KPU | KWANTLEN POLYTECHNIC UNIVERSITY

Physics for Modern Technology Program Review
Self-Study Report

APPENDICES

Table of Contents:

Appendix A: Course Requirements for BSc Major in Physics for Modern Technology

Year 1		Credits
BIOL 1110	Introductory Biology I	4
CHEM 1110	The Structure of Matter	4
CHEM 1210	Chemical Energetics and Dynamics	4
ENGL 1100	Introduction to University Writing	3
PHYS 1600	Introduction to Modern Technology	3
MATH 1120 or MATH 1130	Differential Calculus (recommended) or Calculus for Life Sciences I	3
MATH 1220 or MATH 1230	Integral Calculus or Calculus for Life Sciences II	3
Select one of the following:		4
PHYS 1101	Physics for Life Sciences I	
PHYS 1120	Physics for Physical and Applied Sciences I (recommended)	
Select one of the following:		4
PHYS 1102	Physics for Life Sciences II	
PHYS 1220	Physics for Physical and Applied Sciences II (recommended)	
One Breadth Elective		3
	Credits	**35**

Year 2		
MATH 2721	Complex Numbers and Linear Algebra	3
MATH 2821	Multivariate and Vector Calculus	3
PHYS 2010	Modern Physics	3
PHYS 2030	Classical Mechanics	3
PHYS 2040	Thermal Physics	3
PHYS 2100	Experimental Physics	3
PHYS 2420	Intermediate Electricity and Magnetism	3
PHYS 2600	Electronics	3
PHYS 2610	Sensors and Actuators	3
One Breadth Elective		3
	Credits	**30**

Year 3		
CHEM 2315	Analytical Chemistry	4
PHYS 3610	Introduction to Control	3
PHYS 3620	Process Control	3
PHYS 3700	Signal and Image Processing	3
PHYS 3710	Applied Optics & Optoelectronics	3
PHYS 3900	Project in Physics & Technology	3
PHYS 3950	Work Experience - Part I	3

PHYS 3951	Work Experience - Part II	3
PHYS 4900	Special Topics	3
One Business Elective		3

Year 3 includes work experience. Several courses in the Spring semester are taken in compressed mode, January to March, in order to make a longer period available for work placement.

	Credits	**31**
Year 4		
CHEM 4610	Instrumental Analysis	4
PHYS 4010	Quantum Mechanics	3
PHYS 4199	Senior Project I	3
PHYS 4299	Senior Project II	3
PHYS 4600	Programming for Instrumentation	3
PHYS 4700	Solid State Physics: Theory and Practice	3
Three Breadth Electives		9
One Business Elective		3
	Credits	**31**
	Total Credits	**127**

<u>Electives</u>
As part of the major program, students are required to complete 21 credits of electives, including 6 credits of Business Electives. These electives must satisfy the General Requirements for 18 credits of breadth as stated above.

<u>Breadth Electives</u>
Breadth electives must be selected from subject areas outside of Physics. No more than six of these credits may be from the Faculty of Science & Horticulture.

<u>Business Electives</u>
At least six credits (two courses) must be selected in consultation with Physics faculty to meet Business Elective requirements. Courses must be selected from:

- Accounting (ACCT) – any course other than ACCT 1130
- Business & Quantitative Methods (BUQU) – any course other than BUQU 1130 or BUQU 1230
- Business (BUSI) – any course other than BUSI 1204 or BUSI 1209
- Economics (ECON) – any course
- Marketing (MRKT) – any course

Upon successful completion of the PMT program, students are eligible to receive a Bachelor of Science. Transcripts will indicate a Major in Physics for Modern Technology.

Appendix B

BSc Framework

General Framework for a Bachelor of Science (B.Sc.) at Kwantlen Polytechnic University

This version of the B.Sc. framework passed the Science Curriculum Committee, the Science and Horticulture Faculty Council, and SSCC on 1 June 2010, 14 June 2010, and 5 January 2011, respectively.

The B.Sc. degree program is designed to provide students with a solid foundation in basic science, as well as the opportunity to specialize in their area of interest at the upper levels. It includes a component of liberal education to ensure that students are able to access a variety of future educational and employment opportunities, to participate actively in collegial discussion and to contribute constructively to the body of scientific knowledge.

The program is also designed to provide students with the following:

1) An integrated educational experience that develops critical awareness of issues of cultural and global well being particularly as they relate to the scientific knowledge base.

2) An integrated educational experience that develops problem solving and analytic skills to be used in the workplace or in further study after graduation, and also to be used in making decisions as an informed citizen.

3) An integrated educational experience that enhances skills in written and spoken English, and enables effective communication and constructive contributions to the scientific knowledge base.

Framework

All students seeking to graduate with a Bachelor of Science (B.Sc.) degree from Kwantlen Polytechnic University must complete all of the following requirements:

- A minimum of 120 credits and a minimum of 40 courses total at the post-secondary level.[1] (Note that in this document the word "course" refers to a course of at least 3 credits.) At least 45 of these credits (15 courses) must be at the 3000 or 4000 level.

- A minimum **6** credits writing requirement, including at least 3 credits from ENGL 1100 or any other designated by Senate as meeting writing-intensive guidelines.

- A minimum **3** courses (**9** credits) in MATH[2], and a minimum of **4** credits in each of BIOL, CHEM, and PHYS.[3,4]

- **3** credits of statistics[5] (which could be included in the 3 MATH courses).

- A minimum **66** science[6] credits (including at least **5** courses with a lab component[4]), with at least **30** credits of the 66 science credits at the 3000 and 4000 level. This must include at least 9 credits (minimum 3 courses) at the 4000 level.

- A minimum **18** credits breadth requirement[7], including at least 1 course at the upper level.

- A minimum of a passing grade (D or better) in all courses counting towards the B.Sc., with a cumulative GPA of 2.0 or higher.

- To meet residency expectations, at least **50%** of all courses for the B.Sc.,[8] and at least **66%** of upper level courses for the B.Sc., will be completed at Kwantlen Polytechnic University.

General Framework for a Bachelor of Science (B.Sc.) at Kwantlen Polytechnic University

APPENDIX 1

[1] Courses numbered 1099 or lower (such as CHEQ 1094 or MATQ 1093) **cannot be counted** towards a Bachelor of Science degree.

[2] At least 3 credits in MATH must be from MATH 1120, MATH 1130, or MATH 1140 (with a C+ or better).

[3] ASTR 1100, ASTR 1105, ASTR 3110, ASTR 3111, ENVI 3112, ENVI 2405, MATH 1115, MATH 1116, MATH 1117, MATH 1190, and PHYS 1112 **cannot be counted** as science credits towards a Bachelor of Science, but may be used as elective credits. CHEM 1101 **cannot** be used either as science or elective credits. BIOL 1112, CHEM 1105, MATH 1112, and PHYS 1100 **cannot be counted** as science or elective credits unless included in the degree requirements.

[4] As Mathematics is not a laboratory-based science, students pursuing a major in Math are only required to take **3** courses with a lab component from at least **2** disciplines of biology, chemistry, and physics.

[5] Specific mathematics requirements are generally prescribed in the course content for any Bachelor of Science degree. Calculus 1 may be one of MATH 1120, MATH 1130, or MATH 1140 (with a C+ or better) and Calculus 2 may be one of MATH 1220, MATH 1230, or MATH 1240 (with a B- or better). Courses with considerable content overlap may only be counted once: (MATH 1120 or 1130 or 1140), (MATH 1220 or 1230), (MATH 2335 or 2341), for example. The statistics courses must be coded “MATH” (i.e. MATH 2315 or 2335), unless they are offered at the 3000 or 4000 level, in which case a minimum of **6** MATH credits would be required. Students entering the degree who have already successfully completed an equivalent level of statistics to the one(s) prescribed in the degree may apply for course substitution.

[6] Specific biology, chemistry, mathematics and physics requirements are generally prescribed for any Bachelor of Science degree in these areas. Courses outside these fields may also qualify as science courses provided they are deemed to contain or demand sufficient quantitative reasoning (*numerical, geometric, statistical, probabilistic*), formal reasoning (*mathematical or logically deductive*) or scientific reasoning (*involving the scientific method in general, and/or the methodology or content of a specific scientific discipline*) as a base principle in their primary subject matter. These are usually prescribed in the specific degree requirements. Courses with considerable content overlap may only be counted once: For example, BIOL 1112 or BIOL 1210, ENVI 1106 or CHEM 1110, ENVI 1206 or CHEM 1154 or CHEM 1210, CHEM 3310 or CHEM 2311, PHYS 1101 or PHYS 1120, PHYS 1102 or PHYS 1220.

[7] At least **12** breadth credits **must come** from fields or courses not regarded as science courses as per the above defining criteria (see note #6) for science or mathematics. EDUC 4100 may be used as a breadth requirement. Up to **6** credits of breadth **may come** from fields of science not prescribed in the specific requirements for that Bachelor of Science degree - these may include ASTR 1100, ASTR 1105, ASTR 3110, and ASTR 3111 from Note 3 above. PHYS 1112 may also count towards the breadth requirement, but cannot count towards the physics requirement for the degree.

[8] On an individual basis, students may apply to the appropriate program chair for an exemption to these expectations; however, Kwantlen policy B.14, Credit for Prior Learning, requires that no more than 75% of credits for graduation can be obtained through transfer credit and/or prior learning assessment.

General Framework for Bachelor of Science (B.Sc.) at Kwantlen Polytechnic University

APPENDIX 2

Requirements for B.Sc. Major and B.Sc. Minor Degrees

In addition to satisfying the requirements of the General Framework, students wishing to graduate with a B.Sc. degree must also satisfy the requirements of one of the following options:

B.Sc. Major
Students wishing to complete a B.Sc. Major program must satisfy the specific requirements of that program as outlined in the institution's academic calendar.

B.Sc. Major and Minor
Students wishing to complete a B.Sc. Minor degree must complete at least 15 credits at the 3000 and/or 4000 levels in the subject area of the Minor. Please note that individual departments and programs may stipulate further, or more specific, requirements in addition to these minimum requirements.

If a student satisfies the requirements of both a B.Sc. Major program and a B.Sc. Minor, then they may graduate with both designations. Note that the Major and Minor must be in different subject areas (for example, a student cannot graduate with both a Major and Minor in biology).

B.Sc. Double Minor
Students wishing to complete a B.Sc. Minor degree must complete at least 15 credits at the 3000 and/or 4000 levels in the subject area of the Minor. Please note that individual departments and programs may stipulate further, or more specific, requirements in addition to these minimum requirements.

In order to graduate with a B.Sc. Double Minor, students must satisfy the requirements for B.Sc. Minor degrees in two different subject areas and must also complete at least one 4000 level directed studies, research, or work placement course.

Other
Students wishing to graduate with an option other than those listed above (for example, Double Major) must seek approval from all of the programs and departments involved.

Appendix C: Career Pathways Map

Graduates of the program may choose to go directly into employment, or to first pursue further study:

Employment

Areas of Work	Example Entry-Level Positions
Original Equipment Manufacturer (OEM) Data Science Software Particle Accelerator Development Mining Technology Robotics Green Energy Technology Government Lab	Technical Advisor Product Specialist Service Engineer Junior Data Scientist Software Developer Hardware Systems Technician Engineering Technologist / Cyclotron Operator Electromechanical Technician Assembler

Further Study

Program	Possible Outcomes
MSc / PhD (entry may require completion of upgrading courses at receiving institution)	Advanced technical role in high technology sector Research and development in high technology sector Postdoctoral researcher College or University professor
Teacher training	High school science / math teacher
MBA (normally undertaken after a period of postgraduate employment)	Management role in high technology sector

Appendix D

Curriculum Map

In the curriculum map on the following pages, learning outcomes from courses in the PMT program were mapped onto the following Program Learning Outcomes:

A student who successfully completes this program will have reliably demonstrated the ability to:

1. analyze and solve theoretical and practical problems using learned fundamentals and applied Physics knowledge and concepts;
2. analyze and solve theoretical and practical problems using learned fundamentals and applied Mathematics knowledge and techniques;
3. apply learned fundamentals and applied Chemistry knowledge, including laboratory skills and techniques, to solve theoretical and practical problems;
4. understand and gain an appreciation for concepts of Biology as they relate to physics and technology;
5. apply the conventions and best practices of written and oral communication to effectively convey and discuss thoughts and ideas;
6. appreciate the business aspects of the technology sector and technology development;
7. choose, assemble (soldering, connecting, powering, and interfacing components), and operate laboratory equipment to perform experiments and collect data;
8. design laboratory experiments to investigate and/or validate hypotheses by utilizing the conventions and best practices of experimental research;
9. formulate or validate theoretical and/or numerical models by visualizing, analyzing, and evaluating data;
10. use, adapt, and develop software to: interface with equipment; collect, visualize and analyze data; perform numerical analysis; and model physical systems;
11. work cooperatively and effectively with peers and supervisors;
12. recognize the limits of their own knowledge and skills, identify appropriate avenues for new learning, and pursue new knowledge and skills independently;
13. develop solutions to problems by integrating facets of science, mathematics, technology, business, experience, practical skills, and communication skills.

PROGRAM COURSES WITH COURSE LEARNING OUTCOMES	PROGRAM LEARNING OUTCOMES												
	PLO#1	PLO#2	PLO#3	PLO#4	PLO#5	PLO#6	PLO#7	PLO#8	PLO#9	PLO#10	PLO#11	PLO#12	PLO#13
	Physics Knowledge	Math Knowledge	Chemistry Knowledge	Biology Knowledge	Comm skills	Business	Lab techniques and practical skills	Experimental design skills	Using data to formulate or validate models	Sofware & computer programming	Cooperation and teamwork attitudes	Limits of knowledge & independent learning	Integration of knowledge & skills
For each CLO, the PLO(s) it satisfies are indicated, and at which level. The three levels are:													
Introduced [I]: Course learning outcomes that concentrate on knowledge or skills related to the program outcomes at a basic level or skills at an entry-level of complexity.													
Developing [D]: Course level outcomes that demonstrate learning at an increasing level of proficiency of the program level outcome as well expanding complexity.													
Advanced [A]: Course level outcomes that demonstrate learning related to the program level outcome with an increasing level of independence, expertise and sophistication or integrate the use of content or skills in multiple levels of													
PHYS 1101	**I**	**I**		**I**	**I**		**I**		**I**	**I**	**I**		**I**
Explain the concepts of vectors and their use in mechanics problems	I	I		I	I								I
Apply Newton's laws of motion to point particles as well as extended objects	I	I		I	I								I
Apply the concepts of work and energy to mechanics problems	I	I		I	I								I
Apply the conservation laws to systems of particles	I	I		I	I								I
Explain the basic concepts in simple harmonic motion, waves, sound, fluids and heat	I	I		I	I								I
Use computers in the laboratory for the collection and analysis of data and in the presentation of results	I	I			I		I		I	I	I		I
PHYS 1102	**I**	**I**		**I**	**I**		**I**		**I**	**I**	**I**		**I**
Explain the concepts of currents, charges and electric fields in electrostatic and circuit problems	I	I		I	I								I
Explain the concepts involving moving charges in magnetic fields	I	I		I	I								I
Solve simple problems in finding magnetic fields produced by moving charges	I	I		I	I								I
Explain electromagnetic induction	I	I		I	I								I
Solve both geometric and physical optics problems	I	I		I	I								I
Explain some of the basic concepts of nuclear physics and radioactivity	I	I		I	I								I
Use computers in the laboratory for the collection and analysis of data and in the presentation of results	I	I			I		I		I	I	I		I
Discuss applications of course topics to the life sciences	I	I		I	I								I
PHYS 1120	**I**	**I**			**I**		**I**		**I**	**I**	**I**		**I**
Explain the concepts of vectors and their use in mechanics problems	I	I			I								I
Apply Newton's laws of motion to point particles as well as extended objects	I	I			I								I
Apply the concepts of Work and Energy to mechanics problems	I	I			I								I
Apply the conservation laws to systems of particles	I	I			I								I
Explain the basic concepts of oscillatory motion, waves, and sound	I	I			I								I
Use computers in the laboratory for the collection and analysis of data and in the presentation of results	I	I			I		I		I	I	I		I
PHYS 1220	**I**	**I**		**I**	**I**		**I**		**I**	**I**	**I**		**I**
Explain the concepts of currents, charges and electric fields	I	I			I								I
Explain the concepts involving moving charges in magnetic fields	I	I			I								I
Solve simple problems in finding magnetic fields produced by moving charges	I	I			I								I
Explain electromagnetic induction	I	I			I								I
Solve both geometric and physical optics problems	I	I		I	I								I
Explain some of the basic concepts of modern physics	I	I			I								I

PROGRAM COURSES WITH COURSE LEARNING OUTCOMES	PROGRAM LEARNING OUTCOMES												
	PLO#1	PLO#2	PLO#3	PLO#4	PLO#5	PLO#6	PLO#7	PLO#8	PLO#9	PLO#10	PLO#11	PLO#12	PLO#13
	Physics Knowledge	Math Knowledge	Chemistry Knowledge	Biology Knowledge	Comm skills	Business	Lab techniques and practical skills	Experimental design skills	Using data to formulate or validate models	Sofware & computer programming	Cooperation and teamwork attitudes	Limits of knowledge & independent learning	Integration of knowledge & skills
Use computers in the laboratory for the collection and analysis of data and in the presentation of results	I	I			I		I		I	I	I		I
PHYS 1600	**I**				**I**		**I**	**I**		**I**			**I**
Write computer programs in the C programming language													
Construct simple circuits on a breadboard, based on a microcontroller and Input/Output (IO) devices such as push-button switches and Light Emitting Diodes (LEDs)	I						I	I		I			I
Write simple programs in C to enable a microcontroller to receive and analyze input data	I						I	I		I			I
Use measured data to control output	I						I	I		I			I
Use and maintain a proper notebook													
Function effectively in a group environment													
Produce written and oral presentations on group project(s)	I				I								I
PHYS 2010	D	D	I		D					D			D
State the assumptions made by Einstein which led to the Special Theory of Relativity	D	D											D
State important implications of the theory of special relativity	D	D											D
Perform Lorentz transformation of space-time coordinates under special relativity	D	D											D
Describe the invariants in special relativity and apply them in problem solving	D	D											D
Summarize the historical development of the theory of Quantum Mechanics	D	D			D								D
Recognize the evidence for quantization in nature	D												D
State the Schrödinger Equation, describe its significance, apply to simple problems	D	D								D			D
Solve the Schrödinger Equation for a variety of simple potential functions	D	D											D
State the Uncertainty Principle and its applications	D												D
Describe simple crystal structures	D		I										D
State the principles of band theory and apply to simple problems	D												D
Perform simple calculations involving the electronic properties of solids	D	D											D
Understand the basic properties and operation of	D	D											D
PHYS 2030	D	D			I/D				I	I			I/D
Solve dynamics problems involving time, space and velocity dependent forces using elementary calculus	D	D			I/D				I	I			I or D
Show that a given equation of motion satisfies a given differential equation	I	I			I/D				I	I			I or D
Solve the harmonic oscillator problem including the damped and forced cases	D	D			I/D								I or D
Solve dynamics problems in standard three dimensional co-ordinate systems	D	D			I/D								I or D
Solve dynamics problems in standard accelerated frames of reference, including rotating systems	D	D			I/D								I or D
State the definitions of key fluid properties: density, flow rate, viscosity	I	I			I								
Apply fundamental fluid equations (continuity, mass/energy,...) to the solution of problems	D	D			I/D								I or D
State and apply Euler's and Bernoulli's fluid laws	D	D			I/D								I or D

PROGRAM COURSES WITH COURSE LEARNING OUTCOMES	PROGRAM LEARNING OUTCOMES												
	PLO#1	PLO#2	PLO#3	PLO#4	PLO#5	PLO#6	PLO#7	PLO#8	PLO#9	PLO#10	PLO#11	PLO#12	PLO#13
	Physics Knowledge	Math Knowledge	Chemistry Knowledge	Biology Knowledge	Comm skills	Business	Lab techniques and practical skills	Experimental design skills	Using data to formulate or validate models	Sofware & computer programming	Cooperation and teamwork attitudes	Limits of knowledge & independent learning	Integration of knowledge & skills
Recognize the importance of dimensional analysis in the study of fluids and state several dimensionless ratios of interest such as Euler's number and Reynolds' number	D	D			I/D								I or D
PHYS 2040	D	I			I		I	I/D	I	D			I
State the 4 laws of thermodynamics	D	I			I				I				
Describe the operating principles of common thermometers	D				I		D	D	D				
Name standard themodynamic processes (isothermal,adiabatic, etc)	D				I				I				
Analyze common thermodynamic cycles for ideal gases in the pV plane	D	I			I		I		I	D			
State several versions of the Second Law	D	I			I				I				
Describe several 'real world' heat engines	D				I		I						I
Define entropy macroscopically and statistically	D	I			I				I				
Define thermodynamic potentials: Enthalpy, Free Energy	D	I			I				I				
Describe Planck's resolution of the ultraviolet catastrophe	D	I			I			I	I				
Perform calculations using the Stefan Boltzmann radiation law	D	I			I				I	D			
Apply thermodynamic principles to modern energy technologies such as solar panels and heat pumps	D				I		I						
PHYS 2100	D	D			D		D	I/D	D	D	D	D	D
Describe the characteristics of, and demonstrate the operation of, common laboratory equipment such as oscilloscopes and function generators	D	D			D		D	I & D	D		D	D	D
Apply physical principles in designing, and choosing instrumentation for, physics experimentsUse electronic instrumentation as well as computers to acquire experimental data in physics experiments	D	D			D		D	I & D	D	D	D	D	D
Organize and interpret experimental data in physics experiments	D	D			D		D	I & D	D	D	D		D
Use theoretical methods and computer software to analyze experimental data in physics experiments	D	D			D		D	I & D	D	D	D	D	D
Write a formal laboratory report on physics experiments	D	D			D		D	I & D	D	D	D		D
PHYS 2420	D	D			D							I	D
Calculate electric field and electric potential for various charge distributions, incorporating the effects of dielectrics	D	D			D							I	D
Calculate magnetic fields for various current distributions, with or without the presence of matter	D	D			D							I	D
Calculate induced emfs	D	D			D							I	D
Solve DC and AC circuit problems with standard circuit elements, using phasor and complex number representation where appropriate													
Analyse the operation of the BJT in small-signal amplifiers													
PHYS 2600	D	D			D		D	I	D	D		I	D
Analyse and calculate voltage, current and power in AC and DC circuits containing resistors, capacitors, and inductors using phasor diagrams and complex variable mathematics	D	D			D								D
Analyse circuits containing diodes and operational amplifiers	D	D					D	I	D				D

PROGRAM COURSES WITH COURSE LEARNING OUTCOMES	PROGRAM LEARNING OUTCOMES												
	PLO#1	PLO#2	PLO#3	PLO#4	PLO#5	PLO#6	PLO#7	PLO#8	PLO#9	PLO#10	PLO#11	PLO#12	PLO#13
	Physics Knowledge	Math Knowledge	Chemistry Knowledge	Biology Knowledge	Comm skills	Business	Lab techniques and practical skills	Experimental design skills	Using data to formulate or validate models	Sofware & computer programming	Cooperation and teamwork attitudes	Limits of knowledge & independent learning	Integration of knowledge & skills
Use a microcontroller unit to measure voltages and currents in AC and DC circuits	D	D					D		D	D			D
Troubleshoot circuits that are not performing as expected	D	D					D	I	D			I	D
Work with common laboratory tools such as function generators, oscilloscopes, and power supplies	D	D					D	I		D			D
Record data using a computer spreadsheet (e.g.MS Excel)									D	D			
Write and present reports	D	D			D				D			I	D
Program in C					D					D			D
PHYS 2610	D	D	I				D	D	D	D			D
Choose an appropriate sensor and/or actuator for a particular measurement	D	D	I				D						D
Test and calibrate sensors and actuators	D	D					D	D	D	D			D
Convert sensor output to physical quantities, e.g. convert a thermistor voltage to temperature in degrees Celsius	D	D							D	D			D
Interface a microcontroller unit (MCU) to a sensor and/or actuator and write a C program for the operation of the MCU										D			D
Interface a data acquisition module to a sensor and/or actuator and write a LabVIEW program for the operation of the module										D			D
Collect data using a computer spreadsheet (e.g. MS Excel) and use symbolic math programs (e.g. MAPLE) to aid in converting data	D	D					D			D			D
PHYS 3610	D	D	I		I/D		I/D	I/D	I/D	I/D	D		I/D
Model physical systems in the time and frequency domain	D	D			I/D				I/D				I/D
Analyze the response of first and second order systems	D	D			I/D				I/D				I/D
Obtain the transfer function of linear systems		D			I/D				I/D				I/D
Model linear systems using block diagrams	I/D		I		I/D				I/D	I/D			I/D
Design on-off controls systems with PLCs			I		I/D		I/D	I/D	I/D	I/D	D		I/D
Use software such as Matlab to model linear systems and to design classic control systems					I/D		I/D	I/D		I/D			I/D
Create basic programs in Ladder Logic to control industrial processes					I/D		I/D	I/D		I/D	D		I/D
Create logic circuits using pneumatic and hydraulic components and simulators					I/D		I/D	I/D			D		I/D
Read electrical, pneumatic and hydraulic schematics					I/D		I/D	I/D					I/D
PHYS 3620	I/D	I/D	I		I/D		D	I/D	I/D	D	D		I/D
Design feedback control systems using the root locus, frequency response and state space techniques	I/D		I		I/D			I/D	I/D	I/D			I/D
Use software such as Matlab to plot the root locus, Nyquist and Bode diagrams		I/D	I		I/D			I/D	I/D	I/D			I/D
Use software such as Matlab to simulate feedback control systems using block diagrams		I/D	I		I/D			I/D	I/D	I/D			I/D
Build controllers using operational amplifiers	I/D				I/D		I/D	I/D			D		I/D
Work with laboratory equipment such as power supplies and oscilloscopes					I/D		D	D					I/D
Read and interpret electrical schematics for motor controls					I/D		I/D	I/D					I/D
Control electric motors with a programable logic controller or a microcontroller					I/D		D	D		D	D		D
Read and interpret pipe diagrams					I/D		I/D	I/D					I/D
Work in a team to complete a project of several weeks' duration	D	D			D		D	D		D	D		D

