Operations program is to provide the students with a foundation in brewing science, technology, operations, management, and sales. The foundational knowledge acquired through the program, as well as the critical thinking skills that are developed allow our students to integrate a variety of positions within the brewing industry. The level of education required will differ substantially between the different roles and breweries. Many of the small craft breweries do not require but encourage a formal education in brewing or a background in science. However, strong technical skills, a good work ethic, effective time management skills, troubleshooting skills, and good interpersonal skills are ubiquitous to most job descriptions. Please see Table 1 below for possible Career Pathways. For a full list of possible career opportunities please see Appendix B.

Table 1 Possible career paths for Brewing and Brewery Operations graduates



In British Columbia, craft breweries/brewpubs have increased their production and sales considerably over the last ten years to the point where these enterprises now account for about 30% (BC Craft Brewers Guild, 2022) of the beer market in British Columbia compared to 9% in 2009. (Updated from the KPU, Non-Degree Program Proposal, Brewing and Brewery Operations, 2013, Appendix C, p 10)

Employment in the craft brewery industry has increased with the increase in the number of establishments. According to the BC craft brewer's guild, the number of breweries in British Columbia has increased from 54 breweries in 2010 to 204 breweries in 2020. (BC Craft Brewers Guild, 2022). The number of breweries in Canada has increased from 564 breweries in 2015 to 1210 breweries in 2020 according to the data from Beer Canada (Beer Canada, 2022).

These craft breweries provide employment as head brewer and assistant brewers, brewery operations, quality control technicians, marketing, public relations, and retail sales. Employment opportunities also exist with the larger national and international breweries. The Brewing and Brewery Operations Program trains graduates to work in both the craft brewery establishments as well as larger establishments. (Updated from Appendix C, p 10)

Pathways to Further Study

Degree completion opportunities within the University exist in the following areas:

- Bachelor of Business Administration in Marketing Management or Human Resources Management or Entrepreneurial Leadership; graduates of the Brewing and Brewery Operations Program would be required to complete designated bridging courses prior to entering the programs: Basic Economics, Statistics, Accounting; this option currently exists within the University for students completing the Horticulture Technology Diploma. (Appendix C, p 16)
- There are opportunities in the Faculty of Trades and Technology leading to a diploma or certificate. Courses relevant to the Brewery Operations Program include: millwright, mechatronics, plumbing and piping, logistics and distribution, and welding.

Here is a summary of how the above-mentioned trades link to the brewing industry. Students with a background in brewing and millwright or welding would be well placed to work for a brewery manufacturer. Students with a mechatronics diploma and a brewing diploma would be able to apply, understand and troubleshoot the automation of processes in the brewing industry. Students with an understanding of brewing, plumbing and piping would be uniquely qualified to do the installation of breweries and other food facilities as they would understand the hygienic requirements for a food processing environment. Students with a specialization in logistics and distribution would be uniquely qualified to manage brewery supply chains.

Pathways to an Enriched Civic and Personal Life

In terms of enrichment during the Brewing program students are encouraged to foster critical thinking skills that will help them to adapt to change and make informed decisions. Students are encouraged to critically examine processes and to look for ways to make improvements. It is hoped that the students develop a love of learning that will forever enrich their lives. Students are guided to seek peer reviewed sources to deepen their knowledge and understanding of the brewing process. Students are also given a chance to apply and express their creativity while developing a student signature beer.

Possible Career Pathways for the program graduates is presented in Appendix B.

2.2. Program Learning Outcomes

The program learning outcomes listed below have been revised to be more concise relative to the original program learning outcomes in the program proposal. The revisions to the PLOs have been influenced by the faculty expertise, discussions with regulatory bodies and feedback from the industry. For example, guest lectures from WorkSafeBC have consistently stressed the need to a hazard analysis of the workplace. Hence, PLO #1 was revised to include evaluate safe work practices based on hazard analysis. (Appendix C)

Upon completing the Brewing and Brewery Operations Program, graduates will be able to:

1. Demonstrate and evaluate safe work practices based on hazard analysis.

2. Demonstrate the fundamental techniques of beer production.
3. Apply knowledge of beer chemistry and microbiology in brewery operations.
4. Evaluate appropriate process technology practices in brewery operations.
5. Evaluate and control the consistency and quality of beer using chemical, microbiological and sensory analysis.
6. Relate the history and evolution of the beer industry to today's market, beer styles and regulations.
7. Develop a product portfolio that addresses consumer needs.
8. Discuss and apply business principles and strategies related to running a brewing company.

Table 2 Mapping of initial PLOs from the program proposal to new PLOs

New PLOs	Old PLOs from program proposal											
	1. Demonstrate safe working practices	2. Demonstrate the fundamental techniques of beer making.	3. Demonstrate laboratory analysis of beer as required in a brewery	4. Select and use established techniques in marketing and public relations related to the beer industry	5. Discuss the history and evolution of the beer industry in relation to today's market.	6. Analyze and determine options and select styles from advanced techniques in the beer making process	7. Identify, select and utilize process technology practices in brewery operations, packaging and	8. Evaluate consistency and quality of beer, and determine beer style and characteristics	9. Discuss and apply business principles & strategies related to brewery operations, including human resource management, sales and government legislation	10. Formulate and develop products for the market.	11. Understand the chemical and microbiological basis of beer formation	12. Drive a fork lift
1. Demonstrate and evaluate safe work practices based on hazard analysis	✓											
2. Demonstrate the fundamental techniques of beer production.		✓										
3. Apply knowledge of beer chemistry and microbiology			✓			✓		✓			✓	

in brewery operations												
4. Evaluate appropriate process technology practices in brewery operations.		✓					✓					
5. Evaluate and control the consistency and quality of beer using chemical, microbiological and sensory analysis.					✓		✓			✓		
6. Relate the history and evolution of the beer industry to today's market, beer styles and regulations.					✓							
7. Develop a product portfolio that addresses consumer needs.				✓						✓		
8. Discuss and apply business principles and strategies related to running a brewing company.				✓				✓				

It can be seen by looking at Table 2 that the revised PLOs are more concise and a little broader than the original PLOs from the Program Proposal, in Appendix C. PLO #12 was eliminated as it has not been feasible to teach the students to drive a fork lift in the KPU Brewing Instructional Laboratory.

2.3. Essential Skill Development

This section explains how well the Brewing and Brewery Operations program is helping students attain the following essential skills:

Table 3 Mapping of program learning outcomes (PLOs) relative to the essential skill development

PLOs	Essential Skills												
	1. Creative Thinking and Problem Solving Skills	2. Oral Skills	3. Interpersonal Skills	4. Teamwork and Leadership Skills	5. Personal Management & Entrepreneurial Skills	6. Writing Skills	7. Reading and Information Skills	8. Visual Literacy	9. Mathematical Skills	10. Technological Skills	11. Intercultural Skills	12. Citizenship and Global Perspective	13. Independent Learning
1. Demonstrate and evaluate safe work practices based on hazard analysis		✓	✓	✓			✓	✓		✓			
2. Demonstrate the fundamental techniques of beer production.	✓	✓	✓	✓			✓	✓	✓	✓			✓
3. Apply knowledge of beer chemistry and microbiology in brewery operations	✓	✓	✓	✓			✓	✓	✓	✓			✓
4. Evaluate appropriate process technology practices in brewery operations.	✓	✓					✓	✓	✓		✓		
5. Evaluate and control the consistency and quality of beer using chemical, microbiological and sensory analysis.	✓						✓	✓	✓	✓			
6. Relate the history and evolution of the beer industry to today's market, beer styles and regulations.		✓	✓	✓			✓	✓			✓	✓	✓
7. Develop a product portfolio that addresses consumer needs.	✓				✓		✓	✓					
8. Discuss and apply business principles and strategies related to running a brewing company.	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓

Statements below list how the Brewing and Brewery Operations Program helps to develop the essential skills.

Creative Thinking and Problem-Solving Skills

Students are developing their creative thinking and problem-solving skills throughout the program. Students practice and apply problem solving techniques in a variety of ways, they learn to solve mathematical problems, interpret data, to write reports and make recommendations based on the data they have collected during laboratory activities. Moreover, in the brewing program students have a final capstone project where they must plan and design a beer as well as the marketing strategy, showcasing their creative thinking.

Oral Skills

Students practice oral skills within class presentations. Students also receive oral assessments of their brewing knowledge during the practical brewing classes.

Interpersonal Skills

Students are often asked to work in pairs and small groups thus helping to develop interpersonal skills.

Teamwork and Leadership Skills

Students are often placed in working teams to complete projects during the HOPS courses. Students must work as a team to complete their capstone project of a student signature beer.

Personal Management & Entrepreneurial Skills

Sociability and adaptability are practiced during a career fair. Students are given opportunity to network with the brewing industry and to highlight the skills they are learning in the program.

Writing Skills

Writing and communication skills are developed when students write chemistry, microbiology, sensory evaluation, beer judging, and advanced packaging laboratory reports, analyse and make recommendation on brewing and fermentation data, and produce written reports and assignment for HOPS courses, Introduction to Professional Communication and Business Ethics. In addition, students have written final exams.

Reading and Information Skills

Students are asked to read class notes, textbooks and to do research projects during the program.

Visual Literacy

Students are asked to graph and interpret the data. This is particularly important for interpreting fermentation profiles. They create visual ways of presenting Key Performance Indicators in running a business.

Mathematical Skills

Problem solving and computation skills are reinforced in multiple HOPS classes that require students to do calculations and problem solving.

Technological Skills

Students use a variety of technologies such as analytical instruments, brewing equipment, data management technologies and multimedia tools for classroom presentations.

Intercultural Skills

The cohorts in the HOPS courses are usually very diverse in terms of the learners age, background, and ethnicities. Students learn to work together and respect individual differences.

Citizenship and Global Perspective

Students learn how the brewing industry has been shaped by various regulations, customs, and governmental organisations from around the globe.

Independent Learning

Individual assignments and learning activities help to develop independent learners and foster a practice of continual learning.

2.4. Curriculum Assessment

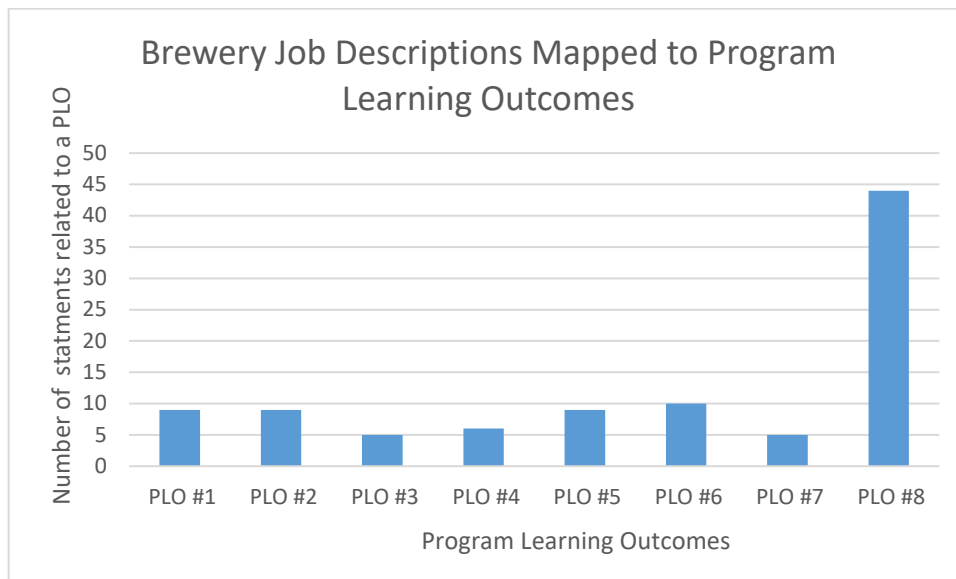
Program Learning Outcomes

Upon completing the Brewing and Brewery Operations Program, graduates will be able to:

1. Demonstrate and evaluate safe work practices based on hazard analysis.
2. Demonstrate the fundamental techniques of beer production.
3. Apply knowledge of beer chemistry and microbiology in brewery operations.
4. Evaluate appropriate process technology practices in brewery operations.
5. Evaluate and control the consistency and quality of beer using chemical, microbiological and sensory analysis.
6. Relate the history and evolution of the beer industry to today's market, beer styles and regulations.
7. Develop a product portfolio that addresses consumer needs.
8. Discuss and apply business principles and strategies related to running a brewing company.

To help determine if the program learning outcomes were still relevant to the brewing industry, the department members looked at current job postings from seventeen different breweries and mapped how well the brewing PLOs aligned with job requirements/descriptions. (See Appendix D) The job descriptions were categorized according to industry competencies, regulatory body competencies, future studies competencies, enriched civic and personal life competencies. It was found that: 27 statements from the job descriptions were attributed to industry competencies, 26 statements were attributed to enriched civic and personal life competencies, 9 statements were attributed to regulatory body competencies, and 1 statement was attributed to future studies competencies. The analysis of the job descriptions to PLOs revealed that all PLOs could be linked to statements in the job descriptions and that 44 of the statements in the job descriptions were attributed to PLO # 8 Discuss and apply business principles and strategies related to running a brewing company.

Figure 1 Brewery Job Description Mapped to Program Learning Outcomes



Sources for Figure 1 can be found in Appendix D.

Course Mix

When mapping the Program Learning Outcomes (PLOs) to the Course Learning Outcomes (CLOs) there is generally good alignment. The different PLOs are covered throughout the Brewing and Brewery Operations Program (Please see **Appendix E** for Mapping of PLOs to CLOs). Good scaffolding is observed between the prerequisite classes, for example concepts that are introduced at the introductory level in HOPS 1105: Brewing 1 are taught at a developing level for HOPS 1205: Brewing 2. It is also noted that certain classes tend to focus on specific PLOs for example all the CLOs for HOPS 2315: Calculation and Recipe Formulation mapped to PLO #4 evaluate appropriate process technology practices in brewery operations.