PROGRAM COURSES WITH COURSE LEARNING OUTCOMES	PROGRAM LEARNING OUTCOMES												
	PLO#1	PLO#2	PLO#3	PLO#4	PLO#5	PLO#6	PLO#7	PLO#8	PLO#9	PLO#10	PLO#11	PLO#12	PLO#13
	Physics Knowledge	Math Knowledge	Chemistry Knowledge	Biology Knowledge	Comm skills	Business	Lab techniques and practical skills	Experimental design skills	Using data to formulate or validate models	Sofware & computer programming	Cooperation and teamwork attitudes	Limits of knowledge & independent learning	Integration of knowledge & skills
PHYS 3700	A	A							A	A			A
Understand and explain the concepts and methods of signal and image processing	A	A							A	A			A
Sample signals effectively and reconstruct signals from samples	A	A							A	A			A
Design and implement digital filters	A	A							A	A			A
Use Fourier transform techniques for signal and image analysis	A	A							A	A			A
Critically assess the appropriateness, reliability, and limitations of various signal and image processing techniques for particular applications	A	A							A	A			A
PHYS 3710	A	A/D					A	A	A	D	D	D	A
Design, construct and analyze optical systems for imaging, illumination, sensing/testing, communications and other applications.	A	A					A	A	A	D	D	D	A
Select, prepare and work with common optical components such as lenses, mirrors, filters, optical fibers.	D	D					A	A	A	D	D	A	A
Confidently use and understand common optical devices such as microscopes, telescopes, interferometric devices and spectrometers.	A	A					A	A	A	D	D	D	A
Understand the operation and applications of a variety of light sources.	A	D					A	A	A	D	D	D	A
Understand the ray, wave and photon models of light and recognize their domains of applicability.	A	A					A	A	A	D	D	D	A
Work safely with lasers.	D						A	A				D	
PHYS 3900	D	D			D	D	D	D	D	D	D	D	D
Perform and present a literature review on the topic of the project	D	D			D	D						D	D
Choose parameters to be measured and/or controlled, instruments/methods to be used, calibration procedures and appropriate techniques for analysis of measurement data and uncertainties	D	D					D	D	D	D			D
Apply knowledge and skills from their coursework to the project	D	D					D	D	D	D		D	D
Identify and address gaps in their knowledge and skills as relevant to the project	D	D						D				D	D
Use appropriate statistical methods and computer software for data analysis	D	D					D	D	D	D			D
Work with less supervision than in laboratory activities in previous courses	D				D		D				D	D	D
PHYS 3950	D	D			D	I	D		D	D	D	D	D
Identify goals and objectives for their work term					D						D	D	D
Apply knowledge and skills from their studies to their work at the host organization	D	D	Some students		D		D		D	D (many students)	D		D
Assess progress and adjust work practices and goals accordingly	D	D			D				D		D	D	D
Identify the relevance of their studies to the work being done by their host organization	D	D	Some students			I	D		D				D
Identify additional knowledge and skills being learned during the work term	I	I										D	D
Appreciate the rigours and demands of the modern workplace					I						I		

PROGRAM COURSES WITH COURSE LEARNING OUTCOMES	PROGRAM LEARNING OUTCOMES												
	PLO#1	PLO#2	PLO#3	PLO#4	PLO#5	PLO#6	PLO#7	PLO#8	PLO#9	PLO#10	PLO#11	PLO#12	PLO#13
	Physics Knowledge	Math Knowledge	Chemistry Knowledge	Biology Knowledge	Comm skills	Business	Lab techniques and practical skills	Experimental design skills	Using data to formulate or validate models	Sofware & computer programming	Cooperation and teamwork attitudes	Limits of knowledge & independent learning	Integration of knowledge & skills
Understand workplace etiquette and norms					I						I		
Identify and assess gaps in their knowledge and skills as relevant to the work being carried out												D	
Respond constructively to feedback from the host organization and from the Physics work experience committee					D						D	D	
Write a report that includes an assessment of progress in meeting the initial goals, a description of the work being carried out, and a plan for the second part of the work term	D	D			D				D			D	D
PHYS 3951	A	D			D	D			A		D/A	A	D/A
Identify goals and objectives for the remainder of the work term					A						A	A	D
Identify the relevance of their studies to the work being done by their host organization	A	A			D	D	A (many students)		A (many students)	A (many students)			D
Identify additional knowledge and skills learned so far during the work experience	D	D			D								
Identify and assess gaps in their knowledge and skills as relevant to the work being carried out					D							A	
Formulate a plan for acquiring additional knowledge and skills during the remainder of the work term					D						A	A	A
Respond constructively to feedback from the host organization and from the Physics work experience committee					D						A		
Appreciate the rigours and demands of the modern workplace					D						D		
Understand workplace etiquette and norms					D						D		
Write a final report that includes a self-assessment and a description of the work that was performed	A	D			A				A			A	A
Make a presentation on the placement to physics faculty and students	A	D			A								A
PHYS 4010	A	A			A					A			A
Calculate measurement probabilities for states with a finite number of outcomes (e.g. spin = n/2 systems)	A	A											A
Use bra-ket formulation in calculations	A	A											A
Normalize state vectors	A	A											A
Determine if two operators are compatible	A	A											A
Solve the characteristic equation for a state with n outcomes and determine the eigenvectors and eigenvalues	A	A								A			A
Explain how interference effects arise in quantum systems	A	A											A
Sketch physically reasonable wavefunctions for 1D potential wells and barriers	A	A								A			A
Numerically determine energy levels of 1D potential wells	A	A								A			A
Numerically determine tunnelling probabilities	A	A											A
Describe applications of quantum mechanics to modern technology.	A	A			A								A
Qualitatively explain different interpretations of quantum mechanics.	I				A								I
PHYS 4199	A	A			A	D	A	A	A	A	A	A	A
Conduct a literature review within the scope of the senior physics project	A	A			A	D						A	A
Develop a project proposal	A				A			A	A			A	A

PROGRAM COURSES WITH COURSE LEARNING OUTCOMES	PROGRAM LEARNING OUTCOMES												
	PLO#1	PLO#2	PLO#3	PLO#4	PLO#5	PLO#6	PLO#7	PLO#8	PLO#9	PLO#10	PLO#11	PLO#12	PLO#13
	Physics Knowledge	Math Knowledge	Chemistry Knowledge	Biology Knowledge	Comm skills	Business	Lab techniques and practical skills	Experimental design skills	Using data to formulate or validate models	Sofware & computer programming	Cooperation and teamwork attitudes	Limits of knowledge & independent learning	Integration of knowledge & skills
Develop a project schedule with milestones	A				A	A							A
Organize materials and equipment required for the project	A						A	A	A	A		A	A
Maintain effective communication with the project supervisor (and industry representative as applicable)	A	A			A	D		A			A		A
Present the full proposal in both written and oral formats	A				A	D		A					A
PHYS 4299	A	A			A	D	A	A	A	A	A	A	A
Conduct the project proposal developed in PHYS 4199	A	A					A	A	A	A		A	A
Maintain a project notebook					A		A						
Troubleshoot and solve problems that may arise during the course of the project	A						A	A	A			A	A
Apply appropriate statistical methods and computer software for data analysis		A						A	A	A			A
Maintain effective communications with the project supervisor (and industry representative if applicable)	A	A			A	D		A			A		A
PHYS 4600	A	A			A	D	A			A	A	A	A
Write effective programs in industrially relevant programming languages to interface with instrumentation		A					A			A		A	A
Analyze and debug programs							A			A			
Interface a variety of hardware devices with computer systems	A						A			A		A	A
Conduct research to select and specify appropriate hardware and software for industrial applications	A	A					A			A		A	A
Explain the limitations and abilities of different prorgramming techniques	A	A				D	A			A		A	
Work in development teams producing human-readable well commented and documented code	A				A	D				A	A		
Describe the software development process in terms of prototyping, testing and profiling code						D	A			A			
Recognize and work with a variety of programming languages						D	A			A			A
Apply industry standards for software and hardware interfaces						A	A			A			
PHYS 4700	A	A			A		A		A	A	A	D	A
Predict and recognise the features of diffraction patterns from various crystal structures	A	A											A
Use band theory to explain the differences between insulators, semiconductors, and metals	A	A			A								A
Use spectroscopic techniques to probe the band structure of various materials													
Explain, and perform calculations pertaining to the properties of semiconductors, metals, superconductors, and magnetic materials	A	A			A								A
Describe important experimental techniques used by solid state physicists	A	A			A								A
Perform laboratory experiments to investigate various electrical, thermal, and magnetic properties of solids	A	A			A		A		A	A	A	D	A
Present and explain the results of their experiments in terms of solid state theory	A	A			A				A		A	D	A
Describe important applications of semiconductors, superconductors, and magnetic materials in modern technology	A				A								A

PROGRAM COURSES WITH COURSE LEARNING OUTCOMES	PROGRAM LEARNING OUTCOMES												
	PLO#1	PLO#2	PLO#3	PLO#4	PLO#5	PLO#6	PLO#7	PLO#8	PLO#9	PLO#10	PLO#11	PLO#12	PLO#13
	Physics Knowledge	Math Knowledge	Chemistry Knowledge	Biology Knowledge	Comm skills	Business	Lab techniques and practical skills	Experimental design skills	Using data to formulate or validate models	Sofware & computer programming	Cooperation and teamwork attitudes	Limits of knowledge & independent learning	Integration of knowledge & skills
PHYS 4900													
Describe the foundational physics of the problem of interest													
Describe the basics of the technology applicable to the topic													
Identify the application of this topic in BC , Canada, North America, and around the world													
Communicate the importance of the topic orally and in writing													
BIOL 1110	I	I	I	I	I	I	I	I	I	I	I		I
Describe the current system of biological taxonomy and explain why it is changing				I	I								
Describe the key features of major groups of organisms					I								
Explain how organisms have evolved by natural selection					I								
Describe and explain nutrient cycling and energy flow in ecosystems	I	I	I	I	I				I				I
Recognize and differentiate a range of interspecific interactions in communities					I								
Relate the structure of plant tissues to their functions					I								
Compare and contrast a range of morphological and physiological systems in selected organisms	I		I	I	I								
Carry out basic laboratory procedures, including the use of compound and dissecting microscopes, preparation of material for observation with a microscope, and construction of biological drawings	I	I		I			I				I		
Apply the scientific method to conduct and report on experimental investigations		I			I		I	I	I	I	I		I
Cooperate with group members to complete tasks in a shared learning environment					I			I			I		I
CHEM 1110	I	I	I	I	I		I		I				I
Solve a variety of stoichiometric and gas law problems	I	I	I				I		I				I
Solve problems based on the Bohr model of the atom, other 1-electron atomic systems and the photoelectric effect	I	I	I				I						I
Use quantum theory to discuss orbital shapes, energies and electron configurations of atoms and ions	I	I	I		I								I
Describe and explain trends in atomic and ionic radii, ionization energies, electron affinities, and electronegativities with reference to the Periodic Table of Elements	I	I	I		I								I
Describe ionic and covalent bonding and explain trends in physical properties based on type of bonding		I	I	I	I								I
Use Lewis structures and resonance to describe bonding and Valence Shell Electron Pair Repulsion (VSEPR) Theory to predict shapes of covalent species		I	I	I	I		I						I
Use Valence Bond Theory and Molecular Orbital Theory to rationalize shapes, stabilities and magnetic properties of covalent species		I	I	I	I		I						I
Describe the different intermolecular forces and explain effects of intermolecular forces on physical properties of covalent compounds			I	I	I		I						I

PROGRAM COURSES WITH COURSE LEARNING OUTCOMES	PROGRAM LEARNING OUTCOMES												
	PLO#1	PLO#2	PLO#3	PLO#4	PLO#5	PLO#6	PLO#7	PLO#8	PLO#9	PLO#10	PLO#11	PLO#12	PLO#13
	Physics Knowledge	Math Knowledge	Chemistry Knowledge	Biology Knowledge	Comm skills	Business	Lab techniques and practical skills	Experimental design skills	Using data to formulate or validate models	Sofware & computer programming	Cooperation and teamwork attitudes	Limits of knowledge & independent learning	Integration of knowledge & skills
Name a variety of organic compounds containing different functional groups			I	I			I						I
Describe and illustrate different types of isomerism possible in organic compounds			I	I	I		I						I
Predict the products of simple reactions involving organic compounds			I	I			I						I
Discuss the common types of radioactivity and their uses	I		I		I								I
Solve problems based on the rates of radioactive decay, binding energies of nuclei and energy associated with nuclear reactions	I	I	I										I
CHEM 1210	I	I	I		I		I		I				I
Solve problems in electrochemistry, chemical kinetics, thermodynamics, equilibria involving gases, acids and bases, ionic compounds, liquids and solids, solutions	I	I	I		I				I				I
Write reports based on observations and data obtained in the laboratory for each of the experiments performed			I		I		I		I				I
Perform lab techniques learned throughout the semester by successfully performing experiments as well as a final practical lab exam			I				I		I				I
CHEM 2315		D	D		D		D		D	I			D
Solve problems related to course content		D	D							I			D
Analyze data and write reports based on experiments performed in the laboratory		D	D		D				D	I			D
Perform lab techniques learned throughout the semester			D				D						D
Quantitatively analyze an unknown sample, using techniques learned in class			D				D						D
Report results in a meaningful and useful format			D		D		D			I			D
Use laboratory equipment and instrumentation in a safe and effective manner			D				D						D
CHEM 4610			D		D		D	D	D			D	D
Illustrate understanding of the chemical principles underlying instrumental analysis techniques discussed in class			D										
Design, carry out, record and analyze the results of instrumental analysis techniques			A				D		D				
Identify and solve chemical problems and explore new areas of research.			D										D
Use modern library search and retrieval methods to obtain information on a topic, chemical, instrumental analysis technique or related issue			D		D								
Problem solve, think critically and reason analytically			A						D				
Know the proper procedures to safely and skillfully use the instruments in the laboratory, design experiments and properly record the results of their experiments			D				D	D	D				D
Describe the fundamental principles behind and the advantages and limitations of each instrument used			D		D				D			D	D
Study the scientific literature to complete their understanding of the background information and future implications of the results obtained by experimentation			A		D								A
ENGL 1100					I						I	I	I
Read, annotate, and summarize a variety of academic and non-academic works					I								I

PROGRAM COURSES WITH COURSE LEARNING OUTCOMES	PROGRAM LEARNING OUTCOMES												
	PLO#1	PLO#2	PLO#3	PLO#4	PLO#5	PLO#6	PLO#7	PLO#8	PLO#9	PLO#10	PLO#11	PLO#12	PLO#13
	Physics Knowledge	Math Knowledge	Chemistry Knowledge	Biology Knowledge	Comm skills	Business	Lab techniques and practical skills	Experimental design skills	Using data to formulate or validate models	Sofware & computer programming	Cooperation and teamwork attitudes	Limits of knowledge & independent learning	Integration of knowledge & skills
Understand audience, purpose, and occasion					I								I
Analyze and evaluate structure, logic, style, and evidence					I						I		I
Explore and refine ideas through discussion and debate					I								I
Think and respond critically to a broad range of texts and cultural products					I								I
Engage in a writing process that includes brainstorming, outlining, drafting, and revising strategies to produce university-level writing					I						I		I
Apply principles of unity, development, and coherence in writing					I								I
Produce clear, grammatical, and logical written work independently					I								I
Write essays that assert and support clear thesis statements					I							I	i
Research and assess secondary-source material using university-level methods and resources					I								I
Integrate sources effectively into written work using quotation, paraphrase, and summary					I								I
Document source material and format essays using MLA and/or APA citation methods to uphold the principles of academic integrity					I								I
Recognize and correct errors in their own writing					I							I	I
MATH 1120		I			I					I			I
State and apply the concepts of differential calculus, including the limit, the derivative, both as the slope of a tangent line and as a rate of change, and the geometry of derivatives	I (minimal)	I			I					I (minimal)			I
Compute, in simple cases, derivatives from the definition		I			I								I
Demonstrate and apply the basic skills of calculus (finding limits, differentiation, graphing) for algebraic and elementary transcendental functions		I			I					I (minimal)			I
Apply these skills to solve applied problems		I			D								I
Use a computer algebra system to solve problems related to differential calculus		I			I					I			I
MATH 1130		I		I	I								I
Understand and state the basic concepts of differential calculus		I			I								I
Find limits of, differentiate, and graph algebraic and elementary transcendental functions		I			I								I
Apply the above concepts and skills to the solution of applied problems, especially those of biological sciences		I		I	I								I
MATH 1220		I			I				I	I			I
Understand, state and apply the concepts of integral calculus, including integration, the fundamental theorem of calculus, approximation techniques, infinite series and simple differential equations	I (minimal)	I			I				I	I	I		I
Evaluate, in simple cases, definite integrals using Riemann sums		I			I								I
Solve applied problems requiring integration and infinite series	I (minimal)	I			I					I	I		I
Use a computer algebra system to solve problems related to integral calculus		I			I				I	I			I

PROGRAM COURSES WITH COURSE LEARNING OUTCOMES	PROGRAM LEARNING OUTCOMES												
	PLO#1	PLO#2	PLO#3	PLO#4	PLO#5	PLO#6	PLO#7	PLO#8	PLO#9	PLO#10	PLO#11	PLO#12	PLO#13
	Physics Knowledge	Math Knowledge	Chemistry Knowledge	Biology Knowledge	Comm skills	Business	Lab techniques and practical skills	Experimental design skills	Using data to formulate or validate models	Sofware & computer programming	Cooperation and teamwork attitudes	Limits of knowledge & independent learning	Integration of knowledge & skills
MATH 1230		I		I	I								I
Evaluate both definite and indefinite integrals		I			I								I
Solve applied problems requiring integration (area between curves, volume of rotation, probability density functions)		I		I	I						I		I
Solve first order differential equations and analyze them qualitatively		I		I	I				I		I		I
Use calculus to model biological systems		I		I	I				I		I		I
MATH 2721	I	I			D					I			D
Use matrices to solve a variety of problems in physics and engineering	I	I			D					I			D
Apply common matrix algebra algorithms such as inversion and diagonalization		I			D					I			D
Perform basic arithmetic and algebra with complex numbers	I	I			D								D
Use complex numbers in the solution of differential equations relevant to physics and engineering	I	D			D					I			D
MATH 2821	I	D			D								D
Find equations of lines and planes		D			D								D
Recognize the equations of cylinders and quadratic surfaces; use level curves to visualize and sketch surfaces		D			D								D
Evaluate and interpret partial derivatives		D			D								D
Evaluate and interpret gradients and directional derivatives		D			D								D
Evaluate and interpret double and triple integrals	I/D	D			D								D
Evaluate multiple integrals using polar, cylindrical, and spherical coordinates		D			D								D
Calculate area, volume, mass, first and second moments, and center of mass	I/D	D			D								D
Evaluate derivatives of vector-valued functions of a single variable		D			D								D
Evaluate line integrals of scalar and vector functions; work as a line integral	I	D			D								D
Evaluate operators (grad, div, curl, Laplacian) in all three major coordinate systems	I	D			D								D
Evaluate surface integrals of scalar- and vector-valued functions	I	D			D								D
State the Divergence Theorem and apply to electricity and magnetism, and fluid flow		I			I								I
Evaluate line and surface integrals using Green's and Stokes' theorems		D			D								D
Apply the concepts of the course to topics such as electricity and magnetism, and fluid flow	D	D			I/D								D

Appendix E

Administrative Data Report

Administrative Data Report for B.Sc. Physics for Modern Technology

The chapter headings refer to the chapters in the Self-Study to which the data pertain.

TABLE OF CONTENTS

Glossary

Average Seats Offered: Maximum number of seats available in a department/Faculty divided by the count of classes offered by the department/Faculty.

Average Seats Filled: Number of seats taken in a department/Faculty divided by the count of classes offered by the department/Faculty.

BC Student Outcomes: Results of the three annual surveys of former post-secondary students in BC, one to two years after graduation, as a supplemental tool for assessing programs offered by KPU and comparing them to similar programs at other institutions. The three BC Student Outcomes surveys include the Diploma, Associate Degree, and Certificate Student Outcomes Survey (DAC), the Baccalaureate Graduates Survey (BGS), and the Trades Student Outcomes Survey (Trades). Note that while DAC covers all BC public post-secondary institutions, BGS does not report data from programs at research-intensive universities such as UBC and SFU.

Cumulative Grade Distribution: The number of students who receive a particular letter grade (A+ through F) plus those who receive a higher grade, as a percentage of the total number of students with a grade or a W/WE or DEF (Deferred). Useful for estimating the proportion of passing students based on any specific grade requirement.

DFW Rate: % of students who received a grade of D or F or withdrew from the course. Percentage is calculated based on number of students with a grade or a W/WE or DEF (Deferred).

Faculty Student Headcount: Count of all students enrolled in a Faculty, including undeclared students.

Fill Rate: Number of seats filled divided by the number of seats offered.

Grade Point Equivalent Mean: The average grade of students in the selected courses, based solely on the numerical grade point equivalent of a letter grade. A weighted average is used, such that larger classes have a larger influence on the computed mean. It is not an average of course-level grades weighted by course credits.

Intended of Undeclared: Students who identified the program under review as their intended major on their application. Note that not all of these students declare into the program.

Program Student Headcount: Count of declared and intended of undeclared students. Withdrawals are included. To avoid double counting students, the student headcount is a unique headcount for the year, not the sum of intended of undeclared and declared counts.

Repeat Rate: Students who repeat a course, that is, have taken the course previously. Percentage is calculated based on number of students with a grade or a W/WE or DEF.

Unmet Demand: Number of waitlist seats held by students unable to enrol in the same course, and have not dropped that course, within the same term. A student waitlisted in multiple sections of the same course in the same term is counted as one waitlist seat.

Seats Offered: Maximum number of seats available in a unit (section, course, department, faculty).

Seats Filled: Number of seats taken in the unit (section, course, department, faculty)

Chapter 3. Program Relevance and Demand

3.1 Relevance

Are the program learning outcomes relevant to the current needs of the discipline/sector?[1]

What percentage of the program graduates are satisfied with the education they received? What percentage of the graduates rate the quality of instruction they received as "very good", "good", or "adequate"? Do they find their program of study useful in their current position?

Exhibit 1: KPU Physics for Modern Technology Program Student Outcomes Data Compared with Ministry Targets

Measures	Student Outcome Data for KPU Physics for Modern Technology Program	Ministry Target
Respondents[2]	*Less than 5*	
Satisfaction[3]	N/A	N/A
Quality[4]		
Usefulness[5]		

3.3 Student Demand

Who takes the program?[6]

Has the demographic profile of Physics for Modern Technology Program students changed over the last five years?

Exhibit 2: Demographic Profile of Physics for Modern Technology Program Students by Academic Year

	2016/17	2017/18	2018/19	2019/20	2020/21
Unique Student Headcount	*118*	*138*	*114*	*102*	*81*
% Female	18%	19%	13%	17%	16%
% 22 years or younger	76%	83%	77%	72%	72%
% International	22%	24%	18%	18%	17%

How does the demographic profile of Physics for Modern Technology Program students compare with that of students at the same level for the Faculty of Science and Horticulture as a whole over the same period?

Exhibit 3: Demographic Profile of Faculty of Science and Horticulture Students by Academic Year

	2016/17	2017/18	2018/19	2019/20	2020/21
Unique Student Headcount	*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%

[1] Data reported in this section was obtained from the Student Outcomes Dashboard 2016-20, which is available at https://our.kpu.ca/sites/sem/data/SitePages/Home.aspx

[2] Results for groups of less than 5 graduates are not reported.

[3] Respondents who are "very satisfied" or "satisfied" with the education or training they received in their program of study.

[4] Respondents who rate the quality of instruction received from their program of study as "very good", "good" or "adequate".

[5] Respondents who describe their program of study as "very" or "somewhat" useful in their current occupation.