Close examination of some of the CLOs revealed that the way they are worded does not always match with the program delivery. For example, the CLO in HOPS 2405: Brewing 4 states that students will order and propagate yeast for a signature beer. Experience from students and instructors has shown that yeast propagation following best practice is not easily carried out at KPU as it is very time consuming and the required equipment is spread across three different laboratories within the Langley campus. Therefore the decision has been made by instructors that the students are better to simply place an order for the required quantity of yeast as opposed to propagate the yeast to a sufficient volume. Proper yeast propagation requires aseptic technique; a large autoclave capable of sterilizing 20 liters of wort and a flow hood is required to minimize the chance of any contamination in the fresh yeast culture. The equipment for this is currently located partly in the ISH lab and Room 1660, which makes it hard to make the process efficient as the equipment must be carted across campus. All this process happens outside the brewery and needs to be supervised by an instructor, which depending on the number of instructors in the brewery can use up 30 to 50% of our people resource. Something similar happens when having to do lab quality checks, as the equipment is in rooms 1345 (for chemistry analysis) and 1685 (for microbiological analysis). There are often not enough people resources to have someone supervise students in the labs during the quality checks. Investment in laboratory facilities that are appropriate for an operational brewery would allow the CLO from Brewing 4 to be met, but also would

enhance the opportunities to complete PLO#5 “Evaluate and control the consistency and quality of beer using chemical, microbiological and sensory analysis.” The possibility of converting the current brewery office space into a laboratory facility should also be considered. This would also require finding new office space for brewing instructors. Another possibility would be to modify one of the two current washrooms into a small lab space, if possible.

It must also be noted that HOPS 2300: Brewing Work Experience and HOPS 2301: Brewing Work Experience Dissemination have never been offered and have not been mapped. The reason these courses were not run was in part because of complaints from the first cohort. The students felt that these courses were not value added. Basically, KPU did not have the resources available to help the brewing students with job placements or job site visits. Therefore, the students felt that they were, in essence, paying KPU to find their own job. The Brewing Department also did not want to penalize students that chose to work in higher paying industries during the summer. The Brewing Department recommendation is to delete these courses or to request faculty time to run these courses.

Although HOPS 2300 and HOPS 2301 have never been run, most of the brewing students tend to get jobs in the brewing industry during the summer and instructors occasionally stop by at breweries where students are working. The student surveys indicate that 82% of the respondents worked during their studies and that 38% indicated that their work was not related to brewing (Appendix I). It has also been observed that given the limited intake and cohort nature of the Brewery and Brewery Operations program most students get together and debrief their work experience informally and often the work experience become part of classroom discussions.

Recommendations:

- The wording of the following CLOs could be changed to better reflect current program delivery
 - a. HOPS 2305: Select quality control measurements (students are not really selecting the QC measurements; type of QC measurements is limited by lab availability)
 - b. HOPS 2314: Explain the importance of proper beer service (done mostly in HOPS 2310: Beer Judging)
 - c. HOPS 2405: Create health and safety procedures for a brewery
 - d. HOPS 2405: Order and propagate yeast for a signature beer
 - e. HOPS 2405: Organize a tasting panel for the regular evaluation of a beer (done mostly in HOPS 2310: Beer Judging)
- Remove HOPS 2300 and HOPS 2301 from the system or request faculty time to run these courses.
- To Indigenize the curriculum, the faculty and instructional staff are requesting help and training from an appropriate Indigenous consultant to approach this very sensitive issue.

The full curriculum map is presented in **Appendix E**.

3. Program Relevance and Demand

3.1. Relevance

Are the program learning outcomes relevant to the current needs of the discipline/sector?

The program analysis was done by looking at the discipline sector, alumni, student, and faculty surveys collected by the Office of Planning and Accountability (OPA) (Appendix F). It must be noted that the response rates indicate that we are only capturing part of the data as discipline sector, alumni and student surveys had lower than a 50% response rate. The response rates for the surveys were as follows: 42 % (n= 13 out of 31) discipline/sector, 24% alumni (n= 23 out of 94 with 30% from 2016), 32% student (n= 12 out of 38) , and 67% faculty (n= 6 out of 9). (Appendices G, H, I and J respectively)

It is hypothesized by the department that the low response rate on the discipline sector, alumni and student surveys might be introducing a nonresponse bias. It is possible that some of the comments might be skewed towards the negative and positive end of the spectrum. It is further hypothesized that people that are generally satisfied with the Brewing and Brewery Operations program may not have taken the time to respond to the surveys. The negative bias may be further represented in the alumni survey as the 2016 year had the highest (30%) response rate of all the alumni. The 2016 cohort experienced the delivery of the Brewing and Brewery Operations program when the brewery was not operational until mid-February of the 2015 Spring semester.

The discipline sector representatives that were polled were primarily part of the Program Advisory Committee (PAC). The majority (77%) of the respondents worked in the brewing industry and the remainder are involved in brewery manufacturing or other sectors of the alcohol beverage industry such as cidery, distillery or hospitality (Appendix G).

The data indicates that the faculty places more relevance on the Program Learning Outcomes (PLOs) than the discipline sector representatives or the alumni. After a more in-depth analysis of the feedback from the discipline sector representatives, alumni, students and faculty in Table 4, Table 5, Table 6, Table 7, and Table 8 respectively, it can be concluded that the Program Learning Outcomes (PLOs) for the Brewing and Brewery Operations Program are relevant. With PLOs 1 through 5 scoring the highest in relevance for discipline sector representative and alumni alike. For the discipline sector analysis, perhaps the importance of the PLOs is reflected in the way the survey question was posed. The question is specifically asking for how the PLOs align with “entry-level” positions in the brewing industry, it is hypothesized that the way this question was posed in the survey has led to a response bias. PLOs 6 to 8 would be associated with higher level positions. Therefore, it has been concluded by the Brewing Department that all the PLOs are relevant but that the degree of relevancy is a function of the position held within the organization. Understanding regulations (PLO# 6), developing a product portfolio (PLO #7) and managing a brewery (PLO # 8) are all crucial elements for successful brewery operations. However, these roles and responsibilities would not be allocated to an entry-level position and thus would score at low or not relevant for an entry-level position and this is indicated in the data from the discipline sector representatives. For example, PLO # 8 would become more relevant as one gains more of a leadership and management role in a brewery. This conclusion is substantiated by the following alumni quote “... the microbiology and yeast management was very important, business and marketing are becoming much more useful since I became management.” (Appendix H, p 73) Furthermore, the mapping of the PLOs to brewery job descriptions (see Figure 1) indicated that PLO #8 is one of the most sought-after competencies.

Table 4 PLO relevance to discipline sector representatives

Considering the needs and expectations of your organization, how important is it for an entry-level employee to be able to demonstrate the following?

#	Question	Not at all important	Somewhat important	Very important	Essential	Total
1	Demonstrate and evaluate safe work practices based on hazard analysis.	0%	8%	42%	50%	12
2	Demonstrate the fundamental techniques of beer production.	0%	25%	50%	25%	12
3	Apply knowledge of beer chemistry and microbiology in brewery operations.	0%	42%	50%	8%	12
4	Evaluate appropriate process technology practices in brewery operations.	8%	25%	67%	0%	12
5	Evaluate and control the consistency and quality of beer using chemical, microbiological and sensory analysis.	8%	50%	25%	17%	12
6	Relate the history and evolution of the beer industry to today's market, beer styles and regulations.	42%	33%	25%	0%	12
7	Develop a product portfolio that addresses consumer needs.	25%	50%	25%	0%	12
8	Discuss and apply business principles and strategies related to running a brewing company.	42%	50%	8%	0%	12

Source for Table 4 (Appendix G) Diploma in Brewing and Brewery Operations Program Review - Discipline/Sector Survey Report , June 2022

Table 5 Program Learning Outcomes relevance to alumni career goals

#	Question	Not at all relevant	Slightly relevant	Somewhat relevant	Very relevant	Total
1	Demonstrate and evaluate safe work practices based on hazard analysis.	0%	5%	27%	68%	22
2	Demonstrate the fundamental techniques of beer production.	0%	13%	9%	78%	23
3	Apply knowledge of beer chemistry and microbiology in brewery operations.	0%	13%	22%	65%	23
4	Evaluate appropriate process technology practices in brewery operations.	0%	9%	43%	48%	23
5	Evaluate and control the consistency and quality of beer using chemical, microbiological and sensory analysis.	0%	17%	17%	65%	23
6	Relate the history and evolution of the beer industry to today's market, beer styles and regulations.	9%	22%	43%	26%	23
7	Develop a product portfolio that addresses consumer needs.	17%	22%	22%	39%	23
8	Discuss and apply business principles and strategies related to running a brewing company.	0%	26%	30%	43%	23

Source for Table 5 (Appendix H) Diploma in Brewing and Brewery Operations Program Review – Alumni Survey Report, June 2022

Table 6 Brewing and Brewery Operations Program’s curriculum relevance to student career goals

#	Thinking of KPU's Brewing and Brewery Operations program as a whole, to what extent do you agree that the program’s curriculum is relevant to your career goals?	Percentage
1	Strongly disagree	0%
2	Somewhat disagree	8%
3	Neither agree nor disagree	0%
4	Somewhat agree	50%
5	Strongly agree	42%
	Total	12

Source for Table 6 (Appendix I) Diploma in Brewing and Brewery Operations Program Review – Student Survey Report, June 2022

Table 7 Brewing and Brewery Operations program as a whole relevance as assessed by the faculty

#	Question	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
1	Program curriculum is relevant to the needs of the discipline/sector.	0%	0%	0%	33%	67%	6
2	The program prepares students for a career in the discipline/sector.	0%	0%	0%	0%	100%	6
3	The program prepares students for further education in the field.	0%	0%	0%	33%	67%	6

Source for Table 7 (Appendix J) Diploma in Brewing and Brewery Operations Program Review – Faculty Survey Report, June 2022

Table 8 PLO relevance for the Brewing and Brewery Operations Program according to the faculty in the Brewing Department

#	Question	Not at all relevant	Slightly relevant	Somewhat relevant	Very relevant	Total
1	Demonstrate and evaluate safe work practices based on hazard analysis.	0%	0%	0%	100%	6
2	Demonstrate the fundamental techniques of beer production.	0%	0%	0%	100%	6
3	Apply knowledge of beer chemistry and microbiology in brewery operations.	0%	0%	0%	100%	6
4	Evaluate appropriate process technology practices in brewery operations.	0%	0%	0%	100%	6
5	Evaluate and control the consistency and quality of beer using chemical, microbiological and sensory analysis.	0%	0%	17%	83%	6
6	Relate the history and evolution of the beer industry to today’s market, beer styles and regulations.	0%	0%	0%	100%	6
7	Develop a product portfolio that addresses consumer needs.	0%	0%	17%	83%	6
8	Discuss and apply business principles and strategies related to running a brewing company.	0%	0%	0%	100%	6

Source for Table 8 (Appendix J) Diploma in Brewing and Brewery Operations Program Review – Faculty Survey Report, June 2022

The comments from the discipline sector representatives, alumni and students are generally positive regarding KPU, words such as “knowledgeable, well trained, talented, technical and relevant” (Appendix G, p 62) are used to describe the KPU Brewing and Brewery Operations Program. The following quotes exemplify this:

Industry quote “The program provides a strong foundation that allows students to adapt quickly to their individual work environment.” (Appendix G, p 68)

Alumni quote “I felt that the program was very well-rounded, it covered fundamental science of brewing (chemistry & microbiology) as well as the necessary hands-on training and some business concepts (people management) •Instructors have a wealth of experience/ knowledge that was very beneficial to the course. •The hands-on brewery and opportunity to create/ market/ sell a product from start to finish is very beneficial to students.” (Appendix H, p 73)

When asked how prepared were KPU’s Brewing and Brewery Operations students to work in their organizations 56% of the discipline sector respondents stated that students were very well prepared versus 44% that stated that the students were somewhat prepared. The level of competency increases with graduates of the program as 83% of the alumni scored very well prepared and 17% for somewhat prepared (Appendix G). The level of preparedness is also substantiated as 63% of the alumni strongly agree that they were well prepared for an entry level job (Appendix H).

Some of the comments from the industry representatives, alumni and students do indicate that improvements could be made relative to teaching more practical skills within the program.

Industry quote “In book knowledge very well. I had a KPU student that graduated this year working in my brewery that did not know how to check carbonation with a Zahm and Nagle CO2 tester.” and “not well prepared for the demands of a commercial brewing operation vs small scale one”. (Appendix G, p 68)

Alumni quote “Hands on brewery maintenance: replacing a pump head, trouble shooting a glycol system; some basic plumbing and electrical would be pretty helpful; how to swap a solenoid. A lot of the owners hiring KPU grads don't have a clue how to run a brewery.” (Appendix H, p 75)

When asked about what is missing some would like learning more about other fermented beverages.

Student quote “Since Ready To Drink (RTDs) are taking over market share, is it worthwhile discussing this category as well? Many are worries about the future of craft beer (which may decrease enrollment)” and “Wine, spirits, distillation, kombucha, sodas and other fermented beverages” (Appendix I, p 94)

Some topics that have been highlighted by the discipline sector to be current are work ethics, diversity and inclusion initiatives, and environmental sustainability. These would be important to include in the curriculum as they become more important in the industry.