[6] Data reported in this section was obtained from the Enrolment Dashboard 2020-21, which is available at https://our.kpu.ca/sites/sem/data/SitePages/Home.aspx

Is demand for the program sustainable?

Various measures of student demand for the program courses are presented below. Consider what, collectively, these measures indicate about the demand for program courses.

Has demand for Physics for Modern Technology courses been changing over the last five years? Is the overall class size, in terms of filled seats, sustainable? How does demand for Physics for Modern Technology courses compare with demand for Faculty of Science and Horticulture courses at the same level over the same period?

Exhibit 4: Unique Student Headcount in Physics for Modern Technology Courses by Academic Year Compared with Faculty of Science and Horticulture Courses

	2016/17	2017/18	2018/19	2019/20	2020/21	%Change[7]
Physics for Modern Technology	553	559	568	508	458	-17%
Faculty of Science and Horticulture	3,563	3,876	4,104	3,646	3,421	-4%

Has demand for the Physics for Modern Technology Program changed over the last five years? How does it compare with demand for Faculty of Science and Horticulture programs at the same level over the same period?

Exhibit 5: Unique Student Headcount in Physics for Modern Technology Program by Academic Year Compared with Faculty of Science and Horticulture Programs

	2016/17	2017/18	2018/19	2019/20	2020/21	%Change
Declared-Major	11	14	13	19	21	91%
Intended of Undeclared	108	129	103	84	62	-43%
Physics for Modern Technology Total Headcount	**118**	**138**	**114**	**102**	**81**	**-31%**
Faculty of Science and Horticulture Total Headcount	**2,591**	**3,256**	**2,795**	**2,672**	**2,405**	**-7%**

Exhibit 5.1: Outcomes of Physics Intended Students by Academic Year Intake Cohort

	2016/17	2017/18	2018/19	2019/20	2020/21
Cohort Headcount	**73**	**60**	**31**	**34**	**13**
% who graduated in Physics	4%	3%	0%	0%	0%
% graduated in something else	7%	13%	3%	3%	0%
% who left KPU without graduating	66%	60%	74%	56%	0%
% studying as undeclared	5%	5%	10%	29%	92%
% studying Physics as declared	11%	5%	3%	6%	0%
% studying in another program	7%	13%	10%	6%	8%

Note: The Cohort Headcount refers to the number of ***new students*** who started as Physics Intended in the Faculty of Science and Horticulture in an academic year. In 2016/17 Academic Year, there were 108 Physics-Intended students (see Exhibit 5), of which 73 were new students.

[7] % Change refers to change between 2016/17 to 2020/21.

How do KPU Physics for Modern Technology Program enrolment trends compare with overall enrolment trends in similar programs in BC?

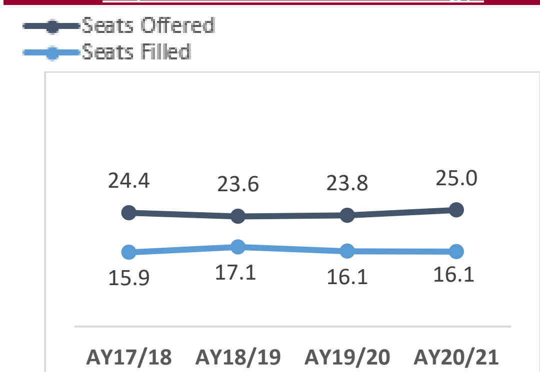
Exhibit 6: Number of Students Enrolled in similar Programs at BC Public Post-Secondary Institutions [8]

	2014/15	2015/16	2016/17	2017/18	2018/19
Total (excluding KPU) [9]	565	630	678	706	744
Bachelor's Degree	482	538	587	620	664
Simon Fraser University	84	92	99	107	111
Thompson Rivers University	14	11	12	15	20
UBC Okanagan	86	102	82	78	92
UBC Vancouver	176	207	230	244	247
University of Northern British Columbia	13	16	23	22	29
University of Victoria	109	110	141	154	165
Associate Degree – Langara College	83	92	91	86	80
KPU Total	63	30	17	14	15
Bachelor's Degree	16	9	11	14	15
Associate Degree	47	21	5	-	-

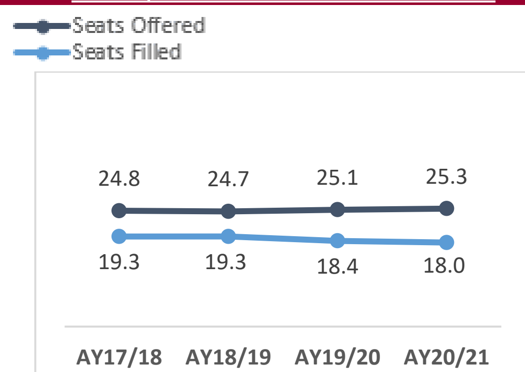
Has there been a change in average filled seats per class in Physics for Modern Technology courses? How do they compare with Faculty of Science and Horticulture courses at the same level? Is demand steady, declining, or increasing?

Exhibit 7: Average Filled Seats per Class by Academic Year

Physics for Modern Technology:



Faculty of Science and Horticulture:



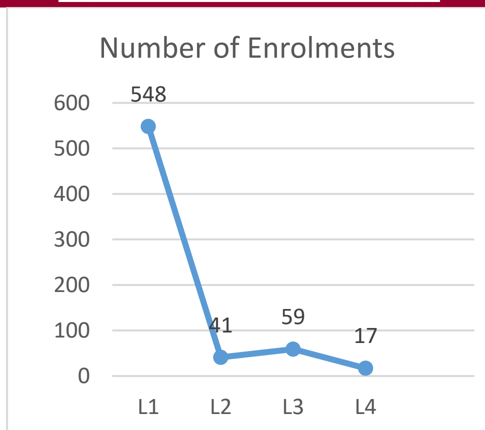
[8] All data reported below was obtained from the STP Enrolment dashboard 2021. STP refers to the BC Student Transitions Project, which tracks students in the public post-secondary education system. Data are coded by Classification of Instructional Program (CIP). To identify Physics programs, CIP code 40.0801 Physics, General was used. The data on UFV's Bachelor of Science in Physics were not available.

[9] Langara College, SFU, TRU, UBC-Okanagan, UBC-Vancouver, UNBC, and UVic.

How does demand for upper level courses (3rd and 4th year) compare with demand for lower level courses, where applicable? How does demand for upper level versus lower level courses compare with demand for Faculty of Science and Horticulture upper level and lower level courses?

Exhibit 8.1: Number of Course Enrolments by Level for Academic Year 2020/21

Physics for Modern Technology:



Faculty of Science and Horticulture:

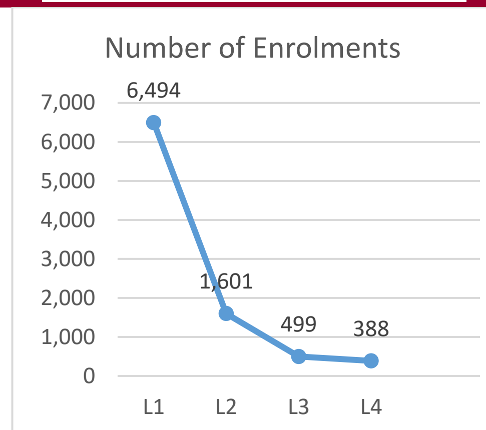
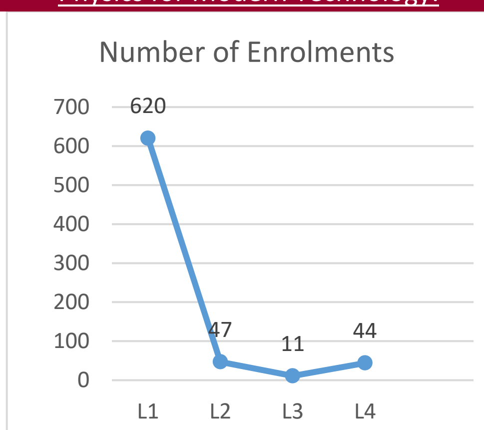


Exhibit 8.2 Number of Course Enrolments by Level for Academic Year 2019/20

Physics for Modern Technology:



Faculty of Science and Horticulture:

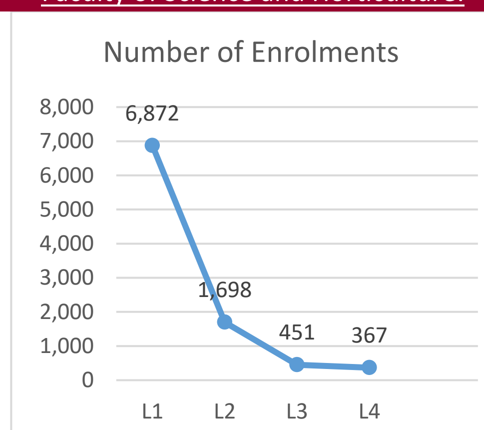
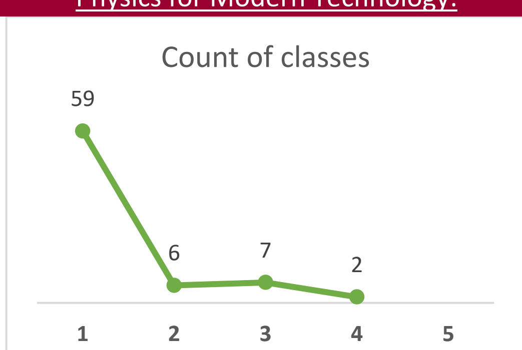


Exhibit 8.3: Number of Courses by Level for Academic Year 2020/21

Physics for Modern Technology:



Faculty of Science and Horticulture:

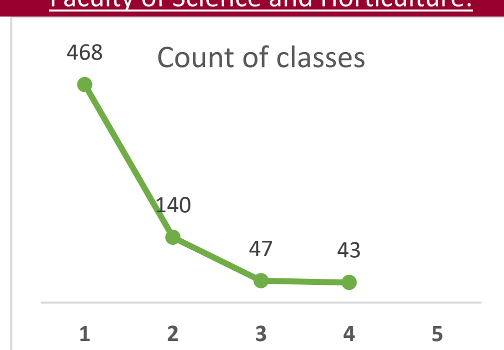
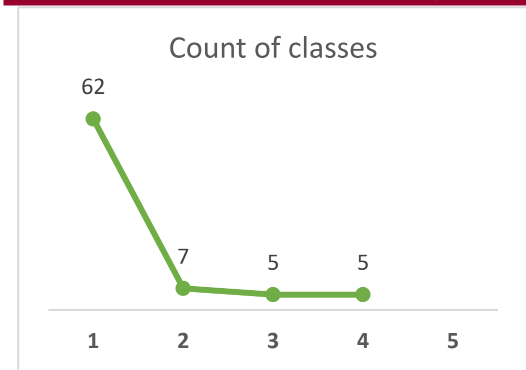


Exhibit 8.4: Number of Courses by Level for Academic Year 2019/20

Physics for Modern Technology:	Faculty of Science and Horticulture:



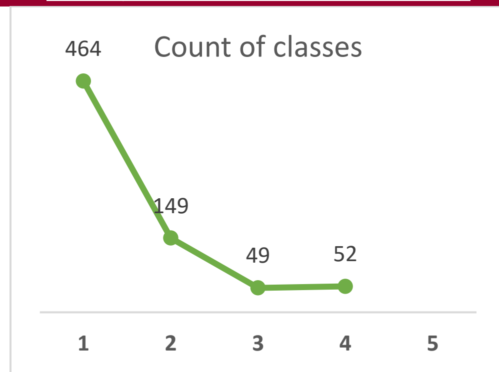
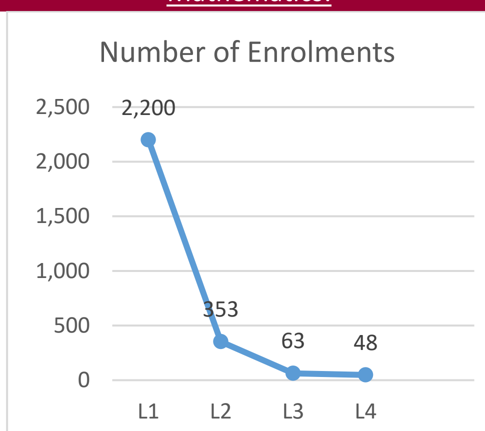


Exhibit 8.5: Number of Course Enrolments in Mathematics and Sustainable Agriculture by Level for Academic Year 2020/21

Mathematics:	Sustainable Agriculture:



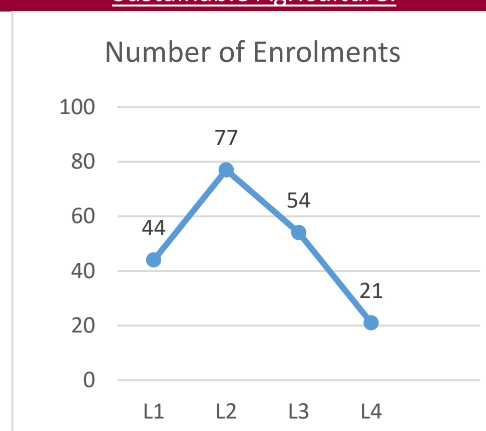
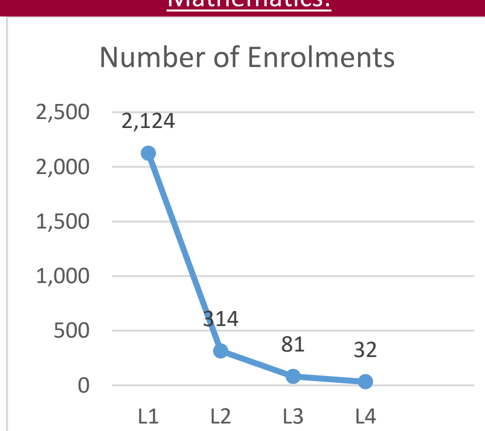
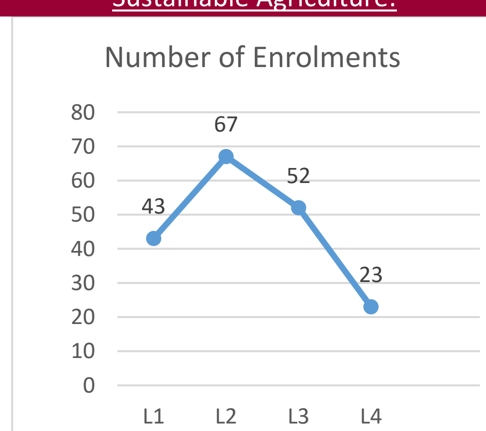


Exhibit 8.6: Number of Course Enrolments in Mathematics and Sustainable Agriculture by Level for Academic Year 2019/20

Mathematics:	Sustainable Agriculture:





How does tuition compare with instructional costs for the average class in your program?

A program's importance isn't gaged by the tuition revenue it brings in, as some programs will not be able to cover their costs, but all programs should be delivered efficiently. Part of assessing a program's sustainability is considering if it can be made more efficient without compromising student safety or success. The biggest driver of efficiency is class size in terms of filled seats. International enrolments, where relevant, can improve a program's sustainability.

Exhibit 9: Cost Structure of Average Class for Physics for Modern Technology, Faculty of Science and Horticulture UG, and All KPU UG Courses for Academic Year 2020/21

	Physics for Modern Technology	SCI & HORT UG Courses	All KPU UG Courses
Cost of Instruction	$15,713	$15,713	$15,713
Average # of Seats Filled	16.1	18.0	25.1
Overall % filled by International	17%	34%	32%
Tuition Revenue	$11,424	$17,580	$23,726
Average Net Revenue	$(4,288)	$1,867	$8,013
Total # of Classes	73	697	4,302
Total Net Revenue	$(313,059)	$1,301,437	$34,471,213

*Average Net Revenue = Cost of instruction - tuition revenue

Does the program have the capacity to meet demand?

Are there waitlists that limit students' ability to progress through the program in a timely manner? Are the waitlists for courses delivered by the program, or delivered by other departments?

Exhibit 10: Unmet Demand at the Stable Enrolment Date

	Unmet Demand	Fill Rate
2020/21 Academic Year	19	64%
2019/20 Academic Year	33	68%

There is no notable unmet demand for the program's discipline-specific courses. Unmet demand by course is available in the Enrolment Tracking Report dashboard for each term.

Chapter 4. Effectiveness of Instructional Delivery

4.1 Instructional Design and Delivery of Curriculum

Are appropriate opportunities provided to help students acquire the essential skills?[10]

Graduates are asked to indicate the extent to which the program helps them achieve the Ministry identified essential skills. Is the program achieving the Ministry's targets in skills development?

Exhibit 11: KPU Physics for Modern Technology Program Student Outcomes Essential Skills Data Compared with Ministry Targets

Measures	Student Outcome Data for KPU Physics for Modern Technology Program	Ministry Target
Respondents[11]	*Less than 5*	
Skill Development[12]	N/A	N/A
Write Clearly and Concisely		
Speak Effectively		
Read and Comprehend Materials		
Work Effectively with Others		
Analyze and Think Critically		
Resolve Issues or Problems		
Learn on your Own		

[10] Data reported in this section was obtained from the Student Outcomes dashboard 2016-20, which is available at: https://our.kpu.ca/sites/sem/data/SitePages/Home.aspx

[11] Results for groups of less than 5 graduates are not reported.

[12] Program graduates' assessment of their skill development at KPU. An overall average for all skills is provided, plus the results for each skill.

4.2 Student Success

Are students performing satisfactorily in courses?[13]

Are an adequate number of students in Physics for Modern Technology courses receiving a grade of C and above? How do they compare with the students in Faculty of Science and Horticulture courses at the same level?

Exhibit 12: Cumulative Grade Distribution for Physics for Modern Technology Courses from AY 2016/17 to AY 2020/21

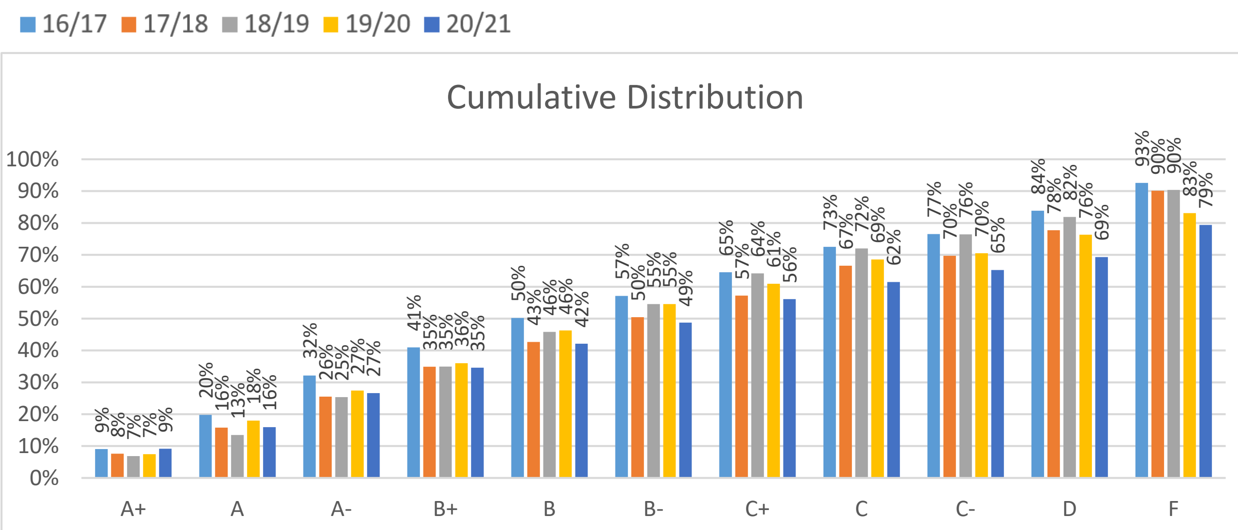
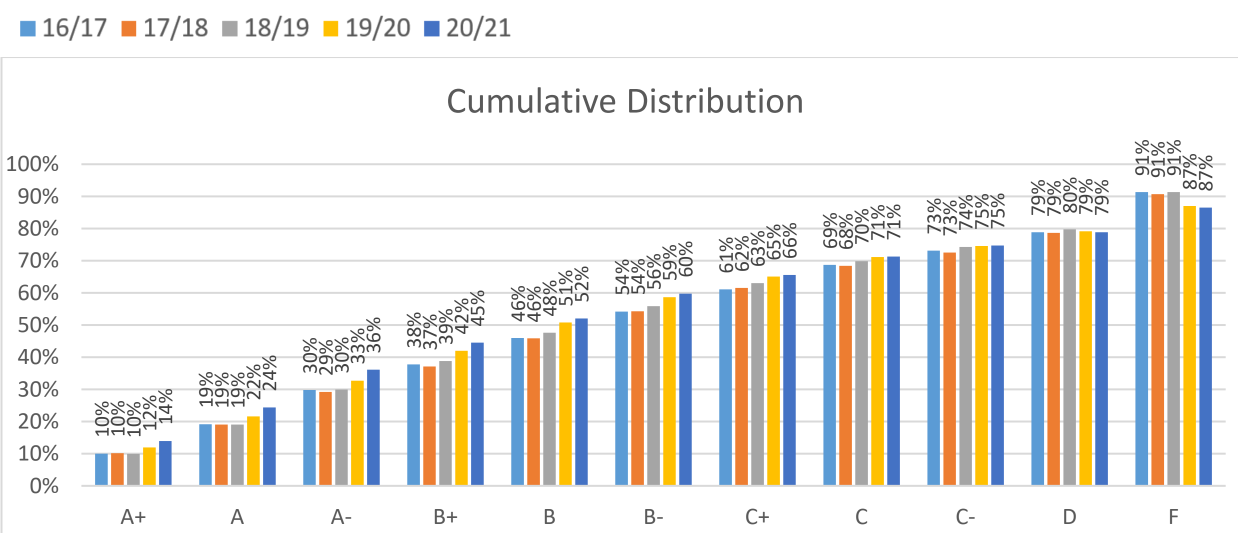


Exhibit 13: Cumulative Grade Distribution for Faculty of Science and Horticulture Undergraduate Courses from AY 2016/17 to AY 2020/21

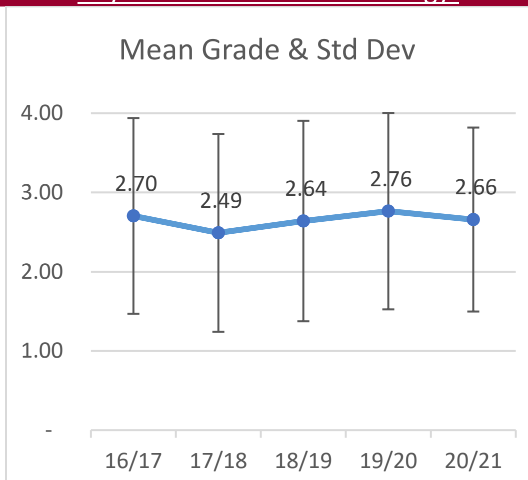


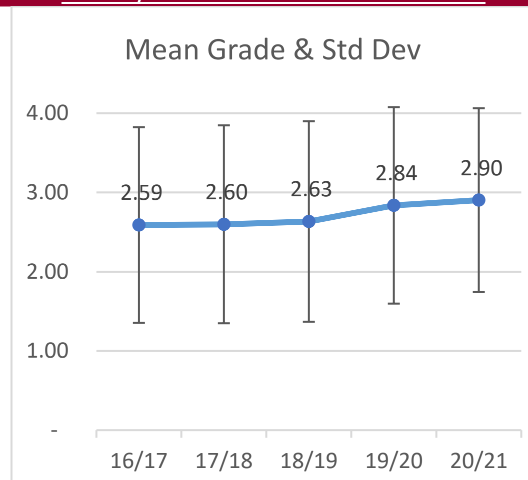
[13] Data reported in this section was obtained from the Grade Distribution dashboard 2020-21, which is available at https://our.kpu.ca/sites/sem/data/SitePages/Home.aspx

Do the overall grade trends for the program indicate an issue? How do they compare with the overall grades for Faculty of Science and Horticulture courses?

Exhibit 14: Grade Data for Physics for Modern Technology Undergraduate Level Courses by Academic Year compared with Faculty of Science and Horticulture

Physics for Modern Technology:	Faculty of Science and Horticulture:

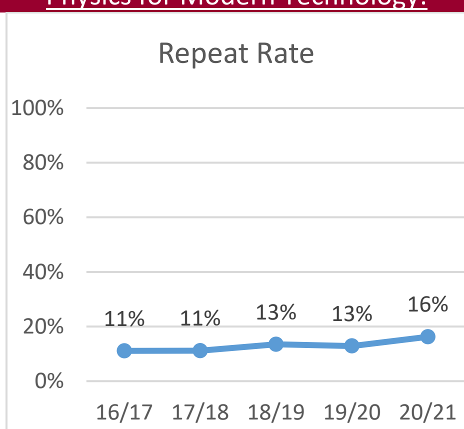


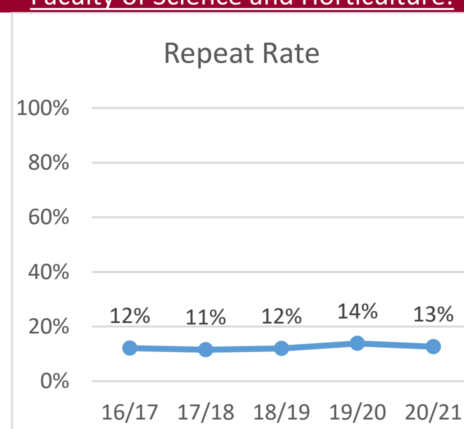


Do the repeat rate trends in Physics for Modern Technology courses indicate an issue? How does it compare with the repeat rate trends of Faculty of Science and Horticulture undergraduate courses?

Exhibit 15: Repeat Rates in Physics for Modern Technology Undergraduate Level Courses by Academic Year Compared with Faculty of Science and Horticulture

Physics for Modern Technology:	Faculty of Science and Horticulture:

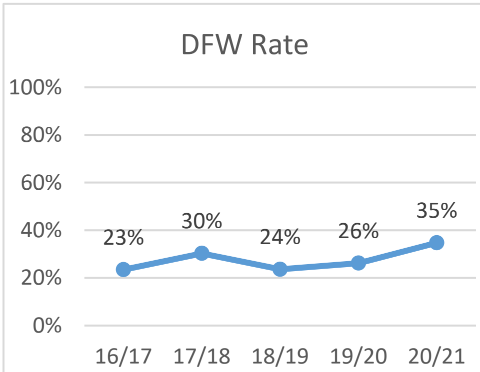




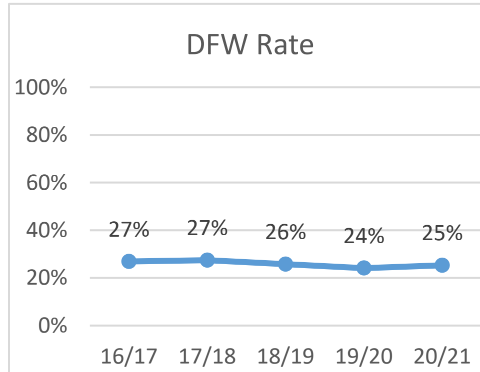
Does the DFW rate trends in Physics for Modern Technology courses indicate an issue? How does it compare with the DFW rate trends in Faculty of Science and Horticulture undergraduate courses?

Exhibit 16: DFW Rates in Physics for Modern Technology Undergraduate Level Courses by Academic Year Compared with Faculty of Science and Horticulture

Physics for Modern Technology:



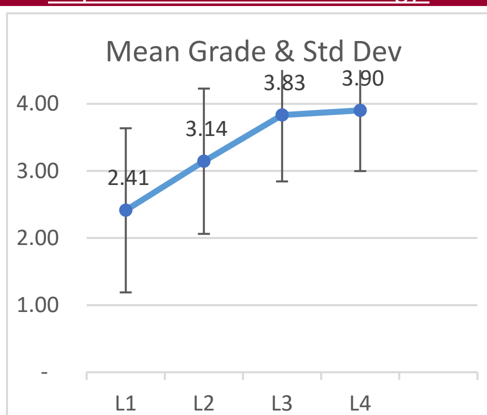
Faculty of Science and Horticulture:



Are there any issues with Physics for Modern Technology students' performance at each level? How do they compare with Faculty of Science and Horticulture undergraduate courses?

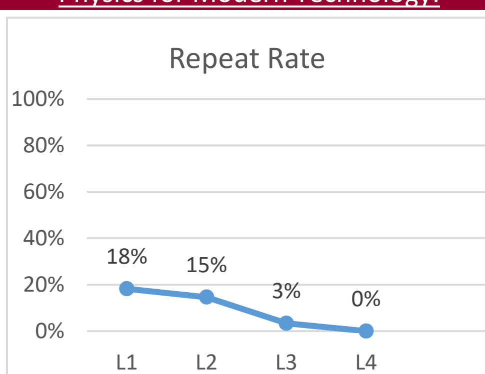
Exhibit 17: Student Performance Data for Physics for Modern Technology Courses for Academic Year 2020/21 by Undergraduate Levels Compared with Faculty of Science and Horticulture

Physics for Modern Technology:[14]

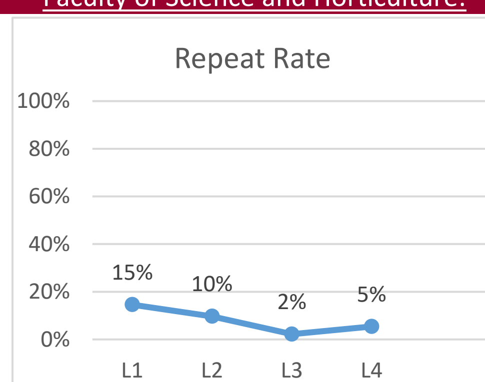


Faculty of Science and Horticulture:

Physics for Modern Technology:

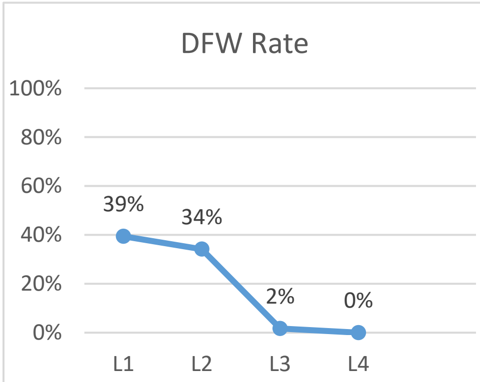


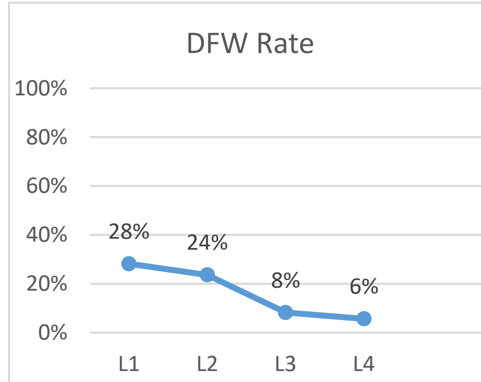
Faculty of Science and Horticulture:



[14] Note that variations in sample size can affect the Grade Point Equivalent Mean data.

Physics for Modern Technology:	Faculty of Science and Horticulture:





Are students making satisfactory progress in the program?[15]

Has there been a change in the number of Physics for Modern Technology Program graduates over time? How does it compare with Faculty of Science and Horticulture in general?

Exhibit 18: Physics for Modern Technology Program Graduate Headcount[16] by Credential and Academic Year

	2016/17	2017/18	2018/19	2019/20	2020/21
Total[17]	-	1	5	2	4
Bachelor's Degree	-	1	5	2	4

Exhibit 19: Faculty of Science and Horticulture Graduate Headcount by Credential and Academic Year

	2016/17	2017/18	2018/19	2019/20	2020/21
Total	181	205	228	256	162
Bachelor's Degree	14	38	39	35	42
Associate Degree	44	36	30	46	27
Diploma	68	68	93	126	79
Certificate	41	42	43	24	8
Citation	26	31	39	38	14

Exhibit18.1: Graduate Headcount of Physics Programs at other BC Public Post-Secondary Institutions [18]

Calendar Year	2015	2016	2017	2018	2019	2020	2021
Bachelor's Degree							
Simon Fraser University	10	10	16	11	11	14	11
Thompson Rivers University	4	4	4	4	5	3	
UBC Okanagan	5	23	24	16	13	16	18
UBC Vancouver	28	41	34	41	56	49	52

[15] All data reported in this section was obtained from the Credentials dashboard AY 2020-21, which is available at https://our.kpu.ca/sites/sem/data/SitePages/Home.aspx

[16] 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.

[17] 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.

[18] Data was obtained from the BC Headset and CDW. CIP code 40.0801 Physics, General was used. CDW does not have the data on UFV's Bachelor of Science in Physics Program.

University of Northern British Columbia			4		5		2
University of Victoria	17	10	9	14	15	21	23
Associate Degree – Langara College	3	1	3	1	3	1	1[19]

Are Physics for Modern Technology students completing the program within a reasonable time? How does it compare with Faculty of Science and Horticulture in general?

Exhibit 20: Median[20] Years to Graduate:[21] Physics for Modern Technology

	2016/17	2017/18	2018/19	2019/20	2020/21
Bachelor's Degree	-	5.9	5.2	5.6	6.3

Exhibit 21: Median Years to Graduate: Faculty of Science and Horticulture

	2016/17	2017/18	2018/19	2019/20	2020/21
Bachelor's Degree	2.8	4.9	4.9	5.9	5.9
Associate Degree	3.5	3.2	3.0	3.2	3.2
Diploma	2.9	2.5	2.4	2.2	2.9
Certificate	0.9	1.1	0.9	1.3	1.9
Citation	0.9	0.6	1.2	1.4	1.3

Are graduates of the program successful?

Are the graduates getting jobs in a related field? Are the graduates pursuing further education?

Exhibit 22: KPU Physics for Modern Technology Program Student Outcomes Data Compared with Ministry Targets

<table>
<tr><th>Measures</th><th>Average Student Outcome Data for KPU Physics for Modern Technology Program (2018-20)</th><th>Ministry Target</th></tr>
<tr><td>Respondents[22]</td><td>Less than 5</td><td></td></tr>
<tr><td>Unemployment Rate[23]</td><td rowspan="4">N/A</td><td rowspan="4">N/A</td></tr>
<tr><td>Currently Employed[24]</td></tr>
<tr><td>In a Related Job[25]</td></tr>
<tr><td>Further Studies[26]</td></tr>
</table>

[19] The graduate data for Langara College for 2021 calendar year is incomplete.

[20] A computed "middle" number in a set of numbers when sorted by value, such that 50% of the values are higher and 50% are smaller than this number. The Median is preferred over the Mean when the distribution of numbers contains a few extreme values. Extreme values will distort the Mean in that direction, whereas the Median is not affected by extreme values.

[21] The data in Exhibits 20 and 21 present the median number of years students took to receive their first credential.

[22] Results for groups of less than 5 graduates are not reported.

[23] Unemployment rate of KPU's graduates (of those in the labour market).

[24] 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).

[25] 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.

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

Appendix F

Student Survey Report

Physics for Modern Technology Program Review - Student Survey Results

The student survey was sent to 34 Physics for Modern Technology students. A total of 13 students responded. The response rate is 38%.

Note: The data includes open-ended comments. In order to preserve integrity and objectivity, OPA does not do value-judgment editing (i.e. we do not fix spelling errors, syntax issues, punctuation, etc.). Comments are included verbatim – with one exception: if individuals or courses are named, OPA redacts the name of the instructor or course. This rule applies to whether the comment is good, bad or indifferent.

QUESTIONS ON CHAPTER 3: PROGRAM RELEVANCE AND DEMAND

Who takes the program?

Your Program

1 - Which of the following credentials are you working towards at KPU? Please select all that apply.

#	Answer	Percentage	Count
1	Bachelor's degree: Major in Physics for Modern Technology	100%	13
2	Another credential, please specify	8%	1
3	Don't know	0%	0
	Total		13

Note: The last row presents the total number of respondents. The total number of responses for this question is greater than the number of respondents. Therefore, the percentage total exceeds 100%.

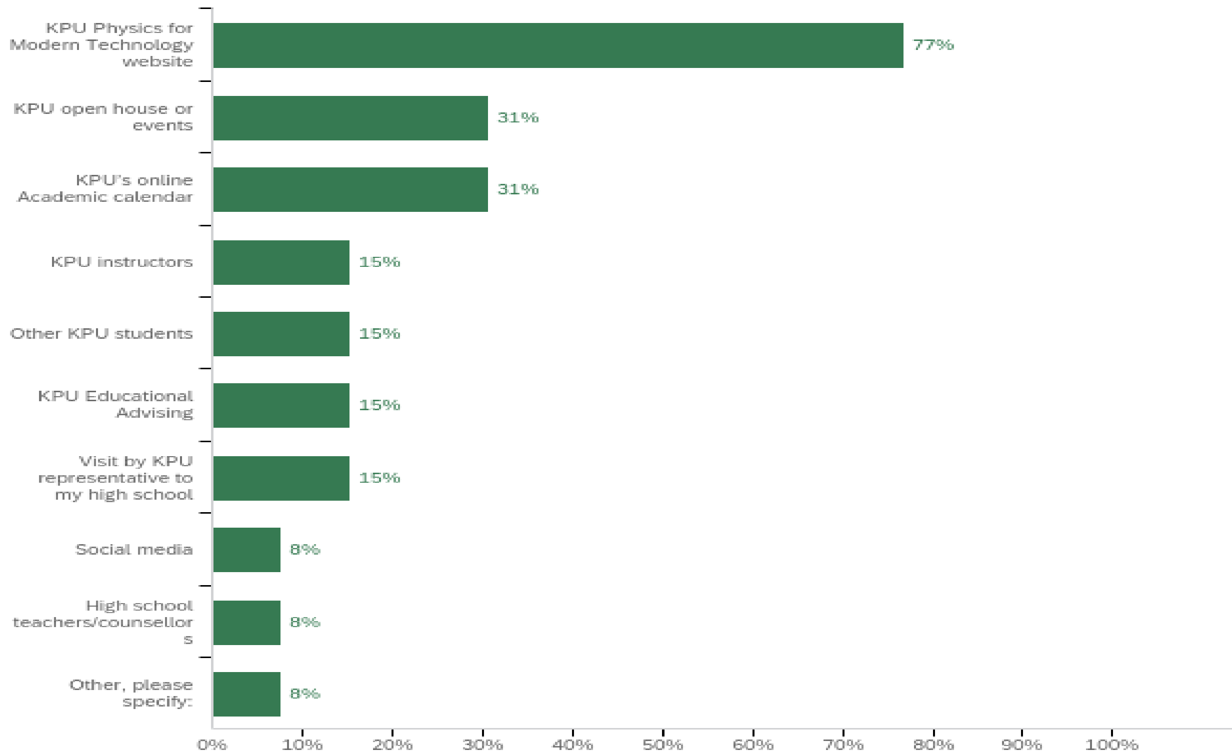
1_2_TEXT - Another credential, please specify

Minor in math

2 - How many PHYS courses have you completed in Physics for Modern Technology program?

#	How many PHYS courses have you completed in Physics for Modern Technology program?	Percentage	Count
1	0 to 2 courses	0%	0
2	3 to 10 courses	15%	2
3	11 to 20 courses	31%	4
4	21 or more courses	54%	7
	Total		13

3 - How did you find out about KPU's Physics for Modern Technology program? Please select all that apply.



#	Answer	%	Count
1	KPU Physics for Modern Technology website	77%	10
2	KPU open house or events	31%	4
3	KPU's online Academic calendar	31%	4
4	KPU instructors	15%	2
5	Other KPU students	15%	2
6	KPU Educational Advising	15%	2
7	Visit by KPU representative to my high school	15%	2
8	Social media	8%	1
9	High school teachers/counsellors	8%	1
10	Other, please specify:	8%	1
11	BC Education Planner website	0%	0
12	BC Transfer Guide website	0%	0
13	Other contact with KPU representative(s)	0%	0
	Total		13

Note: The last row presents the total number of respondents. The total number of responses for this question is greater than the number of respondents. Therefore, the percentage total exceeds 100%.

3_10_TEXT - Other, please specify:

I sort of enrolled by accident by specifying just "physics" in my application

Reasons for Taking the Program

4 - What was your main reason for enrolling in the Physics for Modern Technology program?

#	Answer	%	Count
1	To prepare for a specific career or job	46%	6
2	To improve my job prospects and/or earning potential	15%	2
3	To prepare to transfer to another institution	15%	2
4	To qualify for graduate studies	15%	2
5	To qualify for the Post-Graduation Work Permit program	0%	0
6	Other, please specify	8%	1
	Total	100%	13

4_6_TEXT - Other, please specify

The fact it's a Co-op program

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

Program Relevance

5 - Thinking of KPU's Physics for Modern Technology program as a whole, to what extent do you agree that the program's curriculum is relevant to your career goals?

Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Thinking of KPU's Physics for Modern Technology 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	0%
3	Neither agree nor disagree	0%
4	Somewhat agree	62%
5	Strongly agree	38%
	Total	13

6 - Overall, how satisfied are you with the curriculum of KPU's Physics for Modern Technology program?

Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Overall, how satisfied are you with the curriculum of KPU's Physics for Modern Technology program?	Percentage
1	Very dissatisfied	0%
2	Somewhat dissatisfied	8%
3	Neither satisfied nor dissatisfied	0%
4	Somewhat satisfied	54%
5	Very satisfied	38%
	Total	13

7 - Thinking of KPU's Physics for Modern Technology program's curriculum as a whole, please indicate the strengths of the program.

Hands on training with small class sizes
Very technical/interesting subjects
Courses are relevant to each other, and so far there have been no situations where one course does not cover the material in a way that hampers a students fundamental understanding of the topic.
The focus on electronics and how they apply to research is a strength
•hands-on learning (projects, labs) •approachable instructors (**Instructor Names Redacted**) •work experience is integrated into the program
The instructors
It covers a wide range of topics
The small class sizes make for more effective teaching, and the instructors are all very personable.
I think it has a great ratio of labs and theory courses. The special topics course about communications and soft skills really helps.
Lots of various and interesting physics courses.
The hands-on experience that students gain with this program is unlike any other degree offered right now. Dealing with applied physics concepts is not only helpful for persuing a career after the program but I believe it will benefit me if I continue my physics studies at graduate level or go into research.
hands on education; variety of subjects; close connection to real world when it comes to knowledge application

8 - Thinking of KPU's Physics for Modern Technology program's curriculum as a whole, please provide suggestions you have for improvement.

more frequently offered courses
More hands on/applications for job prospect. More clear understanding of these jobs prospects.
In regards to pre-requisites, if one of them is a mathematics course; than it should not limit physics students from still applying into the course. As most students have a mathematical background from their previous courses; one math course should not hold them back from continuing their degree.
•advertise it more so people would know about it. I found it by chance and didnt know beforehand that it existed.
perhaps add more math courses as a requirement, such as calculus 3 and 4
Include more on how the topics we learn are applicable in the real world
The third-fourth year semester bi-annual cycle thing is a big downside. It essentially forces every other enrolment class of students to spend an extra year in school
I think opening up a couple 3rd and 4th year courses during summer semester can allow those that are behind to catch up or an opportunity for those that wants to get ahead.
Statistics courses are required for most other continuing programs, so I would add a statistics requirement to the curriculum.
Nothing standing out

9 - What topics, if any, are missing from the program?

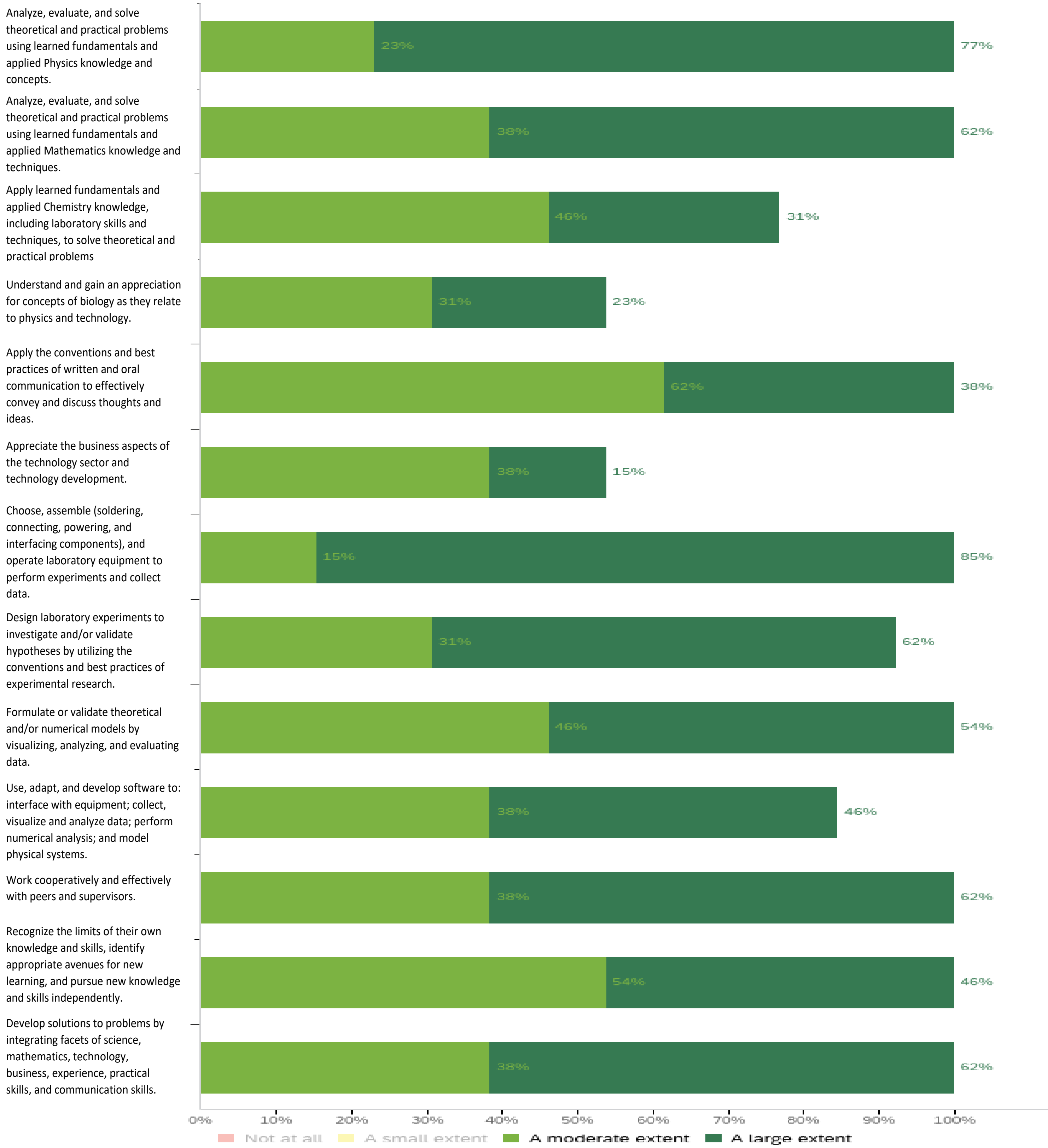
A course in Astronomy from a scientific approach, recently the Astrophysics course was added, but for anyone who wants to pursue a career in Astronomy/Astrophysics than they must learn these courses elsewhere; as there are only a few courses in this field, with most of them being made for Arts/Literature students.
•more astrophysics related content maybe?
courses on particle physics, astronomy
Statistics
I think a materials science course would be fascinating. A science/business hybrid course would also be very helpful for career planning
I think some 3D designing/ drafting course or the concepts of how to design can be a great addition.
See above.
I wish statistics as course was part of the curriculum, or at least an option for an elective course

QUESTIONS ON CHAPTER 4: EFFECTIVENESS OF INSTRUCTIONAL DELIVERY

Instructional Design and Delivery

Are appropriate opportunities provided to help students acquire the PLOs?

10 - Program Learning Outcomes are statements that describe the knowledge and skills students will have upon completion of a program. To what extent are the courses you are taking for KPU's Physics for Modern Technology program helping you develop each of the following learning outcomes?