It should be noted that over the last two years the delivery of some of the practical components of the program have been negatively impacted by the COVID-19 pandemic restrictions.

Summary and Recommendations

The PLOs for the Brewing and Brewery Operation Program are relevant to the discipline sector representative, alumni, students, and faculty. The relevance of each PLO will depend on the positions that are held within the various organizations.

Survey data from the discipline sector representatives and alumni indicate that the students and alumni are generally well prepared for work in the industry. The industry sector scored the alumni at 83 % very well prepared and the students at 53%. (Appendix G)

The KPU Brewing and Brewery Operations Program must strive to deliver a learning environment where the students are given an opportunity to apply the knowledge gained in the lecture courses in the experiential context of the KPU brewery.

Alumni, students, and discipline sector representative all indicate that more practical skill development in the brewery and laboratories would be beneficial. More time dedicated to hands on with the brewing and laboratory equipment. Proficiency is gained by repetition, thus having the students practice a skill multiple times will increase their confidence. For example, students are taught the chemical analysis of beer in the brewing chemistry laboratory but are not often given the opportunity to practice these skills to a beer that they are producing. Having a dedicated lab space in the brewery would provide the opportunity to do this.

The feedback from industry and students also indicates that some information about other fermented beverages would be useful. A curriculum revision should look at the feasibility of adding other fermented beverages or non-alcoholic beer to the curriculum.

The feedback from the industry also indicates the importance for students to understand good work ethics, economics, sustainability, and the environmental impacts of the brewing industry.

Some of the feedback from the alumni and the students indicate they felt that the content of certain courses could be adjusted to be more relevant. It is recommended that the brewing department looks at how the current HOPS courses are delivered and see if there are opportunities to increase the practical skills that the students are acquiring.

The brewing department should investigate the feasibility of teaching more about brewery maintenance and determine if a course on brewery maintenance could be added to the curriculum.

Curriculum review should investigate if the elective courses are benefiting the students and the program. Would it be beneficial to remove one of the elective courses for a course on brewery maintenance or should a course on brewery maintenance be offered as a continuing and professional studies (CPS) offering.

Does the program have the connections to the discipline/sector needed to remain current?

The Brewing and Brewery Operations Program, typically holds a PAC meeting and a career fair annually. The PAC meeting provides an opportunity for the program to get feedback from the industry. The career fair provides an opportunity for students and industry to meet and allows for networking. The discipline sector respondents indicated that 83% were very satisfied and 17 % somewhat satisfied with their ability to stay connected to the KPU Brewing and Brewery Operations Program (Appendix G). All respondents were somewhat or very interested in participating in projects that would connect program students with the industry. Suggestions were made about class field trips to breweries and job shadowing opportunities. The importance of the KPU Brewing Department to attend industry events was also highlighted as a vital way to

maintain the connection with industry. The data from the alumni survey also indicates that they agree that they are provided with opportunities to stay connected to the Brewing and Brewery Operations program. Some alumni also indicate interest in class reunions or opportunities to do recipe development on the KPU pilot brewing system. (Appendix H)

Since January 2022, the Brewing and Brewery Operations Program has started collaborating on a hop breeding project with the Applied Genomic Centre (AGC) at KPU. The AGC is breeding new hop varieties and brewing trials are being done at the KPU Brewery. This collaboration is generating interest within the brewing students and the industry. Most of the research could potentially be done during summer months when there are no brewing courses. However, additional personnel would be required to manage any future research projects.

Recommendations

- KPU Brewing and Brewery Operations program should continue to be involved in collaborations that benefit the students and the brewing industry
- Have opportunities for alumni to brew at KPU, which would allow them to stay connected to KPU BBO program, and provide them with additional networking opportunities
- Host class reunions

Does the program include appropriate Indigenous content?

Brewing and Brewery Operations Program does not provide much if any Indigenous content. Equity, diversity, and inclusion are subjects that are discussed in the brewery management course, but little has been done to Indigenize the curriculum. The subject of alcohol and Indigenization must be approached with great tact and the Brewing Department would appreciate some guidance from Indigenous leaders on how best to approach the inclusion of more Indigenous content into the curriculum. This is an area that requires further consultation.

3.2. Faculty Qualifications and Currency

What is the collective expertise available to deliver the program?

Information below is included in Appendix K.

The Brewing and Brewery Operations program is currently taught by 2 full time faculty instructors (2 FTEs) teaching a total of 13 courses, four part time NR1 contract faculty teaching a total of 4 courses, 3 full time BCGEU instructional staff (3 FTEs) and is supported by administration assistance and an events and communication coordinator from the Faculty of Science and Horticulture. It should also be noted that the Introduction to Professional Communication (CMNS 1140), Business Problem Solving with Spreadsheets (CBSY 1110) and Business Ethics (PHIL 3033) courses are taught by other faculties within KPU.

Within the regular and non-regular teaching faculty of the Brewing Department, four of the instructors hold a masters level education. These include: MSc. Brewing and Distilling, MSc. Food Science, MSc. Microbiology and a MA. Most importantly many of the instructors have decades of experience within the brewing industry.

Within the instruction staff there is an MSc. Microbiology and two Diplomas in Brewing and Brewery Operations.

The faculty and staff in the Brewing and Brewery Operations program maintains currency by attending professional brewing conferences held by organizations such as Master Brewers Association of the Americas,

American Society of Brewing Chemist, European Brewery Convention, Canadian Brewing Conference, and the British Columbia Craft Brewers Conference. The faculty and staff also attend many local brewing festivals.

Some faculty and staff also keep current by attending educational workshops from Teaching and Learning. One member of staff is also taking courses within the provincial instructor diploma program (PIDP).

There is a broad expertise within the department members and a willingness to support the students to achieve their educational career goals.

Collectively, does the department have the expertise needed to deliver the curriculum?

Collectively, the brewing and brewery operations program currently has the expertise to deliver the curriculum. However, the current faculty and staff are at maximum workload capacity to deliver the program. If expansions, research, or other program offerings want to be offered more faculty would need to be hired.

It must be noted that operating the small KPU commercial brewery does require KPU to comply with and communicate with all governmental regulatory agencies (Liquor Distribution Branch, Liquor and Cannabis Regulation Branch, Canada Revenue Agency, Metro Vancouver, and BC safety authority-boiler licensing). Simply operating the brewery does require significant time resources for production, reporting of production, cleaning and sanitation, data entry, routine maintenance, beer sales and beer sales reporting, that are not accounted for in the KPU evaluation of staffing needs. It is the opinion of the Brewing Department that many of the administrative tasks that are involved in running a brewery would best be allocated to a dedicated brewery management role.

Summary and Recommendations

- The brewing and brewery operations program is trying to accomplish two different objectives; one to teach brewing and two to operate a small brewery. It must be recognized that both objectives represent full time jobs. Thus, faculty and staff resources are required to deliver the education program and people resources are also required to operate the brewery.
- KPU Brewery is registered manufacturing brewery in British Columbia and as such it needs proper management to continue its operations. Key responsibilities include: Preparing monthly Excise Duty reports to CRA, Preparing Declaration of Brewery Production Report to LDB, Preparing Packaged Product Movement Summary Report to LDB, Responding to any audit requests from different government bodies. Additional responsibilities include: ensuring accurate data keeping, ensuring daily waste-water pH monitoring and recording, recording and reporting discharge of any off-spec product, ensuring final products are in specification, coordinating daily operation duties including production scheduling, ordering supplies, brewing, sanitation and packaging, organizing production and sample delivery to different beer competitions, coordinating special projects, liaising with internal and external contacts, and representing KPU Brewing at various events.
- Additional resources in terms of people and equipment will be required if the program wishes to offer new courses on brewery maintenance, other fermented beverages, or non-alcoholic beer.
- Additional people resources will be needed if the Brewing and Brewery Operations program wishes to undertake research projects.

The Qualifications and Currency Profile is presented in Appendix K.

3.3. Student Demand

Who takes the program?

Students who enroll in the Brewery and Brewery Operations program are specifically interested in getting a job in the brewing industry with 83% of the students stating this as the main reason for enrolling and 17% of the students indicating that improving job prospects or potential earnings as a reason for enrollment (Appendix I).

Analysis of Table 9 and Table 10 indicates that there are fewer female students in the Brewing and Brewery Operation program as compared to the Faculty of Science and Horticulture (FSH). However, the percentage of female students in the BBO program is in alignment with the industry. A survey conducted by the Brewers Association in 2019 revealed that brewery production staff is 7.5 to 13.9 % female, while non-production staff, both service and non-service, is more gender balanced (Watson, 2022). The data also indicates that the program tends to have more mature students and less international students than the rest of FSH.

Since the industrial revolution the brewing industry has been a white male dominated industry. Efforts to encourage more diversity within the brewing industry are being undertaken by encouraging applicants from all under-represented communities. The brewing industry has recognized the lack of diversity and is trying to make changes by sponsoring awards that help increase diversity. KPU has scholarships and awards that are specifically awarded to underrepresented demographics, for example, Diversity in Brewing, Molson BIPOC, Six Pints Women In Brewing and the Nancy More awards. Every year we also host a Pink Boots Collaboration brew to which all female students, alumni and local industry members are invited. This is an opportunity to inspire women in the community to apply to the program.

KPU can continue to champion diversity in brewery by having diversity within the faculty and staff. Some female brewing students have indicated that having female instructors made applying for the program less intimidating.

Table 9 Demographic Profile of Brewing and Brewery Operations Program Students by Academic Year

	2016/17	2017/18	2018/19	2019/20	2020/21
<i>Student Headcount</i>	39	49	52	41	42
% Female	10%	12%	17%	15%	14%
% 22 years or younger	33%	16%	23%	24%	14%
% International	8%	12%	13%	15%	14%

Table 10 Demographic Profile of Faculty of Science and Horticulture Students by Academic Year

	2016/17	2017/18	2018/19	2019/20	2020/21
<i>Student Headcount</i>	2,591	3,256	2,795	2,672	2,405
% Female	53%	58%	55%	56%	58%
% 22 years or younger	73%	78%	76%	75%	74%
% International	18%	38%	36%	35%	34%

Sources for Table 9 and Table 10 (Appendix F) Administrative Data Report for Diploma in Brewing and Brewery Operations Program, June, 2022.

Recommendation:

- Encourage people with a diverse background to apply for the program by highlighting the awards available to them, which would help to reduce the financial burden
- Collaboration/consultation with organizations such as Pink Boots Society and Diversity in Brewing (i.e., collaboration brews, and hosting events, seminars, or speakers).

Is demand for the program sustainable?

The Brewing and Brewery Operations Program has seen fluctuations in enrolment since its beginning in 2014. The first year of the program started with 30 students enrolled. Unfortunately the program started prior to the brewing facility being built and some of the alumni comments clearly indicate some disappointment with the program delivery “Unfortunately, as I was in the inaugural year some of the courses were in flux and a bit confusing at times. Not necessarily the instructor’s fault as they were building a brand new program”. (Appendix H, p 83) The second cohort of the program in 2015 only saw an enrollment of 16 students. It is hypothesized that the reputation of the program may have been negatively impacted after the challenges of the first year. However, instructors have worked diligently to make improvements and have been successful as indicated by the following alumni quote “From talking to later students/graduates it sounds like the issues I had have been corrected already. Improved labs and more challenging/in depth chemistry and biology.” (Appendix H, p 73). The program saw the highest enrollment in 2018/2019 with 52 students enrolled in the first and second year of the program. (See Table 11 below)

Table 11 Student Headcount in Brewing and Brewery Operations Courses by Academic Year Compared with Faculty of Science and Horticulture Courses

	2016/17	2017/18	2018/19	2019/20	2020/21	%Change ¹
Brewing and Brewery Operations	43	49	52	40	39	-9%
Faculty of Science and Horticulture	3,563	3,876	4,104	3,646	3,421	-4%

Sources for Table 11 (Appendix F) Administrative Data Report for Diploma in Brewing and Brewery Operations Program, June 2022

Unfortunately, the Brewing and Brewery Operations program has seen a 9% decline in enrollment since 2019. This can partly be explained by restrictions that were put in place in 2020 due to the COVID-19 pandemic. The 2020 intake was limited to 20 students due to the reduced student capacity for the practical laboratories. The 2020 cohort also saw a reduction in hands on skill development by at least 50%. The time in the practical brewing and packaging courses were reduced to half the pre-COVID, chemistry laboratories were delivered online, microbiology laboratory and sensory laboratories also saw a reduction in lab time. This reduction in the hands-on components of the program may have negatively affected the program's reputation. Quotes from alumni “Reduce the amount of on-line instruction as soon as COVID-19 restrictions allow!” (Appendix H, p 83) and student “The ‘asynchronous’ delivery of some courses was fairly difficult at times to learn.” (Appendix I, p 103) do indicate that not all students are enthused about online learning. The data from FSH also indicates a peak enrollment in 2018/2019 with a decline after the COVID-19 pandemic. Enrollment for the 2021/22 academic year was 34 students and the current enrolment for 2022/23 academic year is at 25 students. The

¹ % Change refers to change between 2016/17 to 2020/21.

data suggests that the pandemic may have negatively impacted enrollment in FSH. A recent article by Bauer et al. (2022) concludes that COVID-19 has negatively impacted enrolments in post-secondary institutions. It is possible that enrollment will improve once the global economic situation improves.

The hospitality sector has also been particularly impacted by the COVID-19 pandemic and it is possible that the economic uncertainty for the sector has contributed to a decline in applicants. A recent article in the Globe and Mail (Kirby & Lundy, 2022) entitled *Canada's crowded craft beer industry is tapped out. What brewers say must happen to stay afloat* indicates that the Canadian beer market might be saturated. The number of breweries has increased, while the per capita consumption has decreased. There is uncertainty on the industry's expansion. This could lead potential applicants to think there might not be job openings for all the graduates. This type of headline may negatively influence potential applicants.