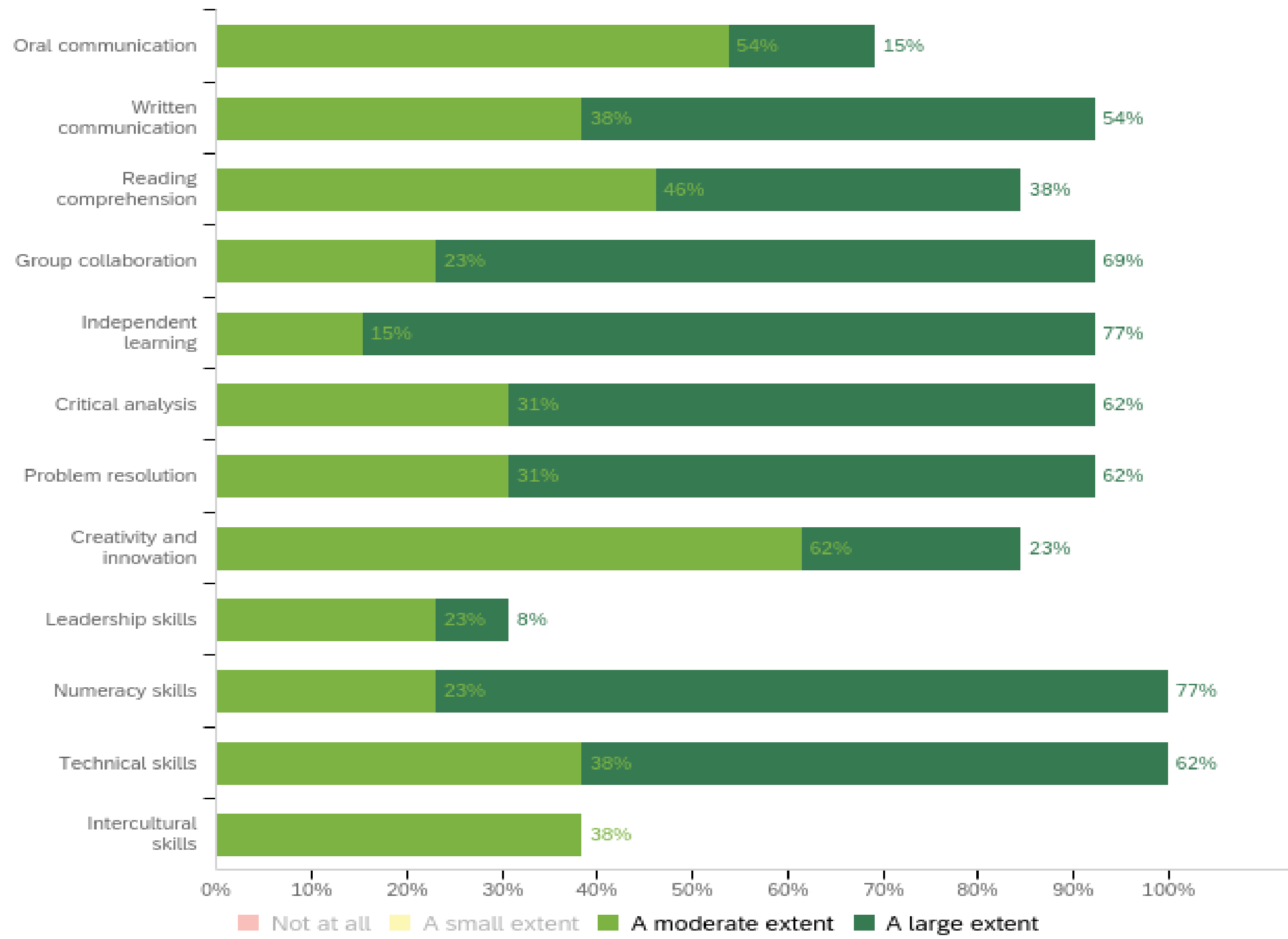


Note that “not at all” and “a small extent” categories are excluded from the chart for quick comparisons between items. Please use the frequency table below for the percentages for the “not at all” and “a small extent” categories

#	Question	Not at all	A small extent	A moderate extent	A large extent	Total
1	Analyze, evaluate, and solve theoretical and practical problems using learned fundamentals and applied Physics knowledge and concepts.	0%	0%	23%	77%	13
2	Analyze, evaluate, and solve theoretical and practical problems using learned fundamentals and applied Mathematics knowledge and techniques.	0%	0%	38%	62%	13
3	Apply learned fundamentals and applied Chemistry knowledge, including laboratory skills and techniques, to solve theoretical and practical problems.	0%	23%	46%	31%	13
4	Understand and gain an appreciation for concepts of biology as they relate to physics and technology.	0%	46%	31%	23%	13
5	Apply the conventions and best practices of written and oral communication to effectively convey and discuss thoughts and ideas.	0%	0%	62%	38%	13
6	Appreciate the business aspects of the technology sector and technology development.	0%	46%	38%	15%	13
7	Choose, assemble (soldering, connecting, powering, and interfacing components), and operate laboratory equipment to perform experiments and collect data.	0%	0%	15%	85%	13
8	Design laboratory experiments to investigate and/or validate hypotheses by utilizing the conventions and best practices of experimental research.	0%	8%	31%	62%	13
9	Formulate or validate theoretical and/or numerical models by visualizing, analyzing, and evaluating data.	0%	0%	46%	54%	13
10	Use, adapt, and develop software to: interface with equipment; collect, visualize and analyze data; perform numerical analysis; and model physical systems.	0%	15%	38%	46%	13
11	Work cooperatively and effectively with peers and supervisors.	0%	0%	38%	62%	13
12	Recognize the limits of their own knowledge and skills, identify appropriate avenues for new learning, and pursue new knowledge and skills independently.	0%	0%	54%	46%	13
13	Develop solutions to problems by integrating facets of science, mathematics, technology, business, experience, practical skills, and communication skills.	0%	0%	38%	62%	13

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

11 - To what extent are the courses you are taking for KPU's Physics for Modern Technology program helping you develop each of the following essential skills?

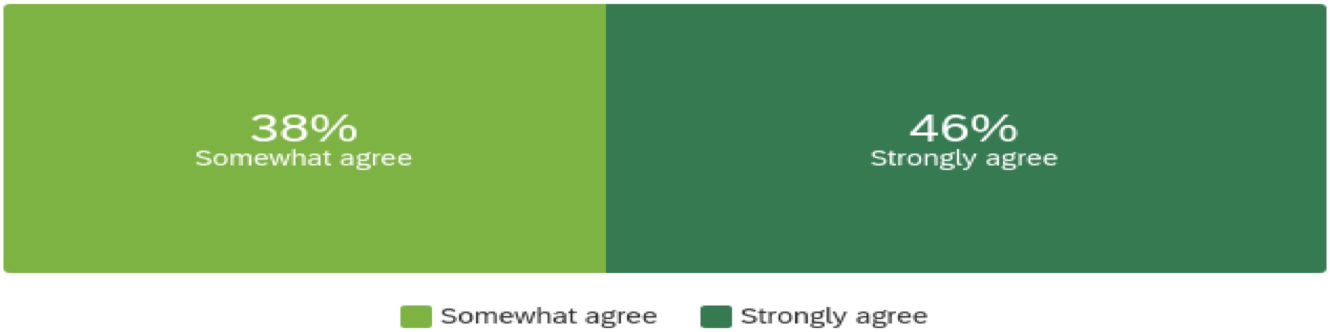


Note that "not at all" and "a small extent" categories are excluded from the chart for quick comparisons between items. Please use the frequency table below for the percentages for the "not at all" and "a small extent" categories.

#	Question	Not at all	A small extent	A moderate extent	A large extent	Total
1	Oral communication	0%	31%	54%	15%	13
2	Written communication	0%	8%	38%	54%	13
3	Reading comprehension	0%	15%	46%	38%	13
4	Group collaboration	0%	8%	23%	69%	13
5	Independent learning	0%	8%	15%	77%	13
6	Critical analysis	0%	8%	31%	62%	13
7	Problem resolution	0%	8%	31%	62%	13
8	Creativity and innovation	0%	15%	62%	23%	13
9	Leadership skills	0%	69%	23%	8%	13
10	Numeracy skills	0%	0%	23%	77%	13
11	Technical skills	0%	0%	38%	62%	13
12	Intercultural skills	15%	46%	38%	0%	13

Are appropriate work-integrated and/or community-engaged learning opportunities provided to help students acquire the learning outcomes?

12 - To what extent do you agree that you have sufficient opportunities in the program to reinforce your learning through practical application of this learning?

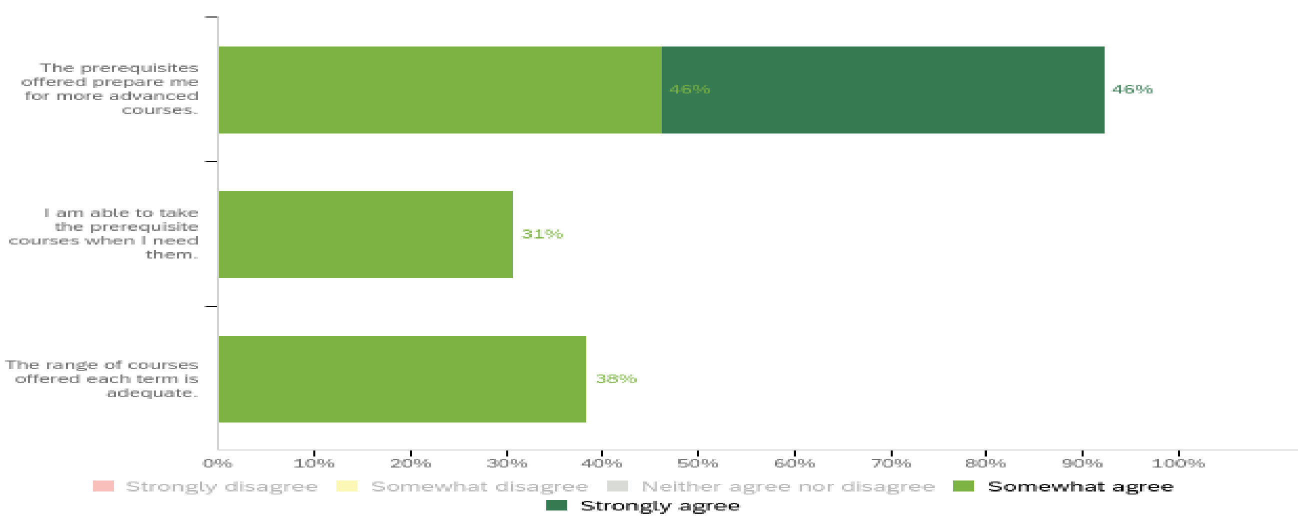


Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	To what extent do you agree that you have sufficient opportunities in the program to reinforce your learning through practical application of this learning?	Percentage
1	Strongly disagree	8%
2	Somewhat disagree	0%
3	Neither agree nor disagree	8%
4	Somewhat agree	38%
5	Strongly agree	46%
	Total	13

Does the program design ensure students are prepared for subsequent courses? / Are students making satisfactory progress in the program?

13 - Thinking of KPU's Physics for Modern Technology program as a whole, please indicate your agreement with the following.

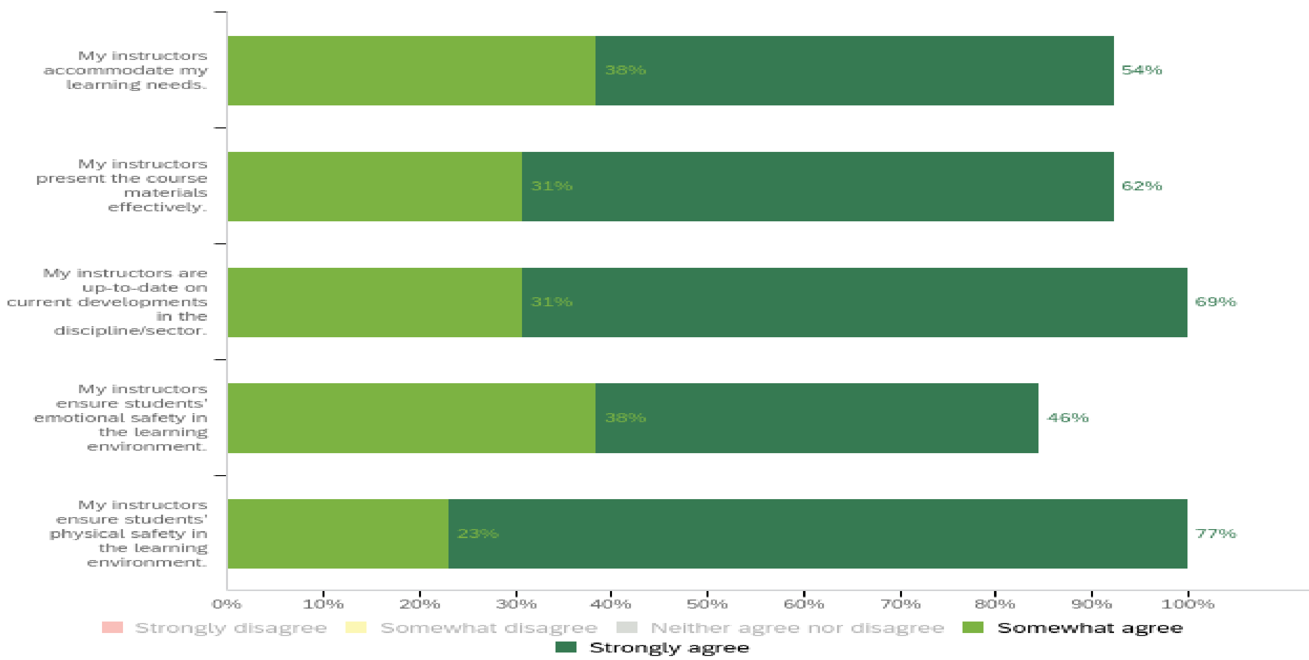


Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Question	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
1	The prerequisites offered prepare me for more advanced courses.	0%	0%	8%	46%	46%	13
2	I am able to take the prerequisite courses when I need them.	0%	54%	15%	31%	0%	13
3	The range of courses offered each term is adequate.	0%	46%	15%	38%	0%	13

Does the instruction meet the needs of diverse learners?

14 - Thinking of how the program is delivered, please indicate your agreement with the following.



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Question	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
1	My instructors accommodate my learning needs.	0%	8%	0%	38%	54%	13
2	My instructors present the course materials effectively.	0%	0%	8%	31%	62%	13
3	My instructors are up-to-date on current developments in the discipline/sector.	0%	0%	0%	31%	69%	13
4	My instructors ensure students' emotional safety in the learning environment.	0%	0%	15%	38%	46%	13
5	My instructors ensure students' physical safety in the learning environment.	0%	0%	0%	23%	77%	13

15 - Overall, how satisfied are you with the instruction you have received in KPU's Physics for Modern Technology program?

Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Overall, how satisfied are you with the instruction you have received in KPU's Physics for Modern Technology program?	Percentage
1	Very dissatisfied	0%
2	Somewhat dissatisfied	0%
3	Neither satisfied nor dissatisfied	8%
4	Somewhat satisfied	46%
5	Very satisfied	46%
	Total	13

16 - Thinking of how instruction is delivered across the program as a whole, please indicate the strengths of the program instruction.

very knowledgeable instructors who care about their students
Delivered clearly.
Instructors have a deep understanding of the subjects, in a way that helps students to not only improve their own understanding; but to also ask thoughtful questions regarding future career/technological opportunities in these respective fields.
Practical demonstrations really help me understand the concepts
•professors are generally approachable •i like the lab settings where we can work independently
Instructors show care to teach each each individual student
Small class sizes
I think each course carries over very well from first year to third year. By fourth year, the topics become more complex but fewer in each course, so instructions are longer and more time allocated is great.
All the professors are very approachable with coursework as well as with any other issues students may be having related to their education.
very technical and inspiring

17 - Thinking of how instruction is delivered across the program as a whole, please provide suggestions you have for improvement in program instruction.

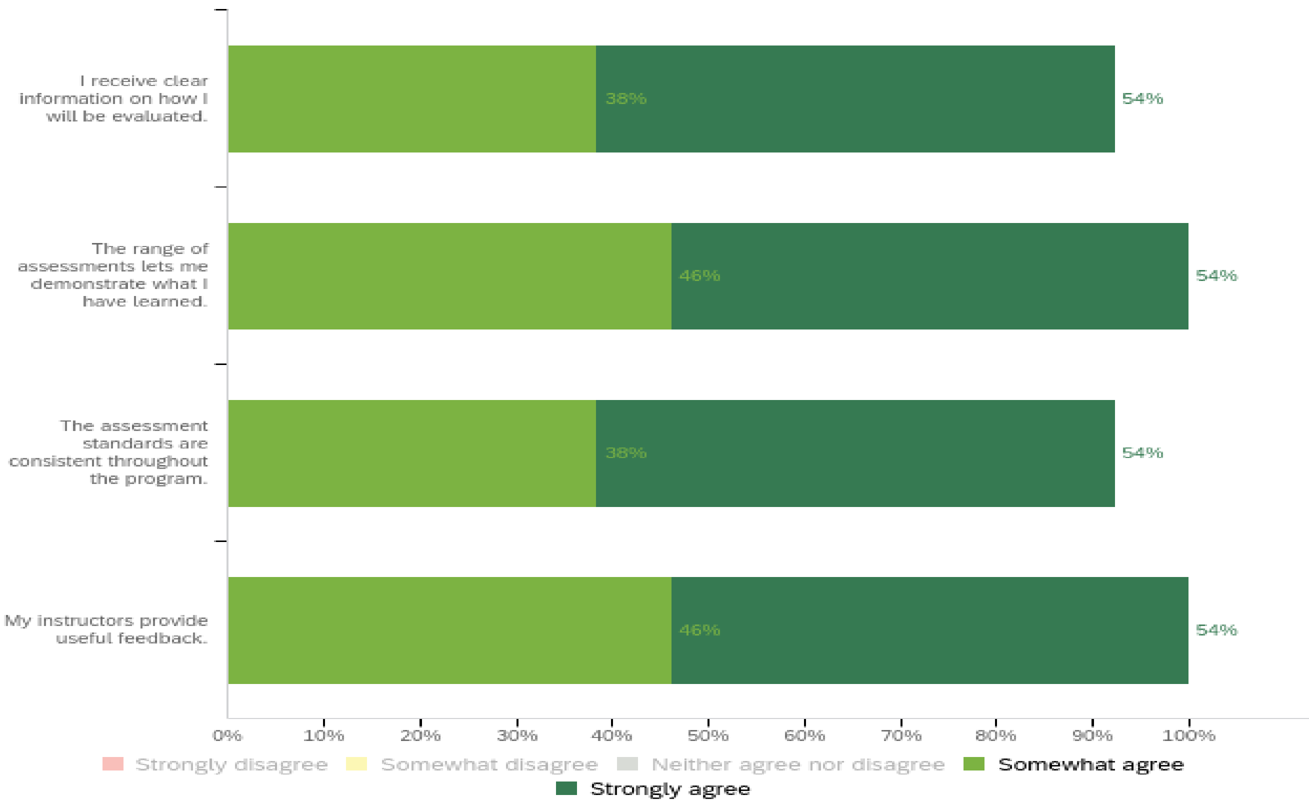
Better examples/applications to theories for better understanding of material. Concepts needed for exams not always clear.
Three hours lectures tend to cover the same material an almost two hour lecture covers, as most instructors simply go over the material too slowly that it makes it hard to focus for the full lecture. Especially since the material tends to be glanced over in a way that enforces the need to simply study it all over again once I leave the class. Also it seems most instructors find three hour lectures to be difficult to lecture, as they are not able to identify how much course material they should cover each lesson; hence the long and arduous discussions on very minor topics.
•some courses need to be pre-reqs for other courses (electronics should be a pre-req for sensors)
None that I can think of currently

More examples, especially with theoretical topics

I would not change the instruction, I would just have certain courses offered more frequently, but I understand that limitations are due to the department's size.

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

18 - Thinking of how learning is assessed in the program as a whole, indicate your agreement with the following.



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

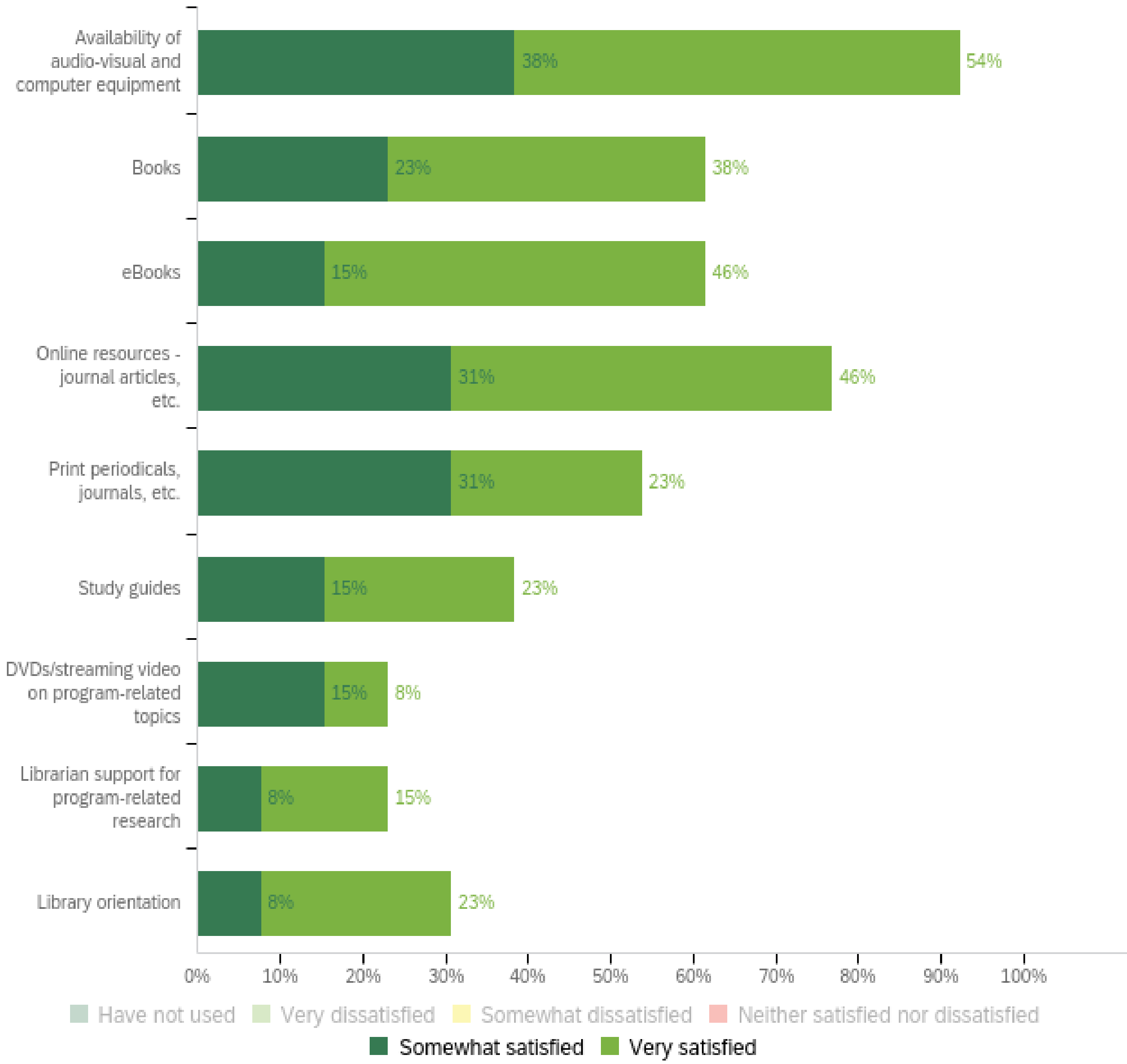
#	Question	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
1	I receive clear information on how I will be evaluated.	0%	0%	8%	38%	54%	13
2	The range of assessments lets me demonstrate what I have learned.	0%	0%	0%	46%	54%	13
3	The assessment standards are consistent throughout the program.	0%	0%	8%	38%	54%	13
4	My instructors provide useful feedback.	0%	0%	0%	46%	54%	13

QUESTIONS ON CHAPTER 5: RESOURCES, SERVICES AND FACILITIES

Program Resources, Services and Facilities

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

19 - How satisfied are you with the following library resources as they apply to KPU's Physics for Modern Technology program?

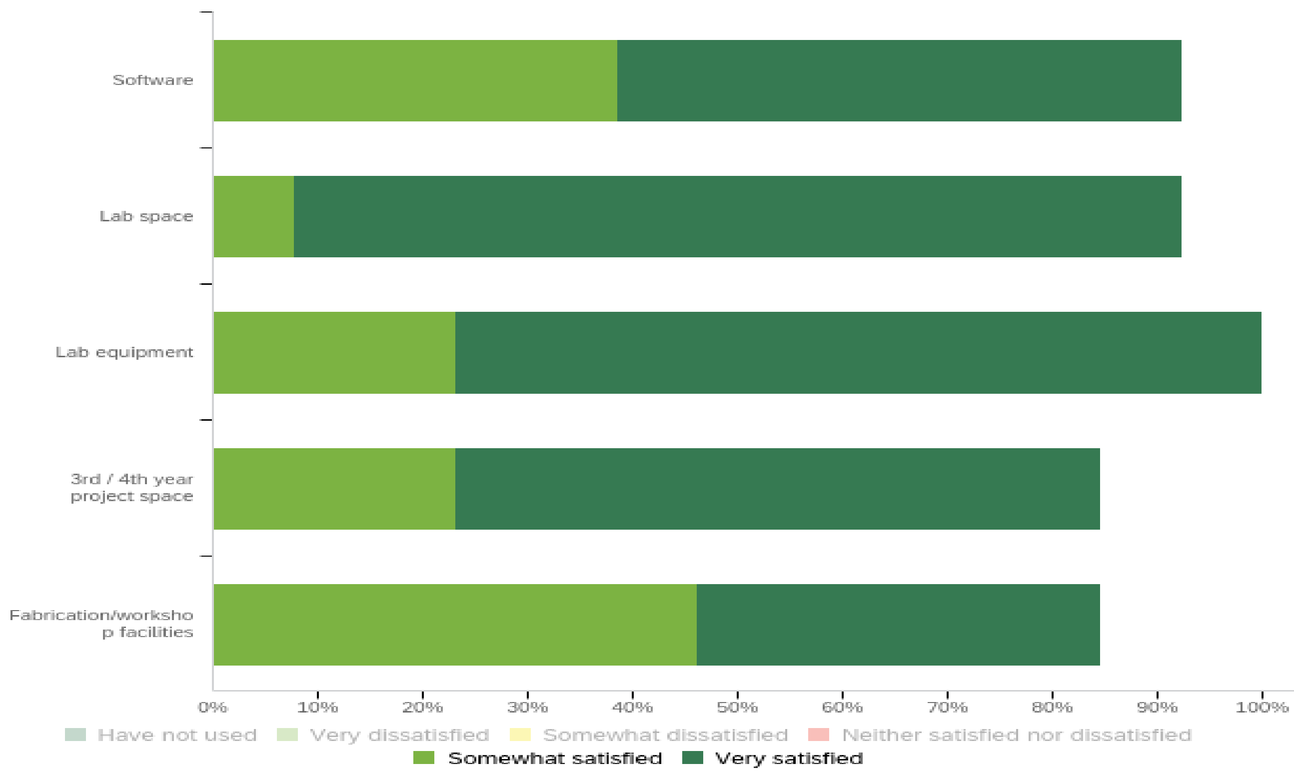


Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Question	Have not used	Very dissatisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Very satisfied	Total
1	Availability of audio-visual and computer equipment	0%	0%	0%	8%	38%	54%	13
2	Books	15%	0%	0%	23%	23%	38%	13
3	eBooks	15%	0%	0%	23%	15%	46%	13
4	Online resources - journal articles, etc.	8%	0%	0%	15%	31%	46%	13
5	Print periodicals, journals, etc.	38%	0%	0%	8%	31%	23%	13
6	Study guides	31%	0%	8%	23%	15%	23%	13
7	DVDs/streaming video on program-related topics	62%	0%	0%	15%	15%	8%	13
8	Librarian support for program-related research	46%	8%	0%	23%	8%	15%	13
9	Library orientation	54%	0%	0%	15%	8%	23%	13

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

20 - How satisfied are you with the following specialized technology and facilities as they apply to KPU's Physics for Modern Technology program?