The Brewing and Brewery Operations Program does have a good employment rate for its graduates with 85% of the alumni surveyed indicating that they are currently employed in a field related to their studies at KPU (Appendix H). As indicated by the 69 postings on the KPU Brewing Job Board during the 2021-2022 fiscal year, there is still a strong demand from the brewing industry for a trained workforce.

Summary and Recommendations

Decrease in enrollment could be a result of the pandemic and the current economic climate.

Enrolment procedures should be investigated to see there are barriers preventing higher enrolment numbers

Recommendations

- Remove the portfolio requirement from the application process
- Allow enrolment until the start of classes

Does the program have the capacity to meet demand?

Yes, the program has the capacity to meet demand as the program was designed for a maximum annual capacity of 35 students. The data provided by OPA in the Administrative Data (Appendix F) does not indicate any unmet demand. The brewing department would like to state that an enrollment of 24 students per cohort allows for the most student-centered delivery of the practical brewing courses. This allows for two sections of the practical brewing courses to run and for the students to work in pairs. When groups are larger students are placed in groups of three and this reduces the hands-on component for each student as well as creates a more crowded workspace, which inherently increases the safety risk.

Does the program have effective outreach to ensure demand?

The Brewing and Brewery Operations program has multiple outreach initiatives to inform potential applicants about the program and to maintain links with the industry. Producing capable graduates and having a good reputation with industry partners can be an important driver for enrollment into the Brewing and Brewery Operations program. Department members are active members of professional organizations such as the Master Brewers Association of the Americas which helps to build relationships with local industry professionals. Please see Table 12 for the list of typical outreach events that the Brewing and Brewery Operations program is involved with. It must be noted that the KPU Brewing Department is often bringing KPU beer when it participates in events and that a lot of time in the summer is allocated by staff to producing beer for events and beer sales.

Table 12 Events that the Brewing and Brewery Operations Program has participated in 2021-2022

Event	Months the events are usually held
Great Canadian Beer Festival	September
Canada Beer Cup	October
BC Craft Brewers Conference	November
Student Beer Releases at Farm Country Brewing	October to December
BC Beer Awards	November
Brewery Advisory Committee Meeting	February
Brewing Career Fair	March
Pink Books Collaboration Brew (to encourage Women in the Brewing Industry)	February, March
Student Signature Beer Tap takeover at the Barley Merchant	March, April
Pacific Beer Chat Podcast	April
US Open College Beer Championship	May
Canadian Brewing Awards	May
Collaboration Brews with local breweries	May to August
Brewhalla Langley Beer Festival	May
Vancouver Craft Beer Week	July
Information Sessions	October, February
Ask Me Anything Sessions	March, June, July, August
Tours of the Brewery to local MPs	September 2021, January 2022
Battle of the Brews	August

It is hard to quantify the effectiveness of the different outreach events as the authors of the report do not have any specific data stating where students learned about the KPU Brewing and Brewery Operations Program. It can be said that the Brewing and Brewery Operations program has won many awards that have brought recognition to KPU and the Program. Please see Table 13 below for a list of awards.

Table 13 List of KPU Brewing Awards

Awards	Year
Canadian Brewing Awards Student Signature Beer wins Bronze – Summertime – in the Wheat Beer Category	2022
US Open College Beer Championship, tying for second place overall	2021
Kwantlen Polytechnic University (KPU) in British Columbia took home the Grand National Championship as the college that brews the best beers in North America.	2019
Brewery of the Year at the BC Beer Awards	2019
US Open College Beer Championship Silver – KPU Dubbel Bronze – KPU Wit	2018
BC Beer Awards - Silver for KPU 50/50 Hefe	2018
US Open College Beer Championship, second place overall	2017
BC Beer Awards – Bronze for KPU Weissbier	2017

4. Effectiveness of Instructional Delivery

4.1. Instructional Design and Delivery of Curriculum

Are appropriate opportunities provided to help students acquire the PLOs?

In general, good opportunities exist to help the students acquire the PLO's. Analysis of the data provided by OPA in Table 14, Table 15, and Table 16 (below) indicate that alumni, students and faculty believe that there are appropriate opportunities to help the students acquire the PLOs. As was highlighted in chapter 3 of this report, there is a greater degree of agreement with the PLOs 1 through 5. The slightly lower degree of agreement to acquire the PLOs 6 to 8 is again linked to the higher level of competency required to become proficient in these PLOs. The first year of the diploma program is more focused on the science of brewing with more of the business and management courses in the second year of the program. Therefore, the structure of the program allows for the students to have more opportunities to acquire the PLOs that are related to the production of beer.

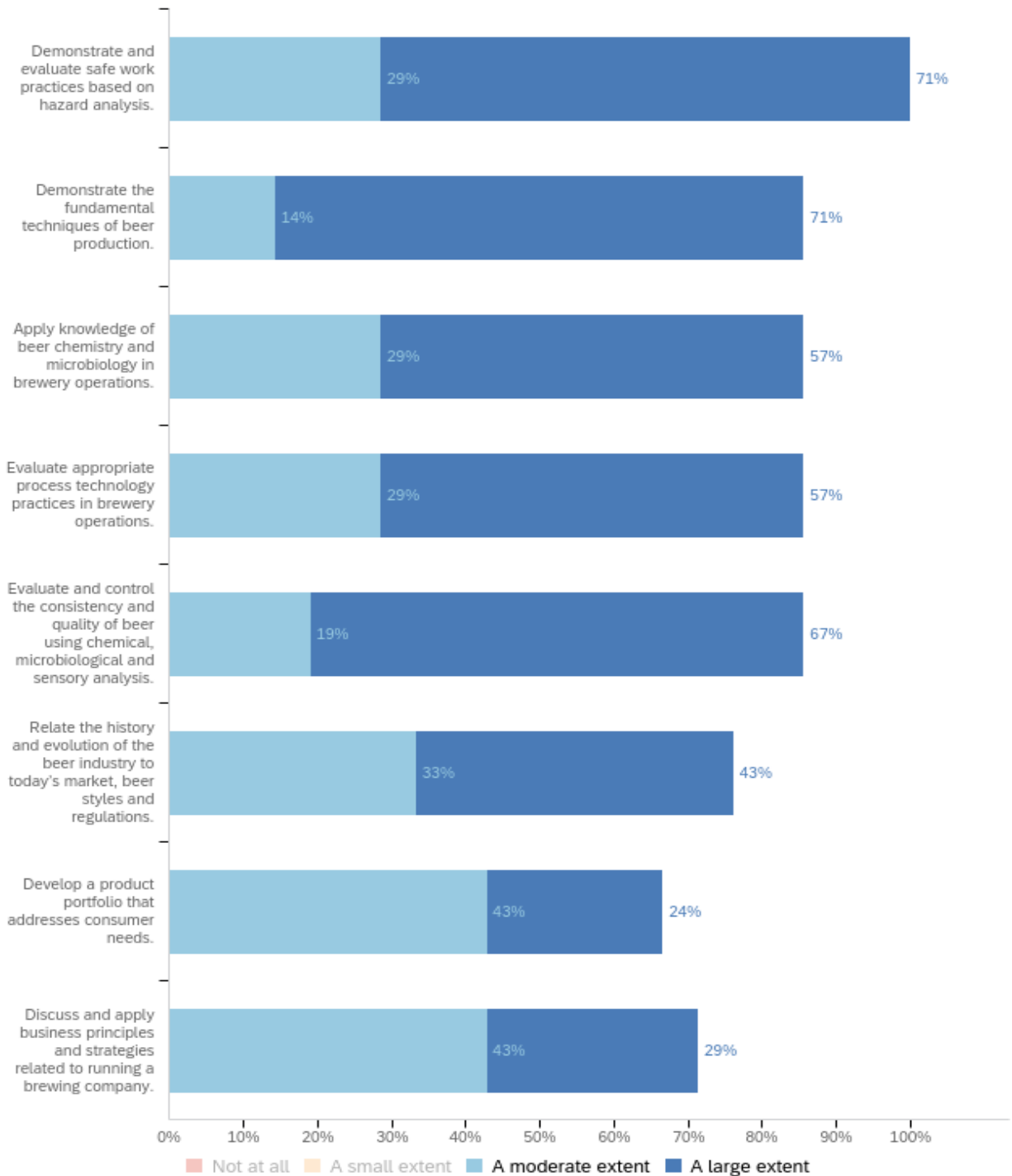
The data suggests that there are opportunities to strengthen how the students interpret and relate to PLO # 6, "Relate the history and evolution of the beer industry to today's market, beer styles and regulations." Some of the students comment on wanting to learn more about beer styles and recipe development earlier on in the program. This indicates that clear articulation from all instructors is needed from the start of the program to help the students understand how the information provided in multiple HOPS courses is assisting them with recipe design and the regulatory requirements they must comply with to sell beer.

For an analysis of improvements to the experiential delivery of the curriculum please refer to the next section of the report.

Recommendation:

- Articulate from the beginning of the program how the course material in multiple HOPS courses is relevant to recipe design and the regulatory requirements

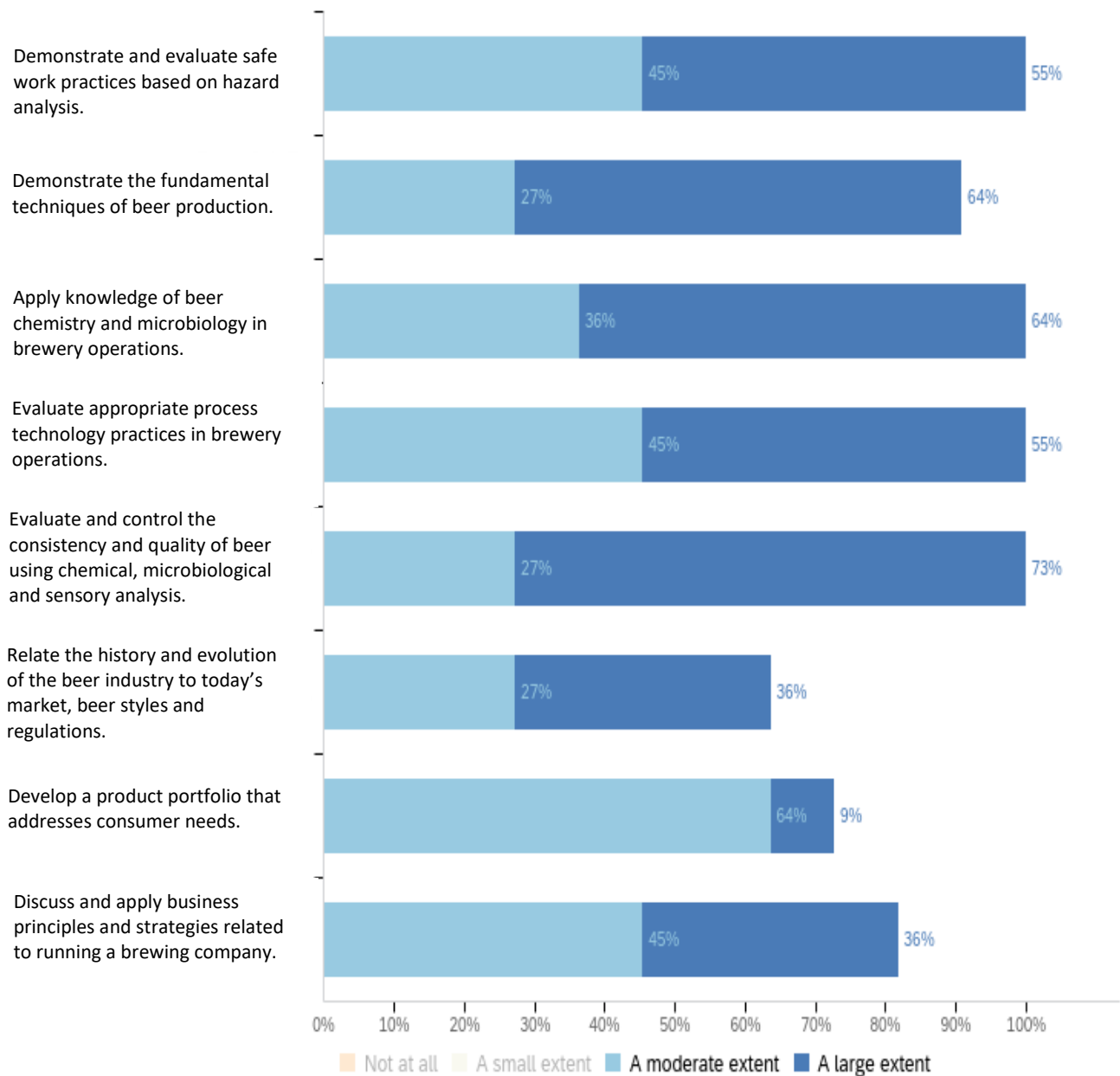
Table 14 The extent KPU's Brewing and Brewery Operations program helped alumni develop each of the Program Learning Outcomes as assessed by alumni



Note that “not at all” and “a small extent” categories are excluded from the chart for quick comparisons between items. Please use the frequency table below for the percentages for the “not at all” and “a small extent” categories.

Source for Table 14 (Appendix H) Diploma in Brewing and Brewery Operations Program Review – Alumni Survey Report, June 2022

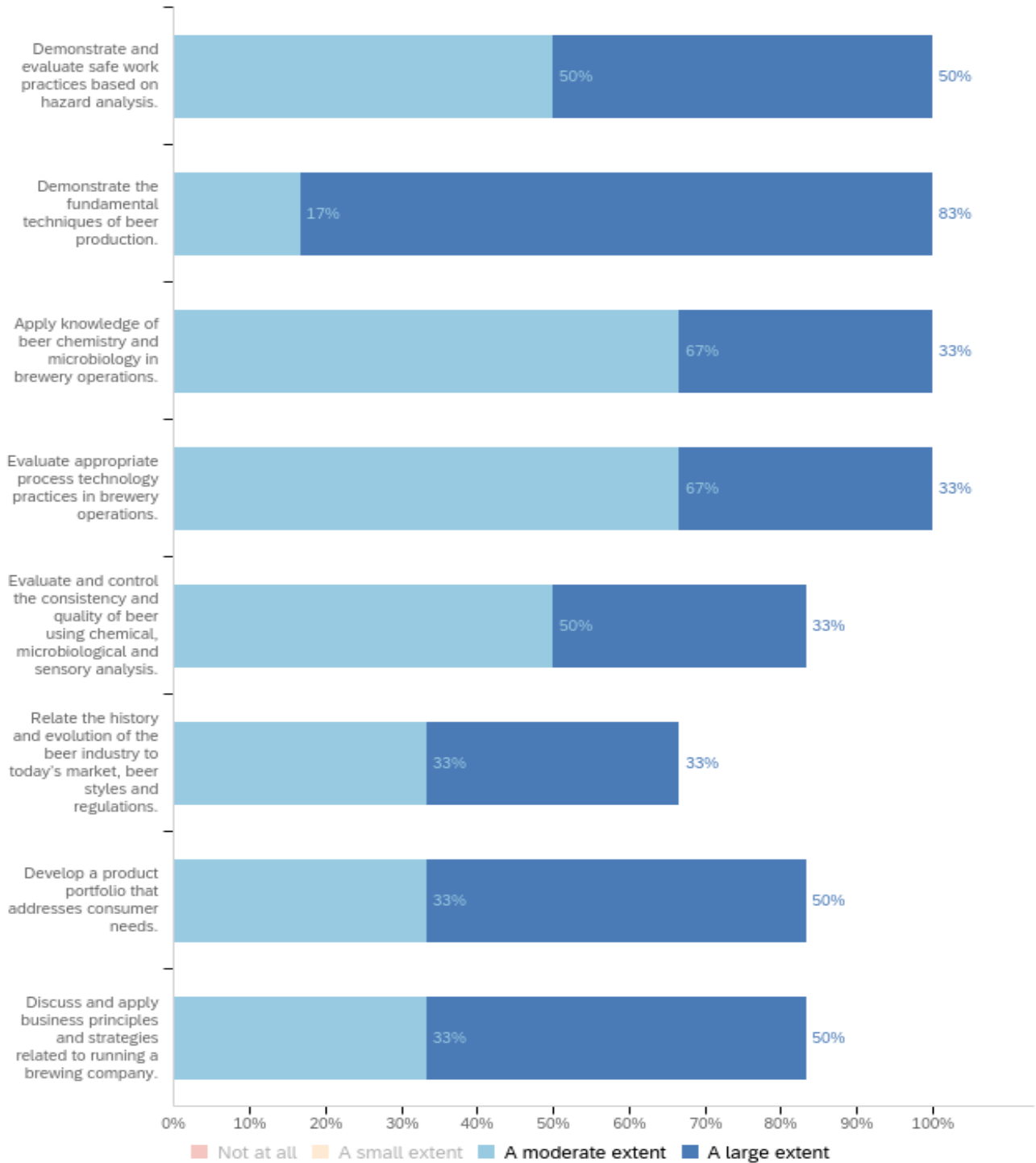
Table 15 The extent courses are helping KPU's Brewing and Brewery Operations program students develop the learning outcomes as assessed by students



Note that “not at all” and “a small extent” categories are excluded from the chart for quick comparisons between items. Please use the frequency table below for the percentages for the “not at all” and “a small extent” categories.

Source for Table 15 (Appendix I) Diploma in Brewing and Brewery Operations Program Review – Student Survey Report, June 2022

Table 16 The extent KPU’s Brewing and Brewery Operations program helps students develop Program Learning Outcomes as assessed by Faculty

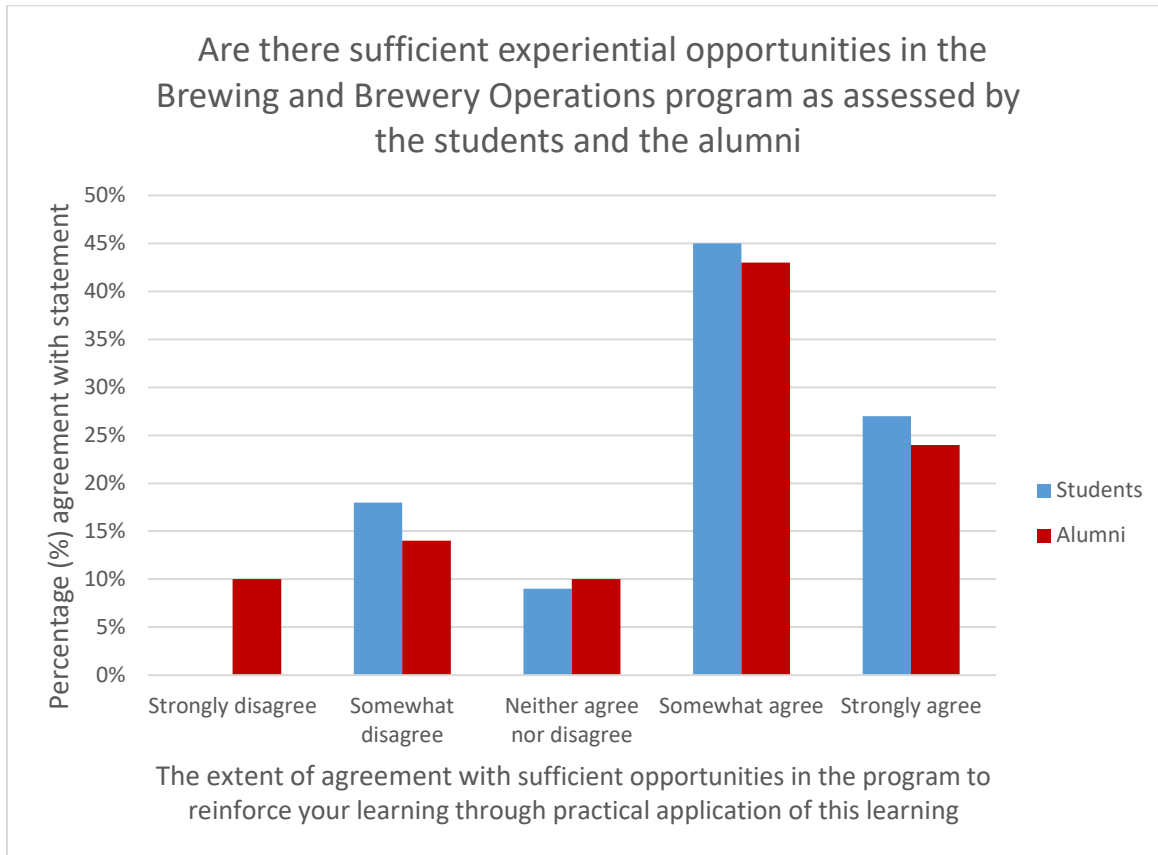


Note that “not at all” and “a small extent” categories are excluded from the chart for quick comparisons between items. Please use the frequency table below for the percentages for the “not at all” and “a small extent” categories

Source for Table 16 (Appendix J) Diploma in Brewing and Brewery Operations Program Review – Faculty Survey Report, June 2022

Are appropriate experiential learning opportunities provided to help students acquire the learning outcomes?

Figure 2 Sufficient experiential opportunities to help students acquire the learning outcomes as assessed by the students and the alumni



Sources for Figure 2 (Appendices H and I) Diploma in Brewing and Brewery Operations Program Review – Student and Alumni Survey Reports, June 2022

Having experiential learning opportunities where students develop their critical thinking skills and learn to analyse what is happening during the brewing process is key to having students deepen their knowledge of brewing. The data in Figure 2 show that, in general, there are good opportunities for the practical application of learning. Nevertheless, the data as well as some of the feedback collected in the surveys provided by OPA indicate that students would appreciate more time in the practical setting of the KPU brewery. Students would also like more field trips. It is also noted in the faculty feedback that more opportunities exist to strengthen the link between what is taught in the lecture classes with what is happening in the KPU brewery.

Quotes from student surveys:

“More hands-on instruction in the brewery” (Appendix I, page 103)

“Increase the practical component (more brew days, field trips etc.)” (Appendix I, p 94)

“More time brewing on the NSI, more QA/QC work in regard to micro” (Appendix I, p 94)

“Beer style analysis in greater detail, more info on ingredients and recipe formation, especially in terms of flavours.” (Appendix I, p 95)

Quotes from alumni surveys:

“More hands-on opportunities.” (Appendix H, p 83)

“More practical labs. Labs with more purpose to them, like the one testing the differences between different methods of rinsing bottles (ex. PA vs. water vs. treated water).” (Appendix H, p 83)

Quotes from faculty surveys:

“We need the equipment and staff time to demonstrate best industry/brewing practice in our brewery. Students notice that we teach one thing and then do another in the brewery because we do not have the equipment or the staff resources to do what should be done in any well managed brewery. It sends the wrong message to the world.” (Appendix J, p 121)

“More practical labs and access to chemical/microbiological analysis.” (Appendix J, p 114)

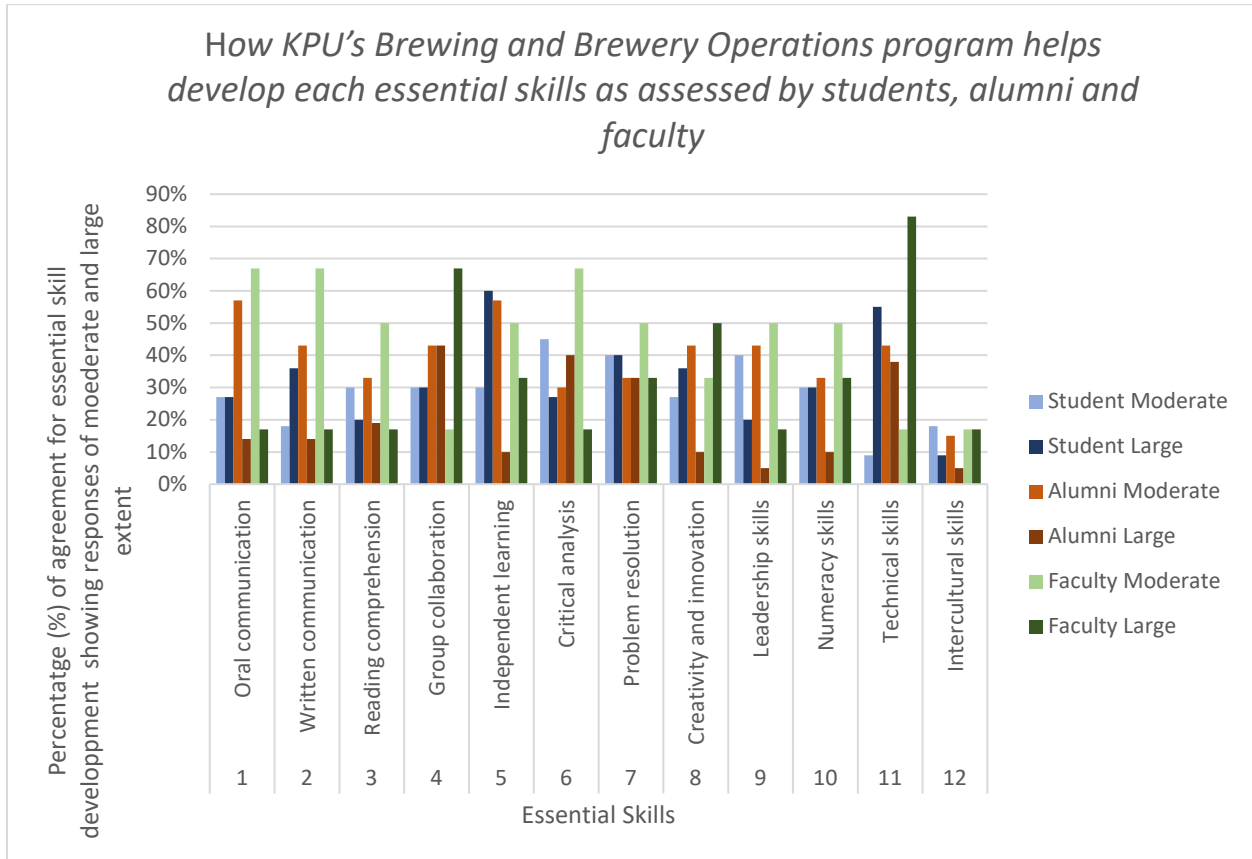
The KPU Brewing program has good access to the KPU Brewery. However, challenges exist when it comes to providing more time in the brewery and the chemistry or microbiology laboratories on the Langley campus. The Brewing Program currently schedules 8-hour practical brewing labs on Tuesdays and Wednesdays and two, 4-hour packaging labs on Thursdays. On top of that there are 6 hours of chemistry or microbiology labs running every week. The current staff is working at capacity to teach the practical components of the program. In addition, to model brewing best practice the KPU brewery should do on top of this, full chemical, and microbiological analysis on each batch of beer. However, the chemistry and microbiology labs on the Langley campus are also used by other programs thus limiting availability. Having the chemistry and microbiology labs physically separate from the brewery adds to the challenge of offering more chemistry and microbiology analysis. This requires a member of the staff or faculty to leave the brewery to supervise the student’s performing the chemistry/microbiology testing while other students are still present in the brewery. Due to staff availability, this is sometimes not possible or feasible. So far, colleagues in FSH have been very accommodating and have allowed brewing students to use laboratory space when other courses are running. This is not an ideal scenario as this causes a disruption to the other students and instructors using the laboratory space.