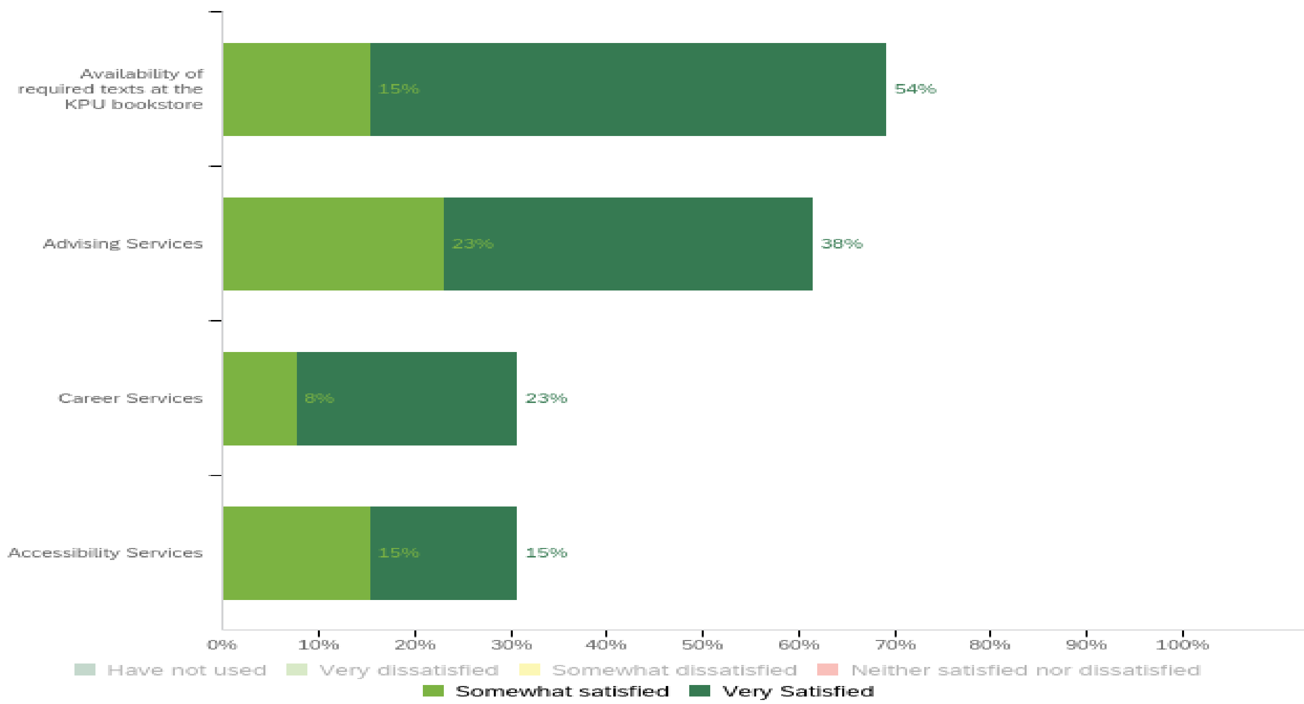


Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Question	Have not used	Very dissatisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Very satisfied	Total
1	Software	0%	0%	0%	8%	38%	54%	13
2	Lab space	0%	0%	0%	8%	8%	85%	13
3	Lab equipment	0%	0%	0%	0%	23%	77%	13
4	3rd / 4th year project space	8%	0%	0%	8%	23%	62%	13
5	Fabrication/workshop facilities	15%	0%	0%	0%	46%	38%	13

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

21 - How satisfied are you with the following as they apply to KPU's Physics for Modern Technology program?



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Question	Have not used	Very dissatisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Very Satisfied	Total
1	Availability of required texts at the KPU bookstore	8%	0%	8%	15%	15%	54%	13
2	Advising Services	23%	0%	0%	15%	23%	38%	13
3	Career Services	62%	0%	0%	8%	8%	23%	13
4	Accessibility Services	54%	0%	8%	8%	15%	15%	13

Appendix G

Faculty Survey Report

Physics for Modern Technology Program Review - Faculty Survey Results

The faculty survey was sent to 25 Physics for Modern Technology faculty members. A total of 15 faculty members responded. The response rate is 60%.

Note: The data includes open-ended comments. In order to preserve integrity and objectivity, OPA does not do value-judgment editing (i.e. we do not fix spelling errors, syntax issues, punctuation, etc.). Comments are included verbatim – with one exception: if individuals or courses are named, OPA redacts the name of the instructor or course. This rule applies to whether the comment is good, bad or indifferent.

About Your Courses

1 - Please tell us about yourself. Are you...

#	Answer	%	Count
1	Instructor	79%	11
2	Lab instructor	7%	1
3	Lab technician	14%	2
	Total	100%	14

2 - Which level courses do you teach? Please select all that apply.

#	Answer	%	Count
1	Preparatory and/or first-year courses	100%	13
2	Second-year courses	62%	8
3	Third- or fourth-year courses	54%	7
	Total		13

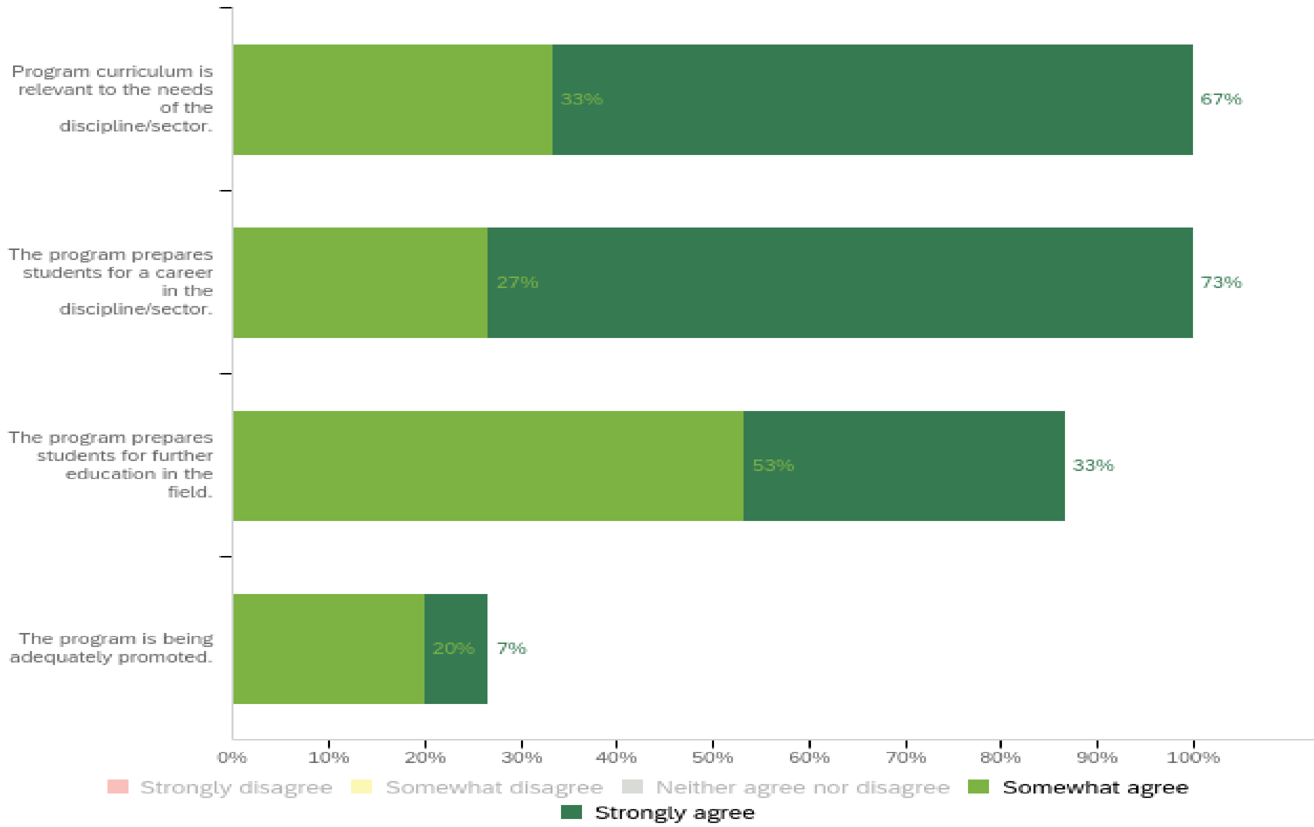
Note: The last row presents the total number of respondents. The total number of responses for this question is greater than the number of respondents. Therefore, the percentage total exceeds 100%.

QUESTIONS ON CHAPTER 3: PROGRAM RELEVANCE AND DEMAND

Program Relevance

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

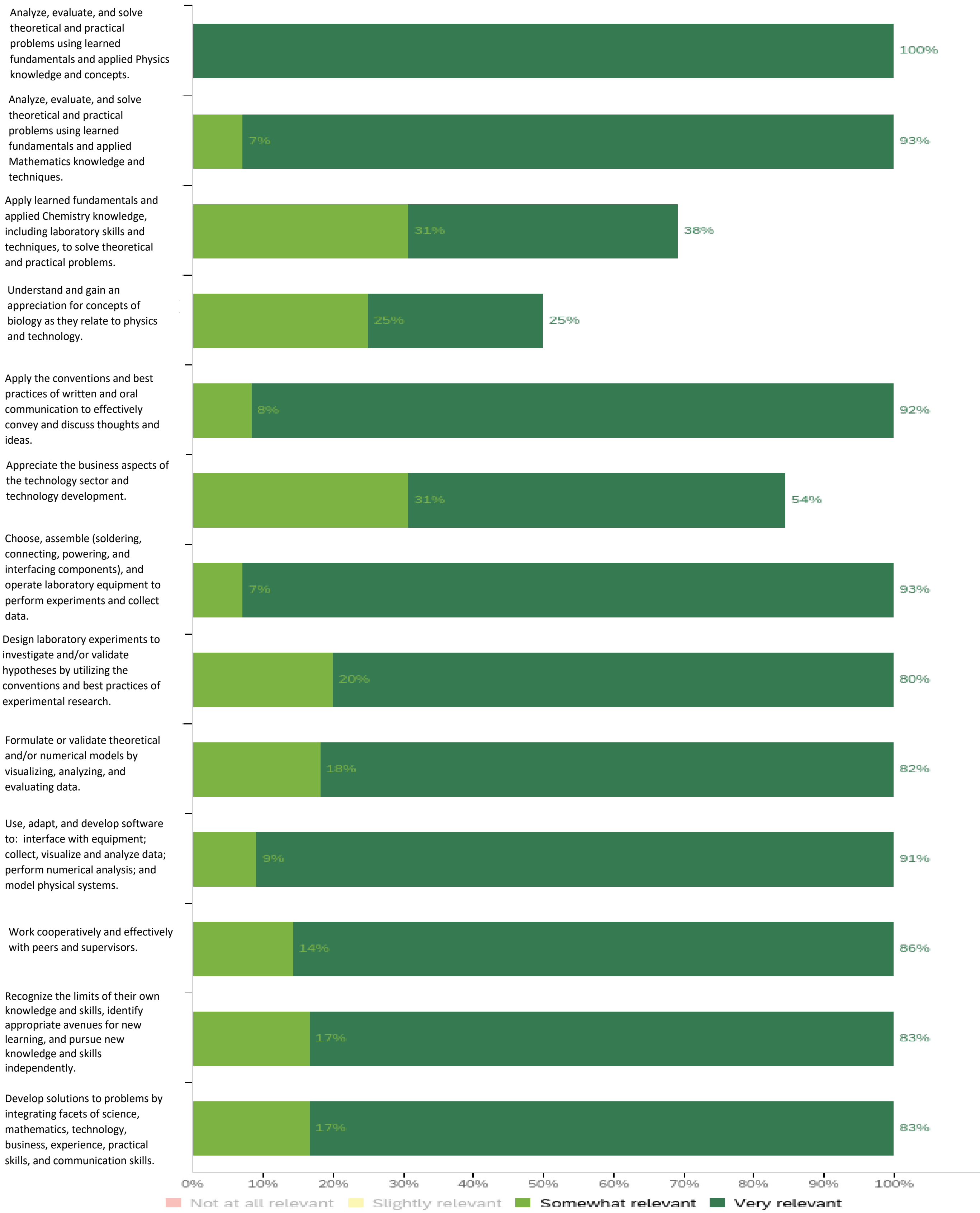
3 - Thinking of KPU's Physics for Modern Technology program as a whole, indicate the extent you agree with the following.



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	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%	15
2	The program prepares students for a career in the discipline/sector.	0%	0%	0%	27%	73%	15
3	The program prepares students for further education in the field.	0%	7%	7%	53%	33%	15
4	The program is being adequately promoted.	7%	40%	27%	20%	7%	15

4 - Please indicate how relevant each of the following Program Learning Outcomes is to the current needs of the discipline/sector.



Note that “not at all relevant” and “slightly relevant” 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 relevant” and “slightly relevant” categories.

#	Question	Not at all relevant	Slightly relevant	Somewhat relevant	Very relevant	Total
1	Analyze, evaluate, and solve theoretical and practical problems using learned fundamentals and applied Physics knowledge and concepts.	0%	0%	0%	100%	14
2	Analyze, evaluate, and solve theoretical and practical problems using learned fundamentals and applied Mathematics knowledge and techniques.	0%	0%	7%	93%	14
3	Apply learned fundamentals and applied Chemistry knowledge, including laboratory skills and techniques, to solve theoretical and practical problems.	0%	31%	31%	38%	13
4	Understand and gain an appreciation for concepts of biology as they relate to physics and technology.	8%	42%	25%	25%	12
5	Apply the conventions and best practices of written and oral communication to effectively convey and discuss thoughts and ideas.	0%	0%	8%	92%	12
6	Appreciate the business aspects of the technology sector and technology development.	8%	8%	31%	54%	13
7	Choose, assemble (soldering, connecting, powering, and interfacing components), and operate laboratory equipment to perform experiments and collect data.	0%	0%	7%	93%	14
8	Design laboratory experiments to investigate and/or validate hypotheses by utilizing the conventions and best practices of experimental research.	0%	0%	20%	80%	15
9	Formulate or validate theoretical and/or numerical models by visualizing, analyzing, and evaluating data.	0%	0%	18%	82%	11
10	Use, adapt, and develop software to: interface with equipment; collect, visualize and analyze data; perform numerical analysis; and model physical systems.	0%	0%	9%	91%	11
11	Work cooperatively and effectively with peers and supervisors.	0%	0%	14%	86%	14
12	Recognize the limits of their own knowledge and skills, identify appropriate avenues for new learning, and pursue new knowledge and skills independently.	0%	0%	17%	83%	12
13	Develop solutions to problems by integrating facets of science, mathematics, technology, business, experience, practical skills, and communication skills.	0%	0%	17%	83%	12

5 - Overall, how satisfied are you with KPU's Physics for Modern Technology program curriculum?

Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Overall, how satisfied are you with KPU's Physics for Modern Technology program curriculum?	Percentage
1	Very dissatisfied	0%
2	Somewhat dissatisfied	7%
3	Neither satisfied nor dissatisfied	7%
4	Somewhat satisfied	43%
5	Very satisfied	43%
	Total	14

6 - Thinking of KPU's Physics for Modern Technology program's curriculum as a whole, please indicate the strengths of the program.

Practical, hands-on training, application of theory, project work
The curriculum is broad enough to provide students with a good background in fundamental and applied physics while at the same time providing them with skills that are directly applicable to careers in the tech sector. The required work experience gives students valuable exposure to the workplace and often leads to post-graduation career opportunities. The curriculum ensure that students' problem-solving skills are constantly developing and are very strong by the time they finish the program.
Graduates (and students) can turn theory into practice. Not all science degrees at the baccalaureate level can, or aim to, do this.
Hands on projects
I think it is a great program. It is very practical and focus towards generating problem solvers.
The labs.
Lot's of practical training
Hands on classes
The majority of the universities with a Physics degree prepare students to continue in academia while failing to prepare them for the industrial application of the degree. Ironically, only a few percentages of the graduates would stay in academia. PMT is meant to directly address the majority of enthusiasts in physics who are willing to work after their graduations while also preparing them for academic life.
The work experience is a huge strength, as is the breadth of the curriculum

7 - Thinking of KPU's Physics for Modern Technology program's curriculum as a whole, please provide any suggestions you have for improvement.

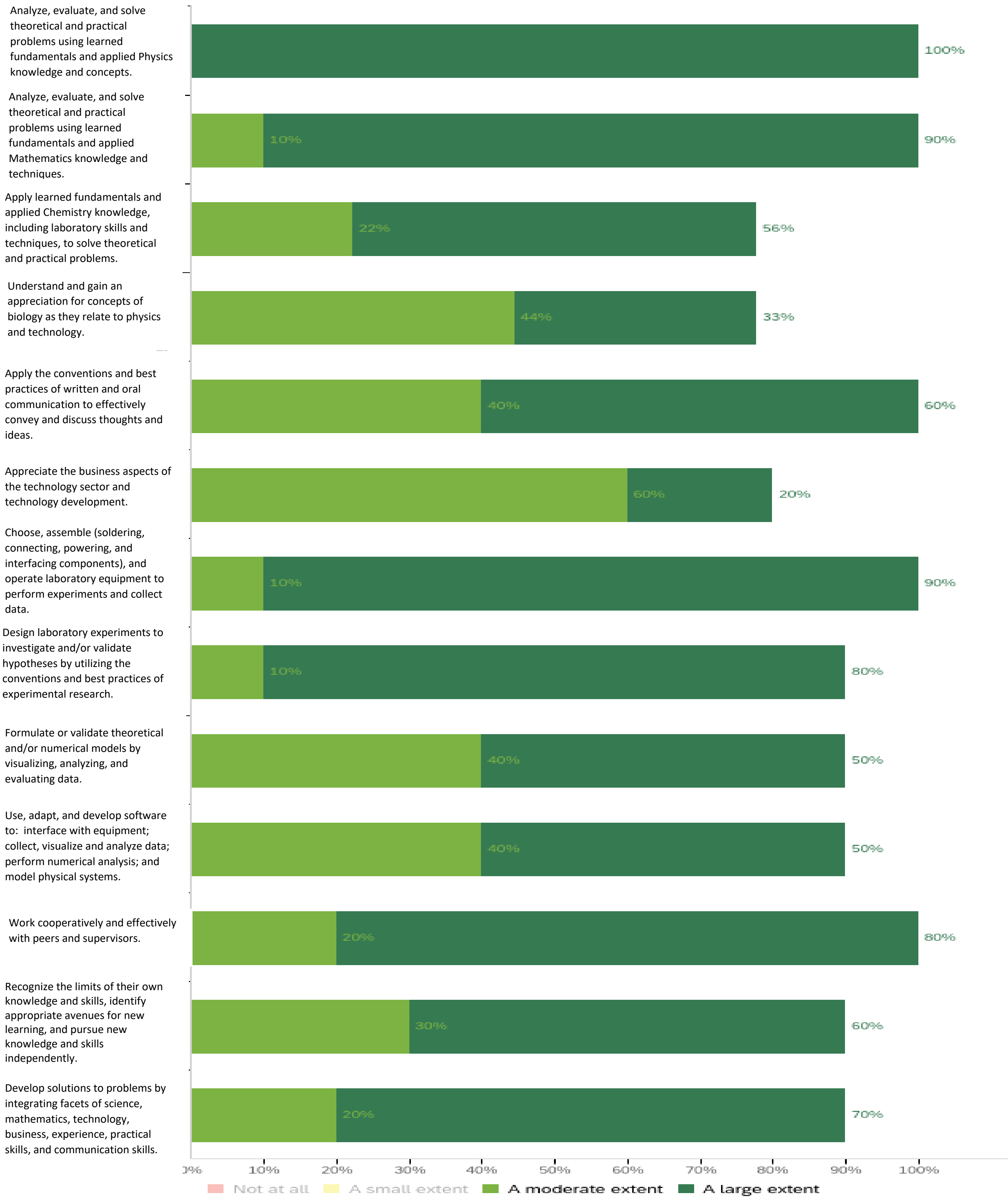
The computer programming content of the program needs to be strengthened, ideally through the addition of one or two dedicated courses (in addition to continuing to infuse it in many of the existing courses). Although students develop quite good communication skills during the program, this area could also be strengthened (for example through something like the recent Special Topics offering).
It would be great if we can find room for RF technology.
Place Multivariable-&-Vector-Calculus on the term after Integral Calculus, that is, on the 1st-term of the 2nd-year. Place a Linear Algebra course as a 1st-year-2nd-term course, or replace their Linear Algebra course by MATH 1152(a course that includes complex numbers on its topics and is offered every Spring term). Then add course covering differential equations (ODEs, PDEs and Fourier series)in the 2nd-term of the 2nd-year of the program.
Dedicated Computer Programming course
- The program is not being promoted the way it should. There is a huge capacity here and I don't think the importance of the program is well advertised. Students would gain skills that are directly applicable to industrial needs. This alone should attract students not only within Canada but also across the globe. - Data analysis also has a huge application in physics and we need to invest more in that. So perhaps fewer biology and chemistry courses to add more PMT relevant courses.
not really curricular, but more encouragement for students to take courses in "order" i.e. don't leave their chemistry until the last year.....

QUESTIONS ON CHAPTER 4: EFFECTIVENESS OF INSTRUCTIONAL DELIVERY

Instructional Design and Delivery

Are appropriate opportunities provided to help students acquire the PLOs?

8 - To what extent is KPU's Physics for Modern Technology program helping students develop the following Program Learning Outcomes?