Recommendations:

- Changes in the schedule would be required to offer more time in practical laboratories.
- More staffing would be required to increase laboratory time.
- Having a dedicated laboratory space inside of the brewing facility (separate from the food production floor), for chemical and microbiological analysis of beer would allow the supervision of more practical activities under the same roof. One possible option would be to convert the current office space in the brewery to a laboratory facility. Another possibility would be to renovate one of the two current washrooms into a small lab space, if possible.

Are appropriate opportunities provided to help students acquire the essential skills?

Figure 3 How KPU’s Brewing and Brewery Operations program helps develop each essential skills as assessed by students, alumni and faculty



Sources for Figure 3 - (Appendices H, I and J) Diploma in Brewing and Brewery Operations Program Review – Student, Alumni and Faculty Survey Reports, June 2022

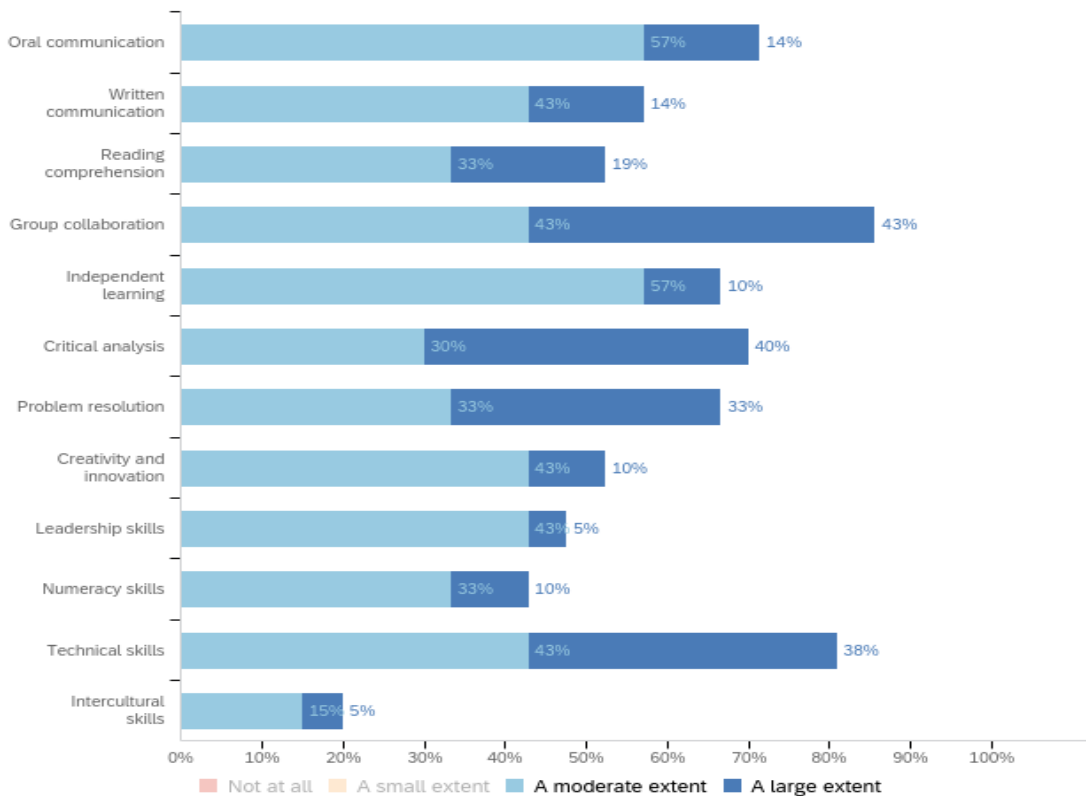
The data in Figure 3 indicates that there are generally good opportunities for students to develop essential skills during the program and that the faculty assessments are generally more favorable than the students or alumni responses. However, intercultural skills are underdeveloped or underrepresented in the curriculum. The diploma program is very focused on beer production and as such does not have many opportunities for students to discuss intercultural perspectives.

Table 17: KPU Brewing and Brewery Operations Program Student Outcomes Essential Skills Data Compared with Ministry Targets

Measures	Student Outcome Data for KPU Brewing and Brewery Operations Program (2018-20)	Ministry Target
<i>Respondents</i>	29	
Skill Development	86%	≥ 85%
<i>Write Clearly and Concisely</i>	68%	≥ 85%
<i>Speak Effectively</i>	83%	≥ 85%
<i>Read and Comprehend Materials</i>	100%	≥ 85%
<i>Work Effectively with Others</i>	89%	≥ 85%
<i>Analyze and Think Critically</i>	93%	≥ 85%
<i>Resolve Issues or Problems</i>	93%	≥ 85%
<i>Learn on your Own</i>	79%	≥ 85%

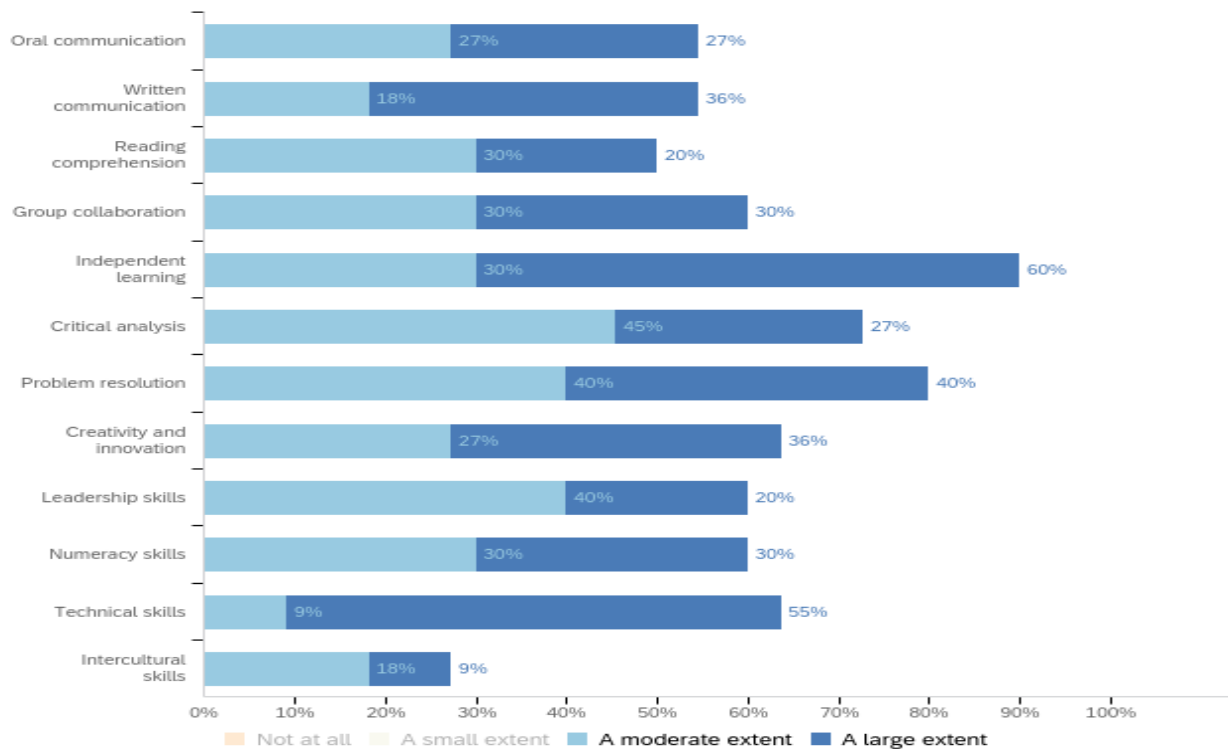
Source for Table 17 (Appendix F) Administrative Data Report for Diploma in Brewing and Brewery Operations Program, June 2022

Table 18 Alumni Survey on how KPU's Brewing and Brewery Operations program helped develop each essential skills



Source for Table 18 (Appendix H) Diploma in Brewing and Brewery Operations Alumni Survey Report, June, 2022,

Table 19 Student Survey on how KPU's Brewing and Brewery Operations program helped develop each essential skills



Source for Table 19 (Appendix I) Diploma in Brewing and Brewery Operations Student Survey Report, June 2022

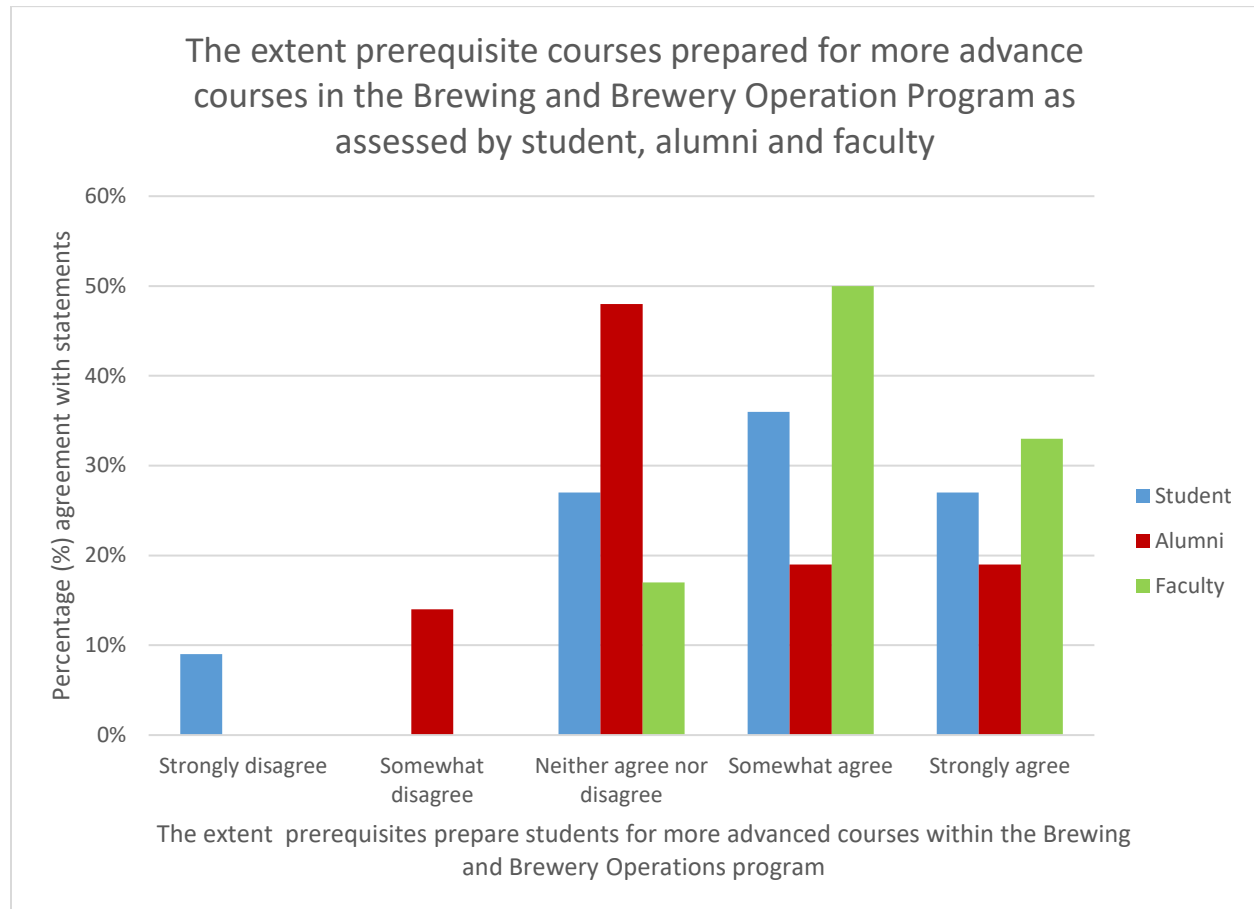
The results from Table 17, Table 18 and Table 19 above indicate that improvements could be made in regard to: writing clearly and concisely, speaking effectively, learning on your own, citizenship and global perspective, and intercultural skills.

Recommendations:

- Have current writing assignments focused on writing clearly and concisely and encourage the students to take writing skills workshops offered by KPU to improve their writing skills.
- Continue to provide opportunities for students to practice their speaking skills
- More projects where students must learn and synthesize material on their own
- Create more opportunities within the HOPS courses to increase students' awareness of global perspectives and individual differences
- Foster more discussions on how alcohol is used and viewed in different parts of the globe
- Promote inclusion, respect, and trusting relationships between students of multicultural backgrounds

Does the program design ensure students are prepared for subsequent courses?

Figure 4 The extent prerequisite courses prepared for more advance courses in the Brewing and Brewery Operation Program as assessed by student, alumni, and faculty



Sources for Figure 4 (Appendices H, I and J) Diploma in Brewing and Brewery Operations Student, Alumni and Faculty Survey Reports, June 2022

The data in Figure 4 shows that not all the students feel that the prerequisite courses prepared them well for subsequent courses. Perhaps, the faculty need to be more explicit or need to design more assignments that build on the competencies that the students have learned in previous HOPS courses. Higher awareness of the materials each instructor is teaching could also avoid repetition or voids.