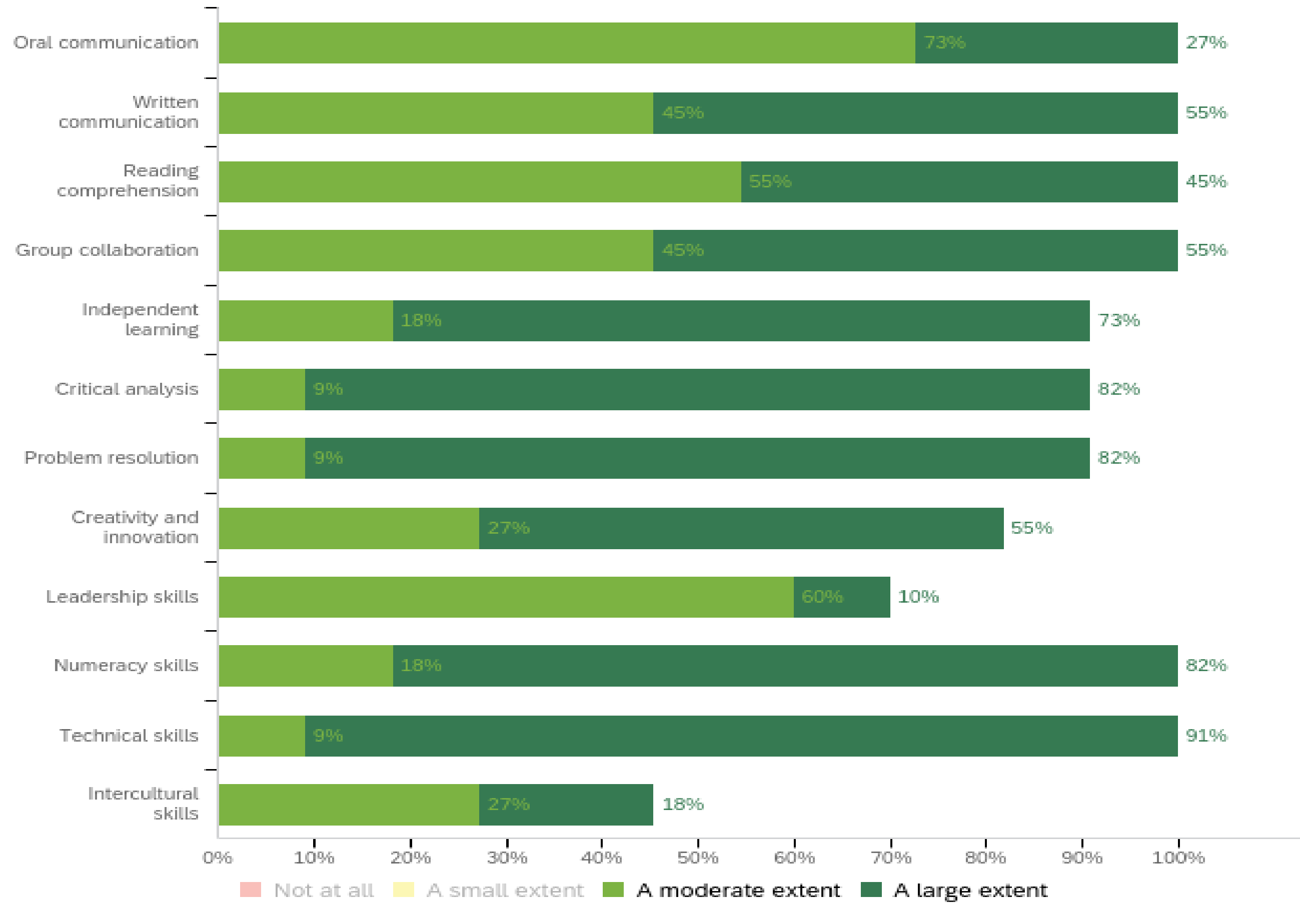


Note that "not at all" and "a small extent" categories are excluded from the chart for quick comparisons between items. Please use the frequency table below for the percentages for the "not at all" and "a small extent" categories.

#	Question	Not at all	A small extent	A moderate extent	A large extent	Total
1	Analyze, evaluate, and solve theoretical and practical problems using learned fundamentals and applied Physics knowledge and concepts.	0%	0%	0%	100%	10
2	Analyze, evaluate, and solve theoretical and practical problems using learned fundamentals and applied Mathematics knowledge and techniques.	0%	0%	10%	90%	10
3	Apply learned fundamentals and applied Chemistry knowledge, including laboratory skills and techniques, to solve theoretical and practical problems.	0%	22%	22%	56%	9
4	Understand and gain an appreciation for concepts of biology as they relate to physics and technology.	11%	11%	44%	33%	9
5	Apply the conventions and best practices of written and oral communication to effectively convey and discuss thoughts and ideas.	0%	0%	40%	60%	10
6	Appreciate the business aspects of the technology sector and technology development.	10%	10%	60%	20%	10
7	Choose, assemble (soldering, connecting, powering, and interfacing components), and operate laboratory equipment to perform experiments and collect data.	0%	0%	10%	90%	10
8	Design laboratory experiments to investigate and/or validate hypotheses by utilizing the conventions and best practices of experimental research.	10%	0%	10%	80%	10
9	Formulate or validate theoretical and/or numerical models by visualizing, analyzing, and evaluating data.	10%	0%	40%	50%	10
10	Use, adapt, and develop software to: interface with equipment; collect, visualize and analyze data; perform numerical analysis; and model physical systems.	10%	0%	40%	50%	10
11	Work cooperatively and effectively with peers and supervisors.	0%	0%	20%	80%	10
12	Recognize the limits of their own knowledge and skills, identify appropriate avenues for new learning, and pursue new knowledge and skills independently.	10%	0%	30%	60%	10
13	Develop solutions to problems by integrating facets of science, mathematics, technology, business, experience, practical skills, and communication skills.	10%	0%	20%	70%	10

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

9 - To what extent is KPU's Physics for Modern Technology program helping students develop the following essential skills?



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.

#	Question	Not at all	A small extent	A moderate extent	A large extent	Total
1	Oral communication	0%	0%	73%	27%	11
2	Written communication	0%	0%	45%	55%	11
3	Reading comprehension	0%	0%	55%	45%	11
4	Group collaboration	0%	0%	45%	55%	11
5	Independent learning	9%	0%	18%	73%	11
6	Critical analysis	0%	9%	9%	82%	11
7	Problem resolution	0%	9%	9%	82%	11
8	Creativity and innovation	0%	18%	27%	55%	11
9	Leadership skills	0%	30%	60%	10%	10
10	Numeracy skills	0%	0%	18%	82%	11
11	Technical skills	0%	0%	9%	91%	11
12	Intercultural skills	36%	18%	27%	18%	11

10 - How satisfied are you with the students' preparation for 2000-level courses?

Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	How satisfied are you with the students' preparation for 2000-level courses?	Percentage
1	Very dissatisfied	13%
2	Somewhat dissatisfied	0%
3	Neither satisfied nor dissatisfied	13%
4	Somewhat satisfied	50%
5	Very satisfied	25%
	Total	8

11 - What do you think the program can do at the first-year level to make Physics for Modern Technology students better prepared for 2000-level course work?

No Results to Show

12 - How satisfied are you with the students' preparation for 3000-level and 4000-level courses?

Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	How satisfied are you with the students' preparation for 3000-level and 4000-level courses?	Percentage
1	Very dissatisfied	0%
2	Somewhat dissatisfied	0%
3	Neither satisfied nor dissatisfied	17%
4	Somewhat satisfied	50%
5	Very satisfied	33%
	Total	6

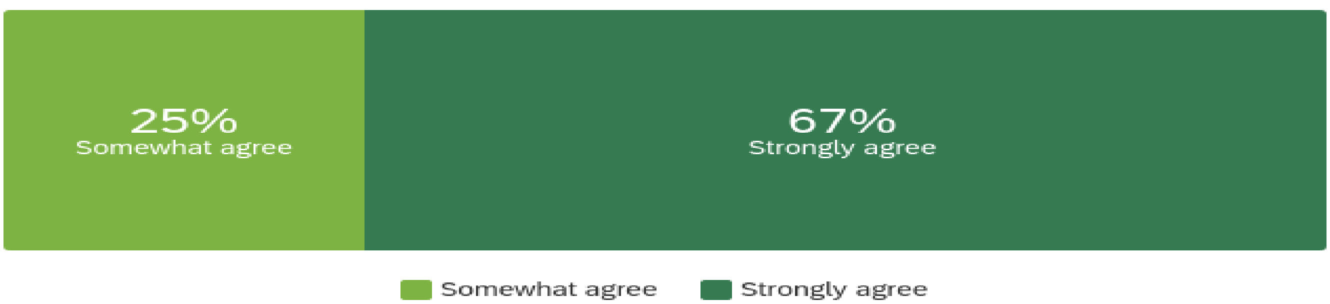
13 - What do you think the program can do at the second-year level to make Physics for Modern Technology students better prepared for 3000-level and 4000-level course work?

No Results to Show

14 - Since 3rd and 4th year courses are offered in alternate years, we have 3rd and 4th year students taking courses together. Please comment on any benefits or drawbacks you have noticed with this arrangement.

It has generally worked fine for the 4000-level course I teach. One drawback is that every other year, the 3rd year students have less time for work experience (4 months as opposed to 5 or 5.5 months). However, this is not a huge problem.
I see no benefit to students with this arregement.
Seems to be working well.
It works well!

15 - Thinking of KPU's Physics for Modern Technology program as a whole, to what extent do you agree that the prerequisites courses offered prepare students for more advanced courses?

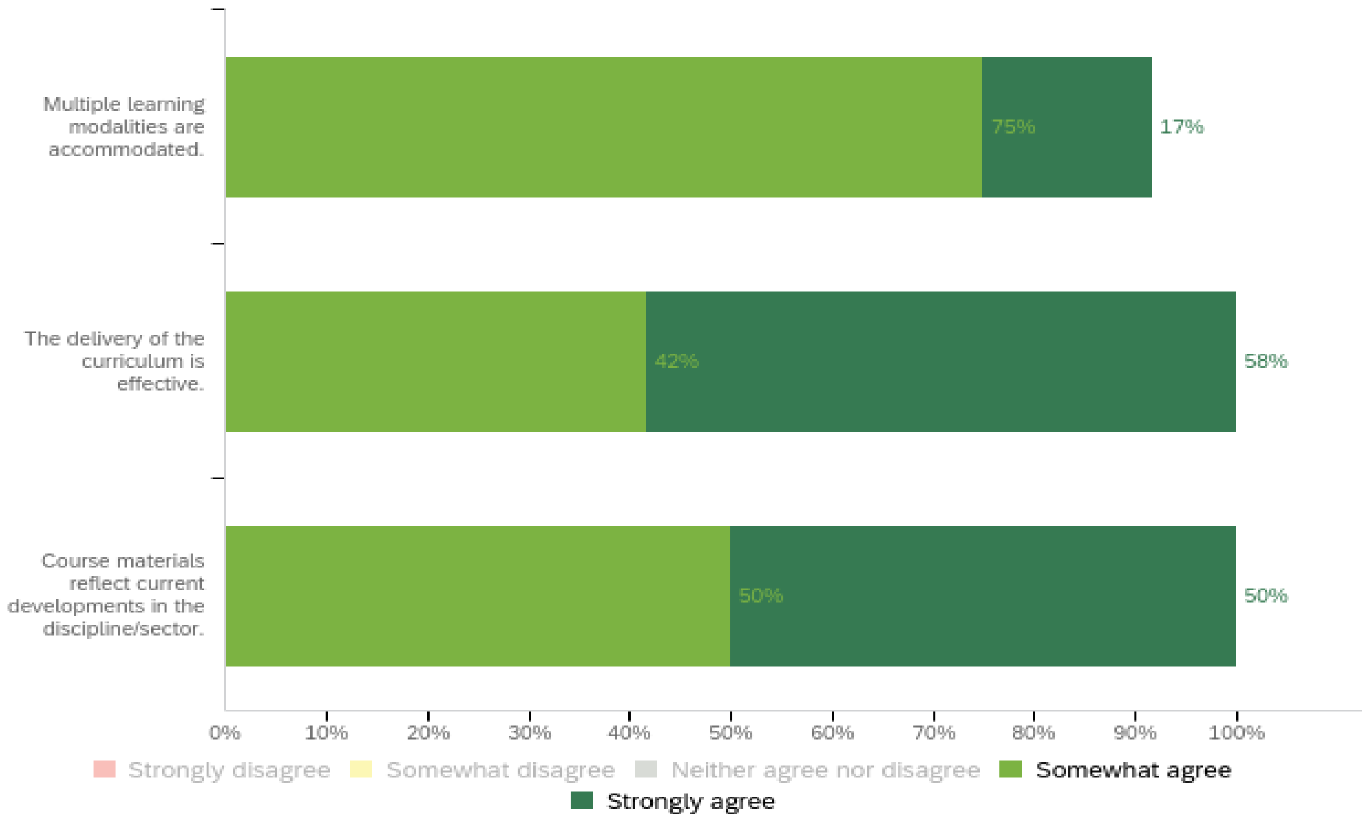


Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Thinking of KPU's Physics for Modern Technology program as a whole, to what extent do you agree that the prerequisites courses offered prepare students for more advanced courses?	Percentage
1	Strongly disagree	0%
2	Somewhat disagree	0%
3	Neither agree nor disagree	8%
4	Somewhat agree	25%
5	Strongly agree	67%
	Total	12

Does the instruction meet the needs of diverse learners?

16 - Thinking of how the program is delivered, please indicate your agreement with the following.



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Question	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
1	Multiple learning modalities are accommodated.	0%	0%	8%	75%	17%	12
2	The delivery of the curriculum is effective.	0%	0%	0%	42%	58%	12
3	Course materials reflect current developments in the discipline/sector.	0%	0%	0%	50%	50%	12

17 - Overall, how satisfied are you with the quality of instruction across the program?

Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Overall, how satisfied are you with the quality of instruction across the program?	Percentage
1	Very dissatisfied	0%
2	Somewhat dissatisfied	0%
3	Neither satisfied nor dissatisfied	10%
4	Somewhat satisfied	30%
5	Very satisfied	60%
	Total	10

18 - Thinking of how instruction is delivered across the program as a whole, please indicate the strengths of the program instruction.

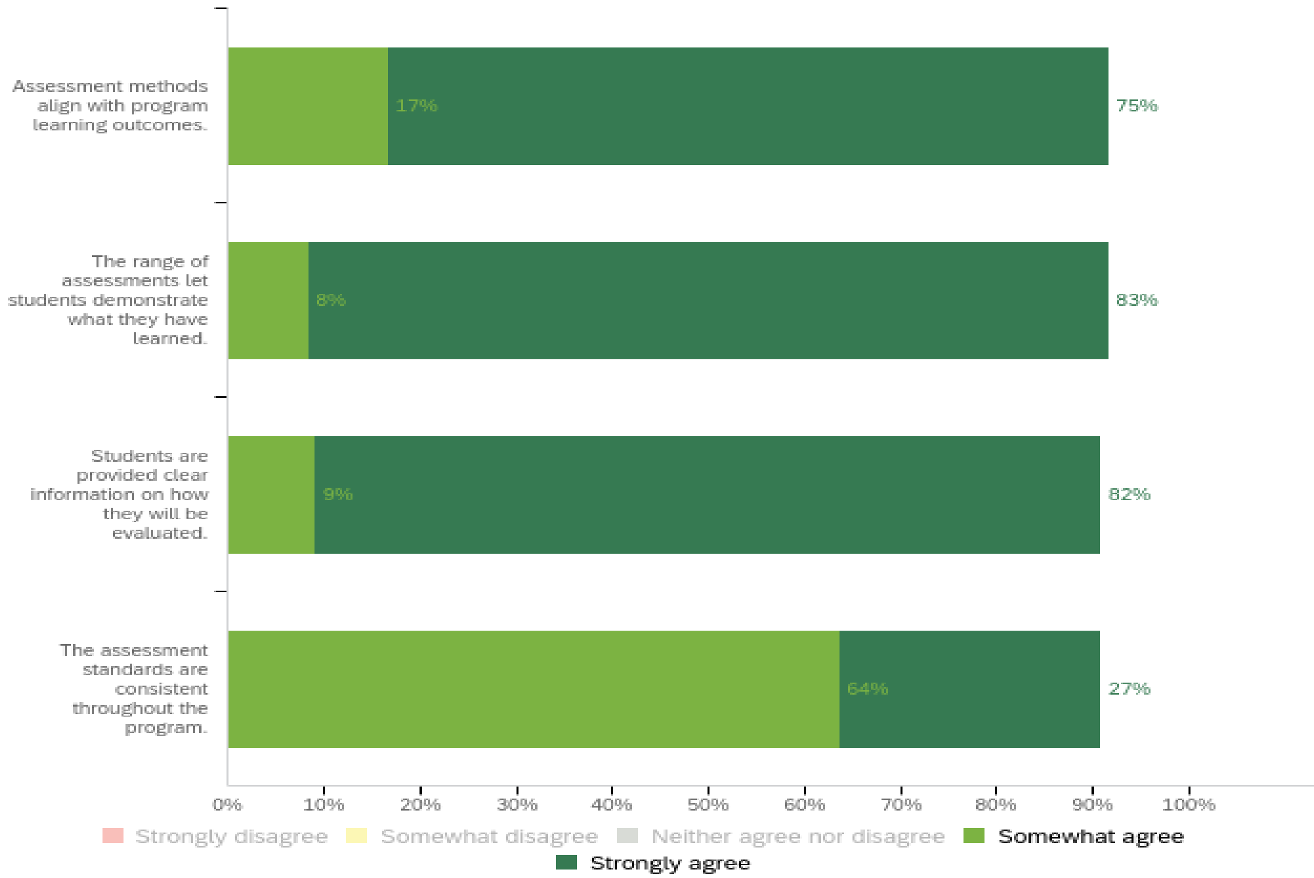
passionate, knowledgeable instructors
Since many/most of the courses take place in the lab, instruction is biased in favour of providing students with hands-on active and experiential learning opportunities, which serves them very well when they enter the workforce (either during their work experience of after graduation). The small classes ensure that students get a a lot of time to work with lab equipment.
Well qualified, dedicated faculty.
The lab training.
Small classes, lots of student-instructor interaction.

Q19 - Thinking of how instruction is delivered across the program as a whole, please provide any suggestions you have for improvements in program instruction.

integration of student-learning across different courses
I can't think of anything, but since there is a big interest in the department in sharing and developing instructional techniques, this would be a great topic for discussion at a department meeting.
faculty could be more engaged in their own professional development and research if there were ongoing time and facilities allocated for it.

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

20 - Thinking of how learning is assessed in the program as a whole, please indicate your agreement with the following.



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

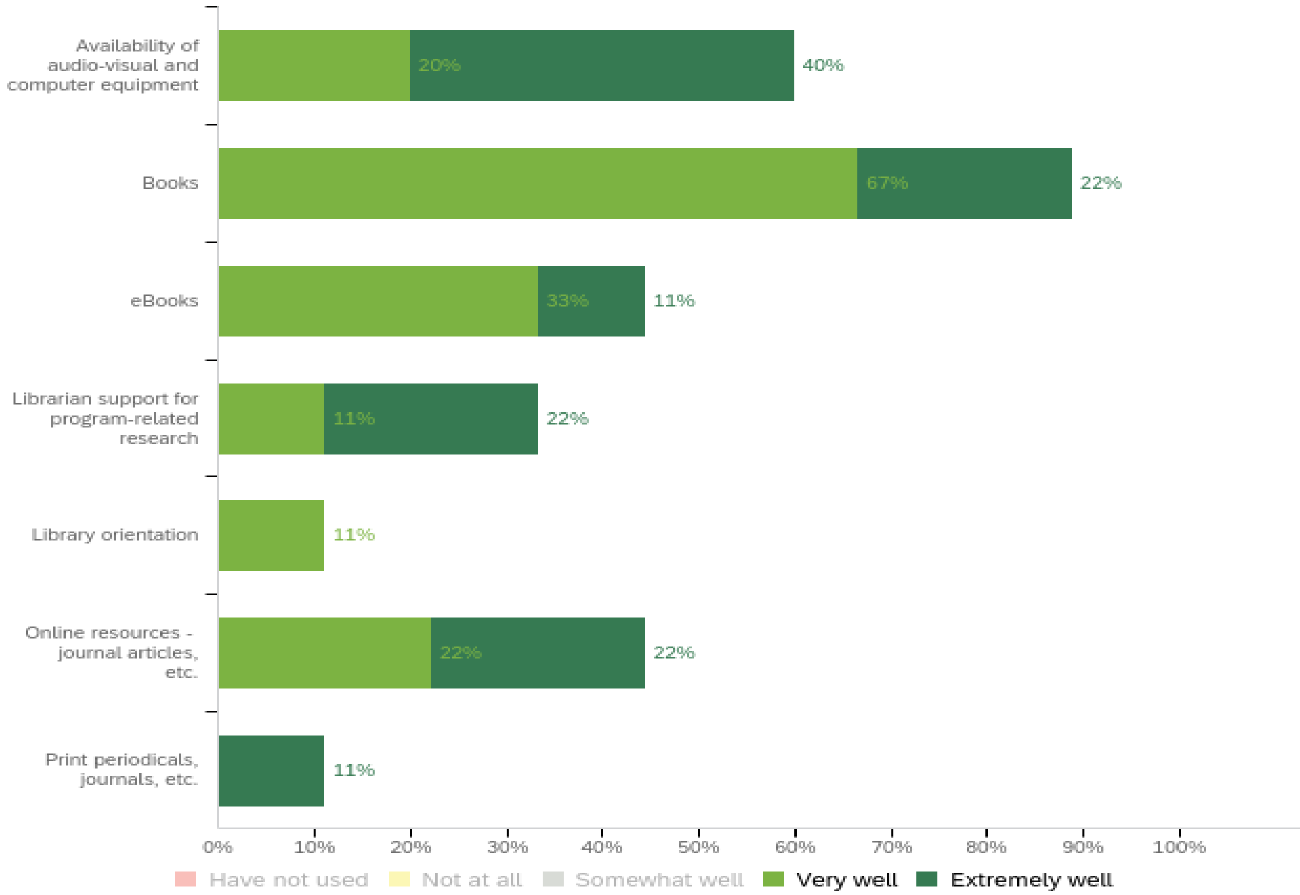
#	Question	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
1	Assessment methods align with program learning outcomes.	0%	0%	8%	17%	75%	12
2	The range of assessments let students demonstrate what they have learned.	0%	0%	8%	8%	83%	12
3	Students are provided clear information on how they will be evaluated.	0%	0%	9%	9%	82%	11
4	The assessment standards are consistent throughout the program.	0%	0%	9%	64%	27%	11

QUESTIONS ON CHAPTER 5: RESOURCES, SERVICES AND FACILITIES

Program Resources, Services and Facilities

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

21 - How well are the following library resources meeting the program's needs?

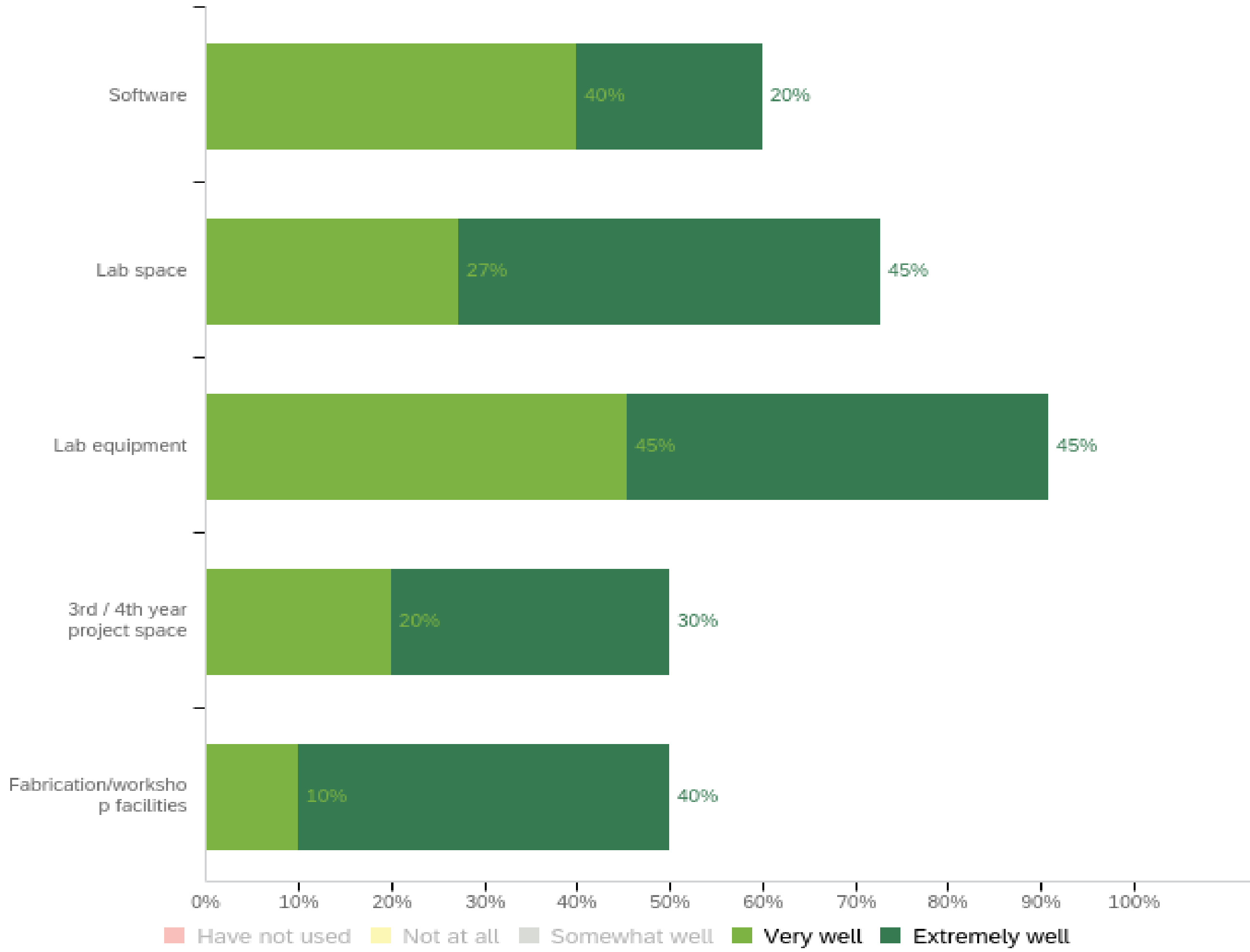


Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Question	Have not used	Not at all	Somewhat well	Very well	Extremely well	Total
1	Availability of audio-visual and computer equipment	40%	0%	0%	20%	40%	10
2	Books	0%	0%	11%	67%	22%	9
3	eBooks	22%	0%	33%	33%	11%	9
4	DVDs/streaming video on program-related topics	89%	0%	11%	0%	0%	9
5	Librarian support for program-related research	44%	0%	22%	11%	22%	9
6	Library orientation	89%	0%	0%	11%	0%	9
7	Online resources - journal articles, etc.	22%	11%	22%	22%	22%	9
8	Print periodicals, journals, etc.	56%	0%	33%	0%	11%	9
9	Study guides	78%	0%	22%	0%	0%	9

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

22 - How well are the following specialized technology and facilities meeting program's needs?