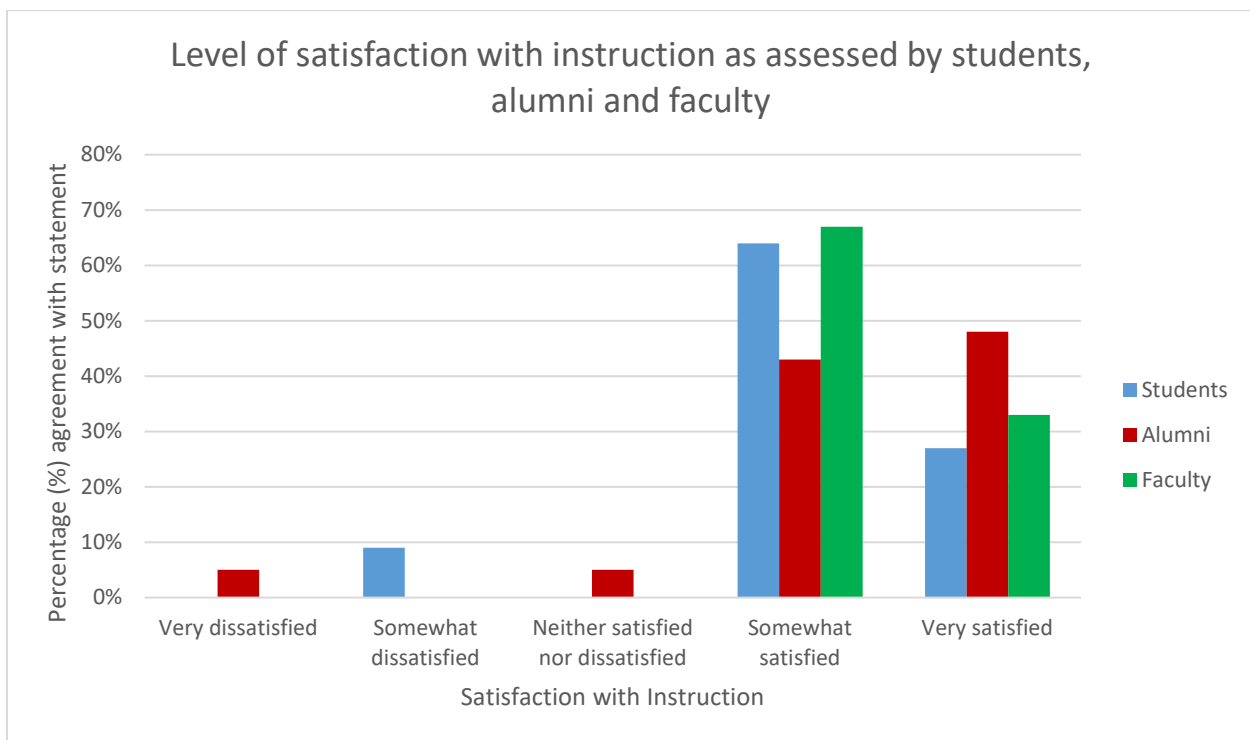
Does instruction meet the needs of diverse learners?

The students and the faculty indicate that people are generally satisfied with the quality of education they received at KPU. See Figure 5 and Figure 6 below. The instructors do make accommodations to help diverse learners succeed.

Since KPU is a teaching focused Polytechnic University the importance of instructional delivery that can captivate and engage the learners is paramount. It is crucial that KPU continues to provide faculty and staff with professional development training around good andragogy. It is vital for all instructors at KPU to stay current with best teaching practices.

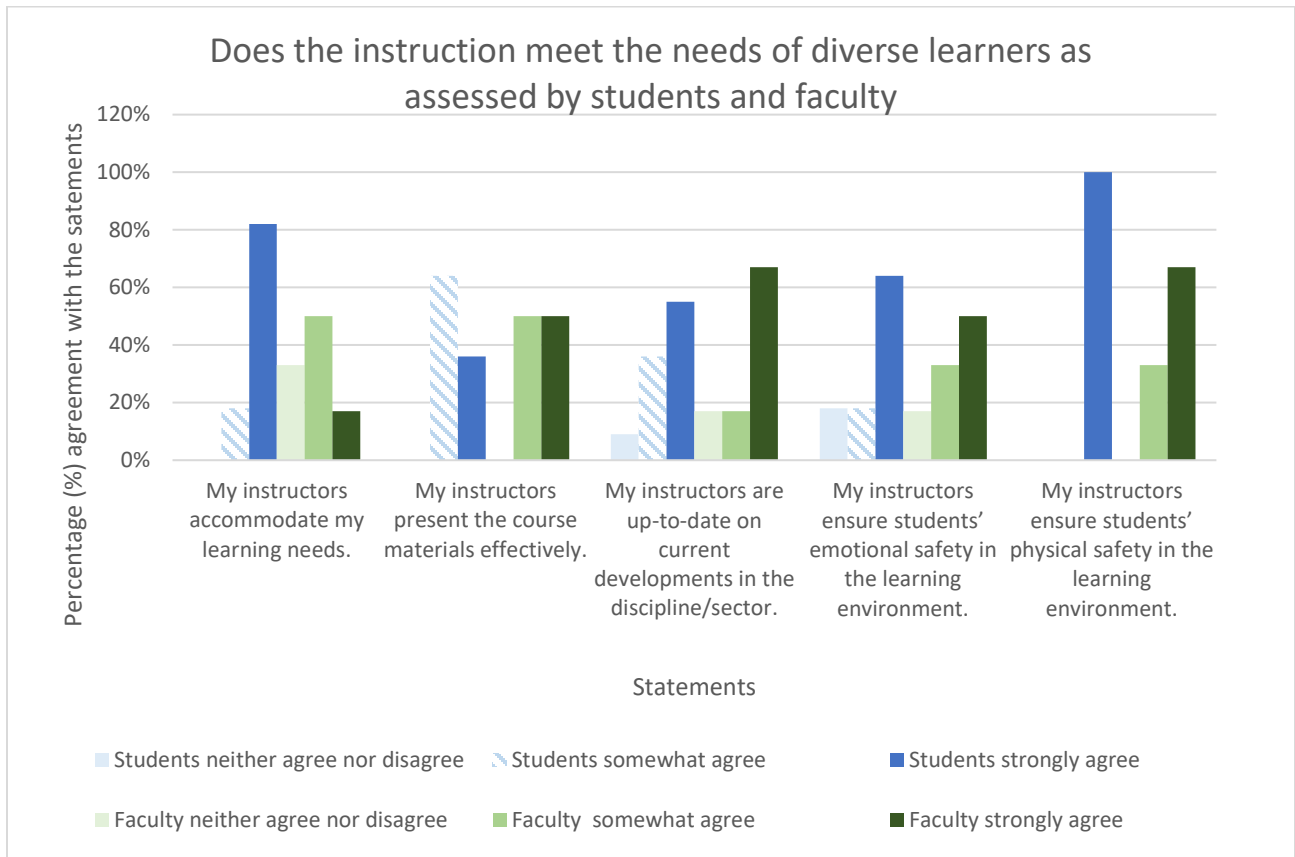
“Some instructors, despite having industry experience, had some opportunity for growth in their instruction. If this is not already the case, perhaps it can be mandatory for instructors to pursue some kind of Professional Development around adult learning?” Alumni quote (Appendix H, p 83)

Figure 5 Level of satisfaction with instruction as assessed by students, alumni, and faculty



Sources for Figure 5 (Appendices H, I and J) Diploma in Brewing and Brewery Operations Student, Alumni and Faculty Survey Reports, June 2022

Figure 6 Does the instruction meet the needs of diverse learners as assessed by students and faculty



Sources for Figure 6 - (Appendices I and J) Diploma in Brewing and Brewery Operations Student and Faculty Survey Reports, June 2022

Do the assessment methods allow students to demonstrate to what extent they have achieved the learning outcomes?

Students and alumni generally agree that the assessments within the program allowed them to demonstrate their knowledge. On average 86% of the students and 83% of the alumni responded that they were somewhat or strongly in agreement with the various assessment methods (See Table 20, Table 21, and Table 22 below for the data). About 20% of the students and 10% of the alumni that responded indicated that improvements could be made to improve the consistency of the assessment throughout the program. One way to improve consistency of assessments is by having regular meetings where instructors discuss and work to align assessment methods with learning objectives.

Table 20 How learning is assessed in the program as a whole, as assessed by students

#	Question	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
1	I receive clear information on how I will be evaluated.	0%	0%	9%	55%	36%	11
2	The range of assessments lets me demonstrate what I have learned.	0%	0%	18%	55%	27%	11
3	The assessment standards are consistent throughout the program.	0%	20%	0%	30%	50%	10
4	My instructors provide useful feedback.	0%	9%	0%	45%	45%	11

Source for Table 20 (Appendix I) Diploma in Brewing and Brewery Operations Student Survey report, June 2022

Table 21 How learning is assessed in the program as a whole, as assessed by alumni

#	Question	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
1	I received clear information on how I would be evaluated.	5%	0%	14%	19%	62%	21
2	The range of assessments let me demonstrate what I had learned.	0%	5%	10%	48%	38%	21
3	The assessment standards were consistent throughout the program.	5%	5%	15%	45%	30%	20
4	My instructors provided useful feedback.	5%	0%	5%	40%	50%	20

Source for Table 21 (Appendix H) Diploma in Brewing and Brewery Operations Alumni Survey report, June 2022

Table 22 How learning is assessed in the program as a whole, as assessed by faculty

#	Question	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
1	Assessment methods align with program learning outcomes.	0%	0%	17%	50%	33%	6
2	The range of assessments let students demonstrate what they have learned.	0%	0%	17%	33%	50%	6
3	Students are provided clear information on how they will be evaluated.	0%	0%	0%	17%	83%	6
4	The assessment standards are consistent throughout the program.	0%	0%	0%	67%	33%	6

Source for Table 22 (Appendix J) Diploma in Brewing and Brewery Operations Faculty Survey report, June 2022

Recommendation:

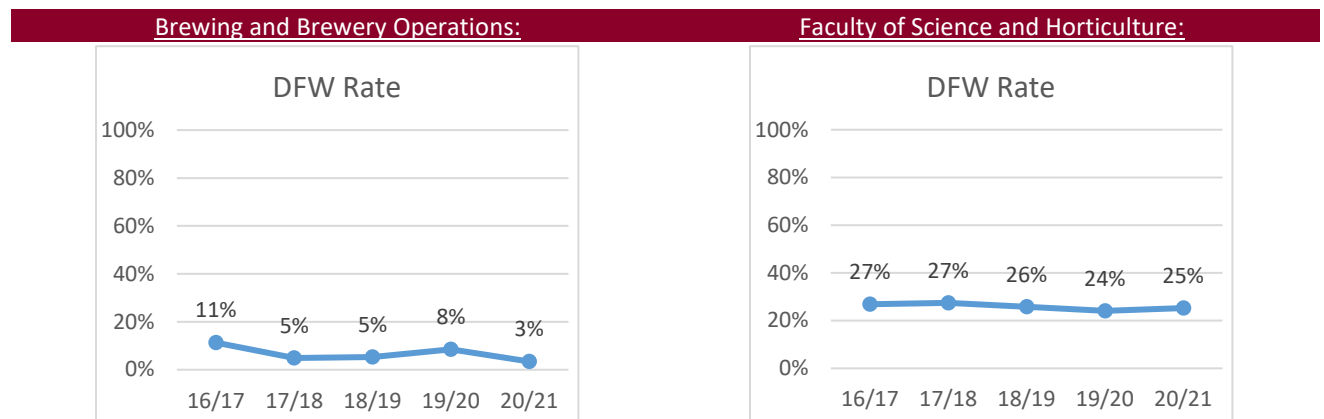
- Regular meetings to discuss and align assessments and supports for students.

4.2. Student Success

Are students performing satisfactorily in courses?

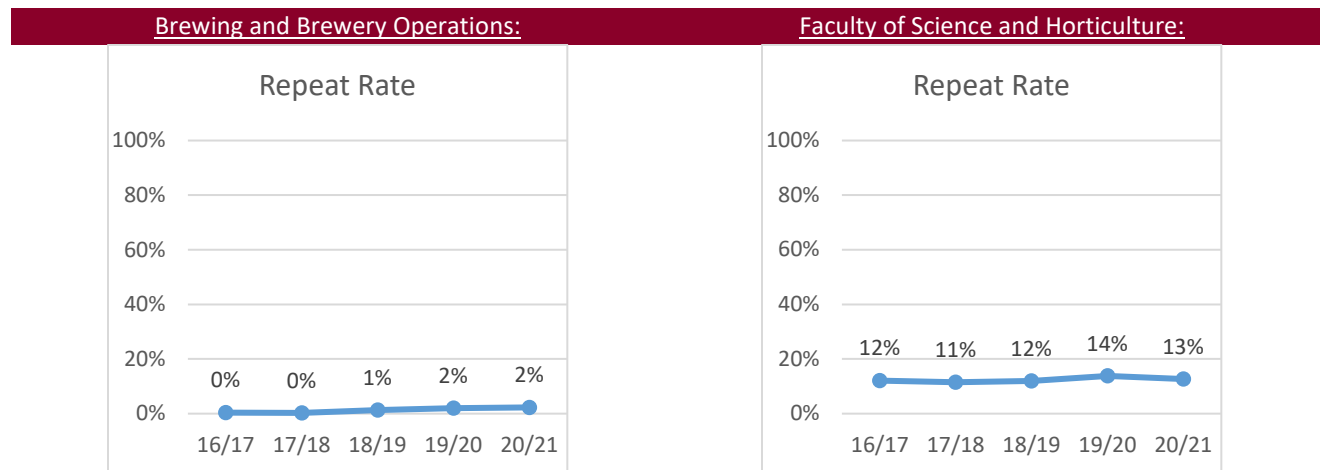
The data provided by the OPA administrative report (Appendix F) indicates that the Brewing and Brewery Operations program has a lower percentage of students who received a grade of D or F or withdrew from the course (DWF) rate (between 11% to 3%) and a lower repeat rate (between 1% to 2%) than the rest of FSH (See Table 23 and Table 24 below). The grade point means between 3.11 and 3.49 also indicate that the grades in the BBO program tend to be higher than rest of FSH. Students are highly motivated to learn and succeed in this field and as a limited intake cohort program, there is good student camaraderie, which contribute to student performance and success in the program.

Table 23 DFW Rates in Brewing and Brewery Operations Undergraduate Level Courses by Academic Year Compared with Faculty of Science and Horticulture



Source for Table 23 (Appendix F) Administrative Data Report for Diploma in Brewing and Brewery Operations Program, June, 2022

Table 24: Repeat Rates in Brewing and Brewery Operations Undergraduate Level Courses by Academic Year Compared with Faculty of Science and Horticulture



Source of Table 24 (Appendix F) Administrative Data Report for Diploma in Brewing and Brewery Operations Program, June, 2022

Are students making satisfactory progress in the program?

Students are generally making good progress in the program, the data in Table 25 does indicate that not all students are graduating from the program. This was especially true in the first three years of the program where many students would find jobs after the first year and simply not return to complete the diploma. The Brewing and Brewery Operations program has seen the amount of attrition between first and second year drop over the last few years and it is believed this is in part due to the improvements that have been brought to the program and that students see the relevance of coming back to complete the diploma program. It is also possible that with the increased competition in the job market students and employers are recognizing the value of completing the diploma program. Observations from instructors in the program note that students are progressing with their cohort in the HOPS courses. However many students opt to take the elective courses outside of the fall and spring schedule and this is likely contributing to delays for students meeting all the graduation requirements. The graduation numbers underrepresent the number of students in the cohort. It is recommended that instructors remind the students of the requirements needed to graduate at the start of the Fall and Spring semesters.

Challenges also exist for students that do not meet the minimum grade to progress in classes that have prerequisites. Students often need to wait a year or more to retake courses if they got below 60% the first time around.

Table 25 Brewing and Brewery Operations Program Graduate Headcount² by Credential and Academic Year

	2016/17	2017/18	2018/19	2019/20	2020/21
Total ³	6	14	21	17	13
Diploma	6	14	21	17	13

Source for Table 25 (Appendix F) Administrative Data Report for Diploma in Brewing and Brewery Operations Program, June 2022

Summary and Recommendations:

- Attrition rates have been lowered with improved program delivery.
- Monitor the graduation rates and remind the students of the graduation requirements.

Are graduates of the program successful?

The data provided by the administrative report (Appendix F) indicates that the alumni and students from the Brewing and Brewery Operations program have good employment rates with 92% of the respondents indicating that they are employed in the field related to their studies. The success of the graduates is also highlighted by the jobs they hold: we have one alumnus that opened their brewery (Mountain View in Hope), we have alumni working as managers of brewery operations, head brewers, assistant brewers, packaging operators, quality managers, quality assurance specialist, brewing laboratory instructors at KPU, and sales representatives within the industry.

² Count of unique students who have earned a KPU credential. Breakdown values may not add up to total or 100% because a student can earn multiple credentials in different categories within the same academic year.

³ To avoid double counting students, total graduate headcounts presented in Exhibits 18 and 19 are unique headcounts of students for the year, not the sum of the credential counts.

Table 26 KPU Brewing and Brewery Operations Program Student Outcomes Data Compared with Ministry Targets (Appendix F)

Measures	Average Student Outcome Data for KPU Brewing and Brewery Operations Program (2018-20)	Ministry Target
<i>Respondents</i> ⁴	29	
Unemployment Rate ⁵	0%	≤ 7.5%
Currently Employed ⁶	96%	
In a Related Job ⁷	92%	
Further Studies ⁸	10%	

⁴ Results for groups of less than 5 graduates are not reported.

⁵ Unemployment rate of KPU's graduates (of those in the labour market).

⁶ Respondents who were working at a job or business at the time of the survey, as a percentage of all respondents, regardless of whether they were in the labour force (see above).

⁷ Respondents who are currently employed in occupations that they describe as "very" or "somewhat" related to their studies, as a percentage of all employed respondents.

⁸ Respondents who have taken further studies after taking the program, including those currently studying.

5. Resources, Services, and Facilities

Does the program have the library and learning resources needed to deliver the curriculum?

In general, the feedback from students and faculty seems to indicate that the library has the necessary resources to deliver the curriculum. With continued investments in e-Books and up to date publications the authors of the report do not see or anticipate any significant deficiencies. See Appendices I and J.

Does the program have the specialized technology needed to deliver the curriculum?

In general, the feedback from students and faculty seems to indicate that the Brewing and Brewery Operations program currently has the necessary specialized equipment to deliver the curriculum.

Capital investments will be required if KPU wants to promote its state-of-the-art brewery. Investments would also be required to improve or increase its course offerings. For example, reverse osmosis and pasteurizing equipment is needed to make non-alcoholic beer.

The recent collaboration with colleagues at the KPU Applied Genomic Centre (AGC) has also been very beneficial. The Brewing and Brewery Operations program is now able to get better quantitative data on the beer that is being produced. The data that is collected with the specialized analytical instrumentation of the AGC - such as the High-Performance Liquid Chromatography (HPLC), and the gas chromatograph (GC) - is instrumental in teaching the science of brewing. The quantitative data provided by the AGC has allowed students to better understand how good quantitative data can be used to improve the brewing processes. The data gathered also makes the information from textbooks more relevant as students can get data on specific flavour compounds that are discussed throughout the HOPS courses.

Recommendation:

- Collaboration with other departments within KPU maximizes available equipment, instrumentation, and expertise.

Does the program have the facilities needed to deliver the curriculum?

The Brewing and Brewery Operations program has a good brewing facility. One of the biggest concerns is storage. The brewery is currently over capacity in terms of storage of equipment and supplies. Things that have contributed to this are: recent electrical upgrades which have taken a significant amount of wall space, upgrading to a canning line which requires storage of empty cans, and the increasing presence in marketing events that comes with increasing promotional materials.

As the facility ages, KPU will need to continue to make investments in maintenance and upkeep of the building and equipment. The current chiller that is used to keep the fermentation vessels cold is not able to keep temperatures consistent during the summer months. This lack of good process control has negative implications if the KPU Brewing Department wishes to produce good quality beer or participate in research or industry projects.

As previously mentioned in section 4.1 of this report, opportunities exist to improve access to chemistry and microbiology laboratories to allow the students to do real time analysis of the beer that is being produced. The Brewing Department is teaching the importance of making decisions based on data. However, students are often only able to collect a limited amount of data as there is a lack of availability and space to access the chemistry and microbiology laboratories on campus. Creating a dedicated lab space within the facility (outside

of the food production floor) would make possible the data collection needed to follow the industry's best practices in quality control and assurance. These are the standards we teach in the classroom and want to see in the brewery.

Recommendations:

- Have dedicated laboratory space for chemical and microbiology analysis of production
- Have dedicated space for storage of cans and promotional material
- Have the appropriate chiller installed that meets capacity year around

Does the program have the other support services needed to deliver the curriculum?

The Brewing Program generally has the support services needed to deliver the curriculum. About 27% percent of the students reported dissatisfaction with textbook availability at the KPU bookstore. It is possible that the disruptions with COVID-19 contribute to this score. (Appendix I)

In the past the Learning Centre has also hired second-year students to work as tutors for the first-year students. This can be very beneficial for both parties and is something the Learning Centre can assist us with every year if second-year students are interested.

6. Conclusions and Recommendations

6.1. Summary of Program's strengths, weaknesses, opportunities, and challenges

Strengths of the Brewing and Brewery Operations Program:

- Instructors are passionate, have a broad range of knowledge and a wealth of industry experience
- Program graduates are successful within the brewing industry
- Awards and accolades received by the program help drive media attention (and enrolment inquiries) to KPU

Weaknesses:

- Lack of facility space for standard brewery quality control activities
- There is insufficient storage space in the brewery for materials and equipment
- Equipment and people resources are required to develop new offerings such as non-alcoholic beer, distilling, ready to drink (RTDs), cider, kombucha or wine
- Need people resources for good management and good brewery manufacturing practices

Opportunities:

- Including information about other fermented or non-fermented beverages into the curriculum
- Develop a course on brewery maintenance or integrate more brewery maintenance items in the curriculum
- Including more information on non-alcoholic beer production
- Teach and model more environmentally sustainable practices in the KPU brewery
- Collaborating within KPU and with external partners

Challenges and Threats:

There has been an increase in Brewing Education programs in North America. To remain competitive KPU needs to continue to invest in people and equipment to stay current and relevant. Below are the challenges that the program faces as well as the number of competing institutions:

- Global interest/demand for the beer sector declines in the foreseeable future
- At least ten universities in the United States are offering degree programs in fermentation science
- Three universities or colleges in Canada are offering diploma programs in brewing (including KPU)
- At least eight colleges in the United States are offering diploma programs in brewing
- Three universities or colleges in Canada are offering certificate programs in brewing

- At least twenty-four universities, colleges or institutes in the United States are offering certificate programs in brewing

Please see **Appendix L** for the full list of other programs.

6.2. Recommendations

The program review process has led to the following recommendations:

Curriculum Review

1. The wording of the following CLOs could be changed to better reflect current program delivery
 HOPS 2305: Select quality control measurements (student learning and choices are limited by equipment and lab availability)
 HOPS 2314: Explain the importance of proper beer service (done mostly in HOPS 2310: Beer Judging)
 HOPS 2405: Create health and safety procedures for a brewery
 HOPS 2405: Order and propagate yeast for a signature beer
 HOPS 2405: Organize a tasting panel for the evaluation of a beer (done mostly in HOPS 2310: Beer Judging)
 Investigate how indigenization can be integrated into the curriculum

Program Relevance and Student Demand

1. The KPU Brewing and Brewery Operations Program must strive to deliver a learning environment where the students are given an opportunity to apply the knowledge gained in lecture courses in the experiential context of the KPU brewery.
2. Alumni, students, and discipline sector representative all indicate that more practical skill development in the brewery and laboratories would be beneficial.
3. The feedback from industry and students also indicates that some information about other fermented beverages would be useful.
4. The feedback from the industry also indicates the importance for students to understand the economics, sustainability, and the environmental impacts of brewing.
5. It is recommended that the brewing department looks at how the current HOPS courses are delivered and see if there are opportunities to increase the practical skills that the students are acquiring.
6. The brewing department should investigate the feasibility of teaching more about brewery maintenance and determine if a course on brewery maintenance could be added to the curriculum.
7. Curriculum review should investigate if the elective courses are benefiting the students and the program. Would it be beneficial to remove one of the elective courses for a course on brewery maintenance or should a course on brewery maintenance be offered as a continuing and professional studies (CPS) offering.
8. KPU Brewing and Brewery Operations program should continue to be involved in collaborations that benefit the students and the brewing industry

9. Have opportunities for alumni to brew at KPU, this would allow them to stay connected to the KPU BBO program, and provide them with additional networking opportunities
10. Host class reunions.
11. Encourage people with a diverse background to apply for the program
12. Highlight the awards that are available to people from a diverse background to help reduce the financial barriers
13. Remove the portfolio requirement from the application process
14. Allow enrolment until the start of classes

Effectiveness of Instructional Delivery

1. Articulate from the beginning of the program how the course material in multiple HOPS courses is relevant to portfolio/ product development, recipe design and the regulatory requirements
2. Changes in the schedule would be required to offer more time in practical laboratories
3. More staffing would be required to increase laboratory time
4. Having a dedicated laboratory space inside of the brewing facility (separate from the food production floor), for chemical and microbiological analysis of beer would allow the supervision of more practical activities under the same roof. One possible option would be to convert the current office space in the brewery to a laboratory facility. Another possibility would be to renovate one of the two current washrooms into a small lab space, if possible.
5. Have current writing assignments focused on writing clearly and concisely. Encourage the students to take writing skills workshops offered by KPU to improve their writing skills.
6. Continue to provide opportunities for students to practice their speaking skills
7. More projects where students must learn and synthesize material on their own
8. Create more opportunities within the HOPS courses to increase students' awareness of global perspectives and individual differences
9. Foster more discussions on how alcohol is used and viewed in different parts of the globe
10. Promote inclusion, respect, and trusting relationships between students of multicultural backgrounds
11. Regular meetings to discuss and align assessments and supports for students
12. Monitor the graduation rates and remind the students of the graduation requirements

Resources, Services and Facilities

1. Faculty and staff resources are needed to deliver the education program
2. Staff resources are needed to operate the KPU Brewery

3. Additional people and equipment resources will be required for new program offerings
4. Having a dedicated laboratory space separate from the food safe brewing facility for chemical and microbiological analysis of beer are required to meet the program needs
5. Collaboration with other departments within KPU maximizes available equipment, instrumentation, and expertise
6. Have dedicated space for storage of cans and promotional material
7. Have the appropriate chiller installed that meets capacity year around

In conclusion, the program review has found that:

1. The learning outcomes for the Brewing and Brewery Operations program are still relevant to the industry.
2. The training provided by Brewing and Brewery Operations program generally meets the needs of the students and the employers. However, more experiential learning opportunities would be an asset.
3. The Brewing and Brewery Operations program curriculum should be refined: to strengthen the link between the classes, to include more material on brewery maintenance, to model best practice in the KPU brewery, and teaching about other beverages should be investigated.

7. Appendices

Appendices are provided in a separate document.