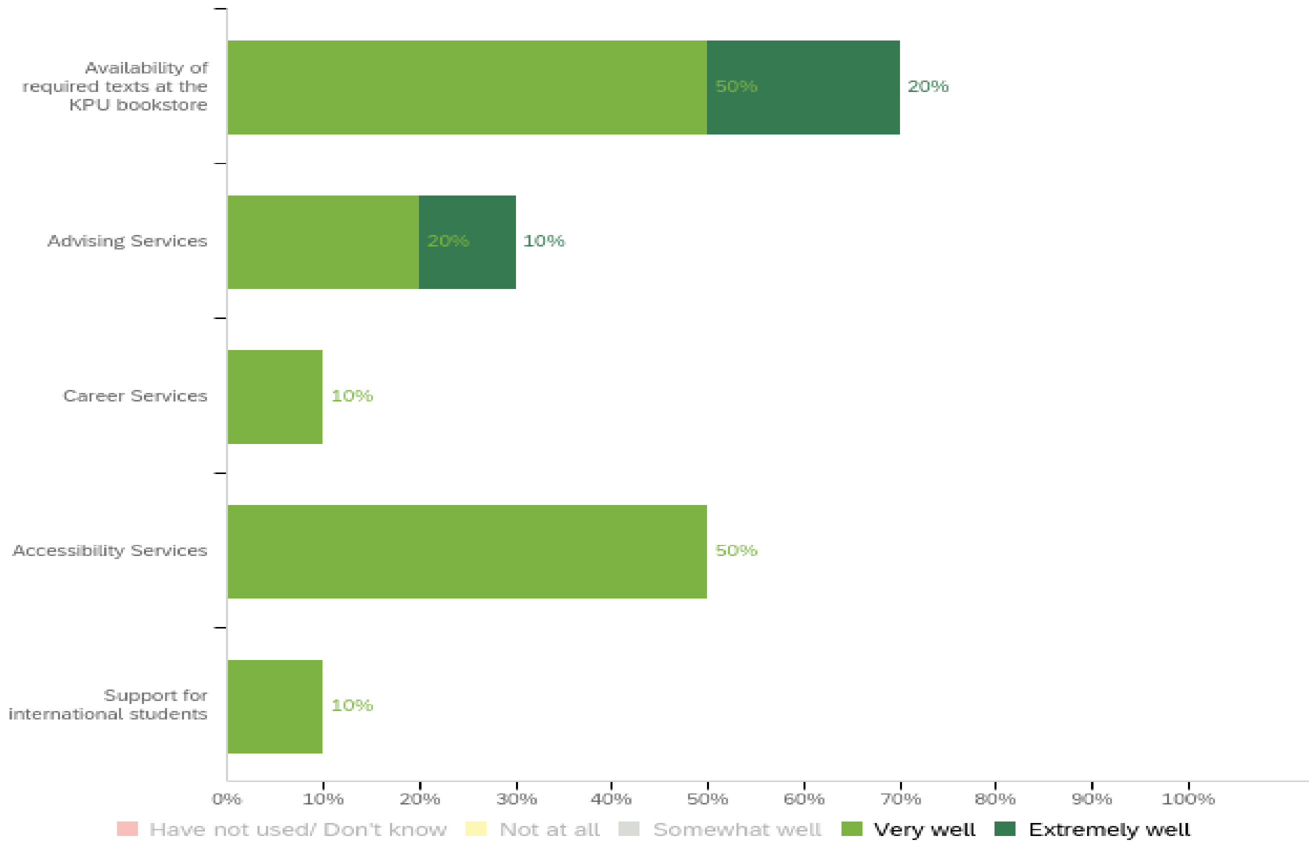


Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Question	Have not used	Not at all	Somewhat well	Very well	Extremely well	Total
1	Software	10%	0%	30%	40%	20%	10
2	Lab space	0%	0%	27%	27%	45%	11
3	Lab equipment	0%	0%	9%	45%	45%	11
4	3rd / 4th year project space	20%	0%	30%	20%	30%	10
5	Fabrication/workshop facilities	30%	0%	20%	10%	40%	10

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

23 - How well are the following services meeting program's needs?



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Question	Have not used/ Don't know	Not at all	Somewhat well	Very well	Extremely well	Total
1	Availability of required texts at the KPU bookstore	20%	0%	10%	50%	20%	10
2	Advising Services	40%	10%	20%	20%	10%	10
3	Career Services	50%	0%	40%	10%	0%	10
4	Accessibility Services	30%	0%	20%	50%	0%	10
5	Support for international students	80%	0%	10%	10%	0%	10

Appendix H

Alumni Survey Report

Physics for Modern Technology Program Review - Alumni Survey Results

The alumni survey was sent to 14 Physics for Modern Technology alumni. A total of 8 alumni responded. The response rate is 57%.

Note: The data includes open-ended comments. In order to preserve integrity and objectivity, OPA does not do value-judgment editing (i.e. we do not fix spelling errors, syntax issues, punctuation, etc.). Comments are included verbatim – with one exception: if individuals or courses are named, OPA redacts the name of the instructor or course. This rule applies to whether the comment is good, bad or indifferent.

1 - When did you complete KPU's Physics for Modern Technology program?

#	When did you complete KPU's Physics for Modern Technology program?	Percentage
1	2021	50%
2	2020	25%
3	2019	13%
4	2018	13%
	Total	8

2 - Physics for Modern Technology has been designed as a 4-year program, but we recognize that many students complete it in more than 4 years for various reasons. How long did it take you to complete the program?

#	Physics for Modern Technology has been designed as a 4-year program, but we recognize that many students complete it in more than 4 years for various reasons. How long did it take you to complete the program?	Percentage
1	4 years	25%
2	4 to 5 years	63%
3	5 to 6 years	13%
4	More than 6 years	0%
	Total	8

3 - Can you tell us about some of the factors that contributed to taking more than 4 years?

The limitation that some courses are not offered every year.
I was not initially planning on remaining at KPU for the entire degree but decided to stay after seeing the amazing program and extraordinary assistance from the Faculty.
Some classes are only offered once every other year so some semesters are overloaded.
1) took classes part time to work 2) needed to repeat courses
Mainly due to majority of course offer in Richmond only. It nice for the 3rd and 4th year but the 1 st and 2nd year we need to also take other general elective which does not have many option at Richmond campus.
No or few summer classes open, and alternate third and fourth

4 - Were program faculty helpful in helping you plan your studies?

#	Were program faculty helpful in helping you plan your studies?	Percentage
1	Yes	88%
2	No	13%
	Total	8

5 - Were KPU advisors helpful in helping you plan your studies?

#	Were KPU advisors helpful in helping you plan your studies?	Percentage
1	Yes	100%
2	No	0%
	Total	8

6 - What could the program or KPU do to make life easier for students who are pursuing the program?

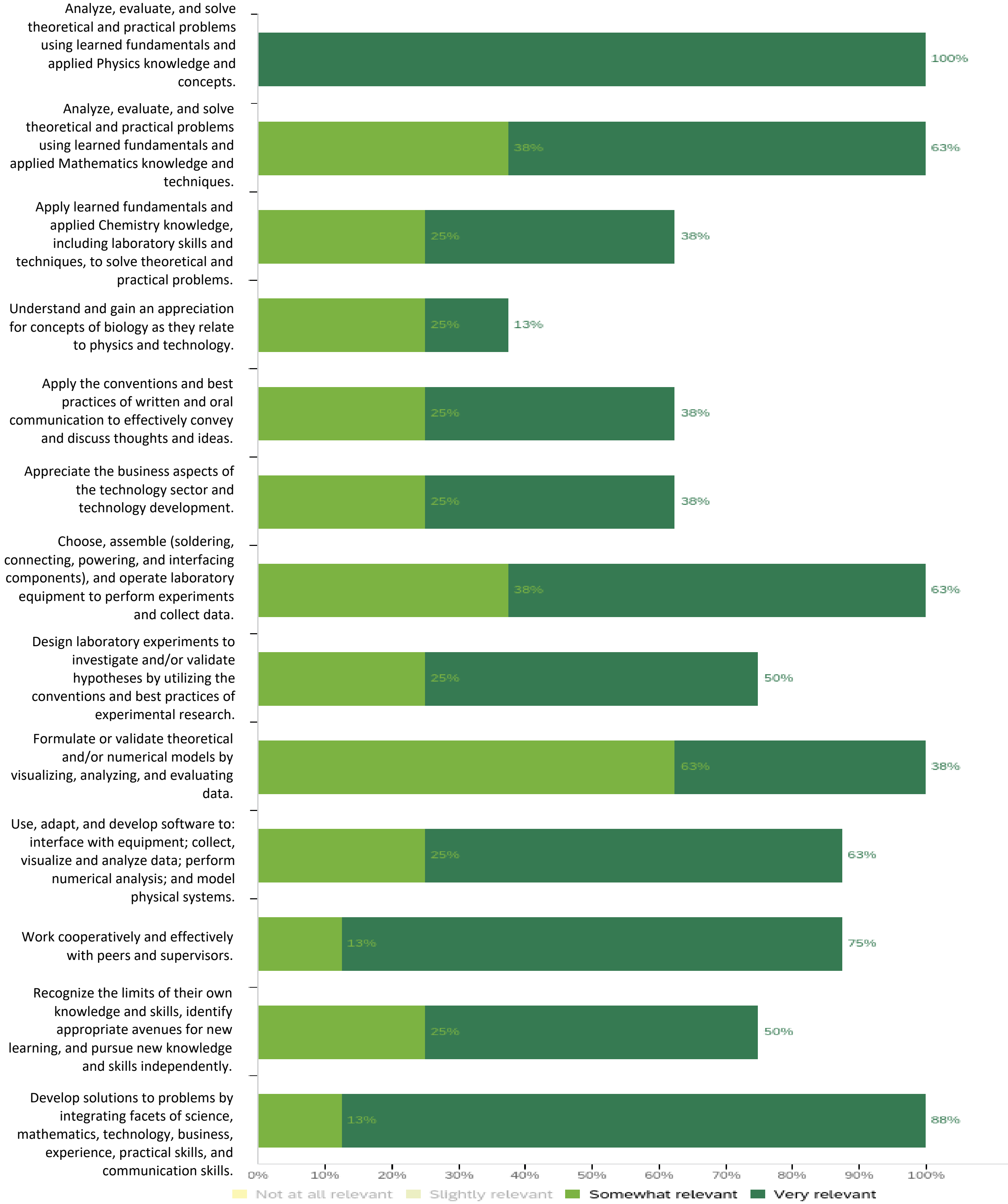
Make sure everyone know when does the courses are offered.
It is pretty much greatly laid out.
Have a better plan for which upper level courses will be offered on which semester. Especially the upper level chemistry courses.
Target part time students for financial aid to help them become full time
Nothing that stands out for me. Maybe a bit more flexibility on elective courses. But overall it's a great program.
I do know PMT has the preplan / suggest course plan out. I wish that I am able to knew that early on as 1st year. So make that more accessible on the kpu/PMT website.

QUESTIONS ON CHAPTER 3: PROGRAM RELEVANCE AND DEMAND

Program Relevance

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

7 - Program Learning Outcomes are statements that describe the knowledge and skills students will have upon completion of a program. Please indicate how relevant each of the following Program Learning Outcomes was to your career goals.



Note that “not at all relevant” and “a somewhat relevant” 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 relevant” and “somewhat relevant” categories

#	Question	Not at all relevant	Slightly relevant	Somewhat relevant	Very relevant	Total
1	Analyze, evaluate, and solve theoretical and practical problems using learned fundamentals and applied Physics knowledge and concepts.	0%	0%	0%	100%	8
2	Analyze, evaluate, and solve theoretical and practical problems using learned fundamentals and applied Mathematics knowledge and techniques.	0%	0%	38%	63%	8
3	Apply learned fundamentals and applied Chemistry knowledge, including laboratory skills and techniques, to solve theoretical and practical problems.	0%	38%	25%	38%	8
4	Understand and gain an appreciation for concepts of biology as they relate to physics and technology.	38%	25%	25%	13%	8
5	Apply the conventions and best practices of written and oral communication to effectively convey and discuss thoughts and ideas.	0%	38%	25%	38%	8
6	Appreciate the business aspects of the technology sector and technology development.	0%	38%	25%	38%	8
7	Choose, assemble (soldering, connecting, powering, and interfacing components), and operate laboratory equipment to perform experiments and collect data.	0%	0%	38%	63%	8
8	Design laboratory experiments to investigate and/or validate hypotheses by utilizing the conventions and best practices of experimental research.	0%	25%	25%	50%	8
9	Formulate or validate theoretical and/or numerical models by visualizing, analyzing, and evaluating data.	0%	0%	63%	38%	8
10	Use, adapt, and develop software to: interface with equipment; collect, visualize and analyze data; perform numerical analysis; and model physical systems.	0%	13%	25%	63%	8
11	Work cooperatively and effectively with peers and supervisors.	0%	13%	13%	75%	8
12	Recognize the limits of their own knowledge and skills, identify appropriate avenues for new learning, and pursue new knowledge and skills independently.	0%	25%	25%	50%	8
13	Develop solutions to problems by integrating facets of science, mathematics, technology, business, experience, practical skills, and communication skills.	0%	0%	13%	88%	8

8 - The program curriculum is the academic content taught in a specific program. Overall, how satisfied are you with the curriculum of KPU's Physics for Modern Technology program?

Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	The program curriculum is the academic content taught in a specific program. Overall, how satisfied are you with the curriculum of KPU's Physics for Modern Technology program?	Percentage
1	Very dissatisfied	0%
2	Somewhat dissatisfied	0%
3	Neither satisfied nor dissatisfied	0%
4	Somewhat satisfied	50%
5	Very satisfied	50%
	Total	8

9 - Thinking of KPU's Physics for Modern Technology program's curriculum as a whole, please indicate the strengths of the program.

The program includes many hand-on work that student can understand not only the theoretical knowledge.
The projects really helped me to be able to think on my own and get some guidance. The hands on aspect of the program is useful for industry careers.
Comprehensive and wide berth of topics
Has good mixture of physics, engineering, and programming. The project courses are very useful as you can match the theory with application and demonstrate it.
Excellent instruction Relevant topics Good resources for lab work
Great professors who are dedicated to the success of students and the program. A lot of hands on laboratory work which other physics programs lack. Great opportunities to find relevant work experience. The professors are passionate at what they do.
It provide a hand on approach to the theoretical concept which makes it easy to apply to the industry skill.

10 - Thinking of KPU’s Physics for Modern Technology program's curriculum as a whole, please provide any suggestions you have for improvement.

Show how does the course apply in workplace.
I believe it is still a growing program and I would love to see bigger projects once the program has expanded similar to projects carried out by UBC's engineering teams.
More programming
The biology class is irrelevant and the selected business electives are not particularly useful.
Tests could be harder Stronger emphasis on software tools More time spent on differential equations and linear algebra
It could have options for core physics courses such as statistical physics.
Some class I feel can go into deeper understanding to be more beneficial in the job industry. For example, large portion of the program has use coding as a way of interfacing with the technology. if stream line all the coding course to build a solid foundation of 1 language by 4th year can open up many more job opportunity for student

11 - What topics, if any, were missing from the program?

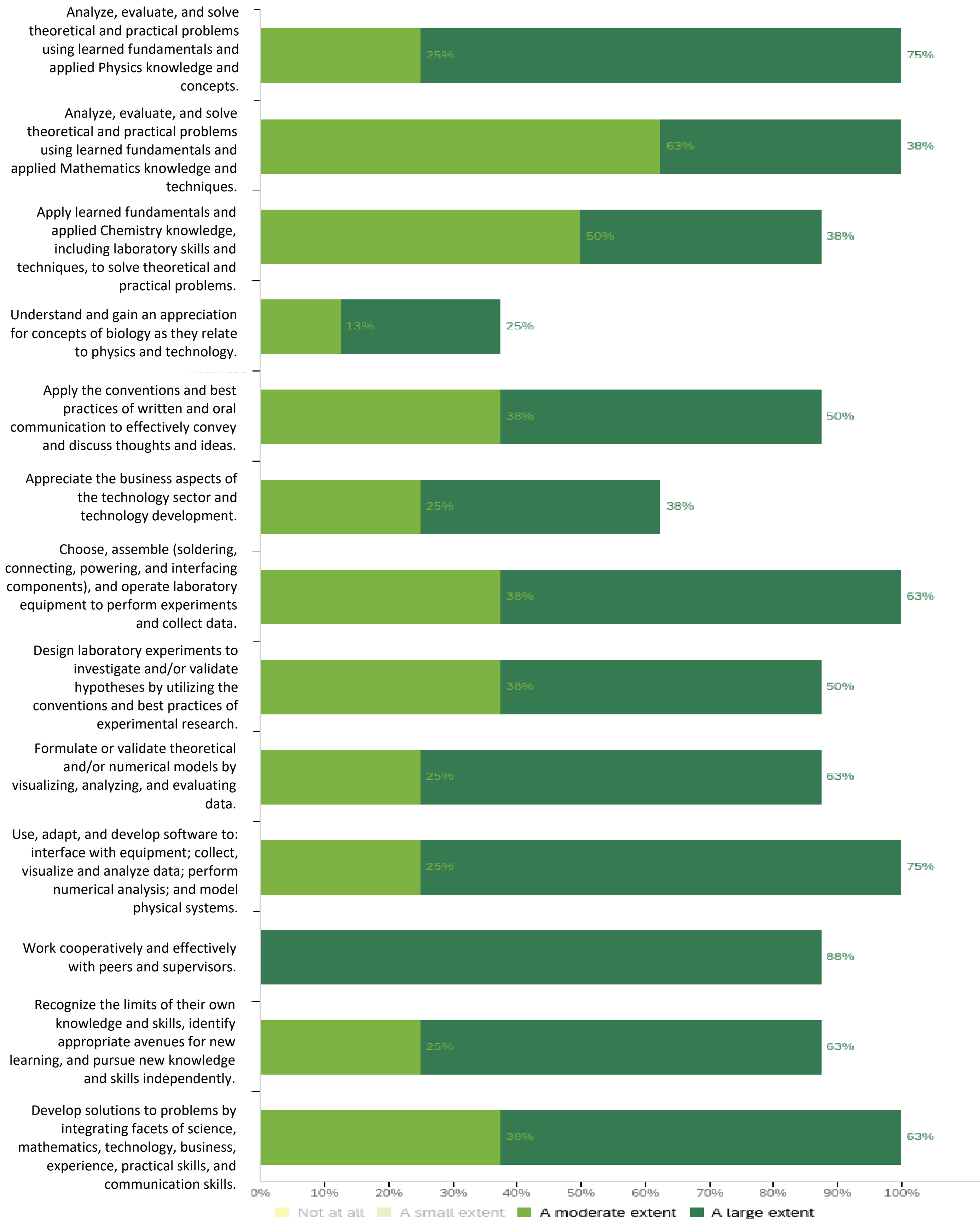
Astronomy
Could add some courses to do with data science or more hands on electronics courses.
Computational physics would be amazing. Teach students to make models and visualize data. Also a more formal co-op program would be better.
Core upper division courses such as statistical physics, electricity and magnetism. Although the concepts were taught in other courses. Anyone who wants to pursue post graduate physics will need to upgrade their degree with 4 extra courses.
It would be beneficial to offer some optional and deeper understanding of the 3rd or 4th year topic such as optic or control

QUESTIONS ON CHAPTER 4: EFFECTIVENESS OF INSTRUCTIONAL DELIVERY

Instructional Design and Delivery

Are appropriate opportunities provided to help students acquire the PLOs?

12 - To what extent did KPU's Physics for Modern Technology program help you develop each of the following Program Learning Outcomes?

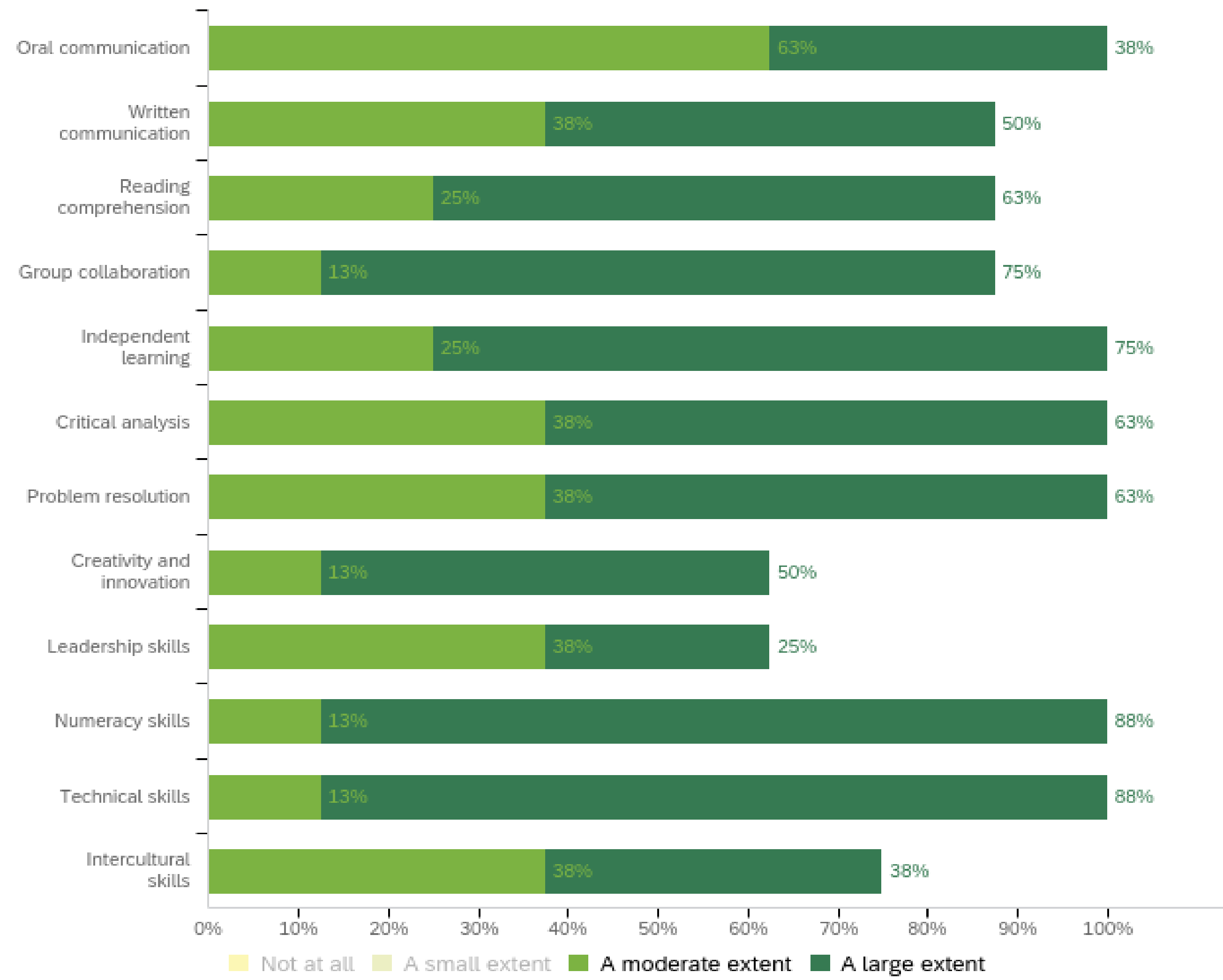


Note that “not at all” and “a small extent” categories are excluded from the chart for quick comparisons between items. Please use the frequency table below for the percentages for the “not at all” and “a small extent” categories.

#	Question	Not at all	A small extent	A moderate extent	A large extent	Total
1	Analyze, evaluate, and solve theoretical and practical problems using learned fundamentals and applied Physics knowledge and concepts.	0%	0%	25%	75%	8
2	Analyze, evaluate, and solve theoretical and practical problems using learned fundamentals and applied Mathematics knowledge and techniques.	0%	0%	63%	38%	8
3	Apply learned fundamentals and applied Chemistry knowledge, including laboratory skills and techniques, to solve theoretical and practical problems.	0%	13%	50%	38%	8
4	Understand and gain an appreciation for concepts of biology as they relate to physics and technology.	13%	50%	13%	25%	8
5	Apply the conventions and best practices of written and oral communication to effectively convey and discuss thoughts and ideas.	0%	13%	38%	50%	8
6	Appreciate the business aspects of the technology sector and technology development.	0%	38%	25%	38%	8
7	Choose, assemble (soldering, connecting, powering, and interfacing components), and operate laboratory equipment to perform experiments and collect data.	0%	0%	38%	63%	8
8	Design laboratory experiments to investigate and/or validate hypotheses by utilizing the conventions and best practices of experimental research.	0%	13%	38%	50%	8
9	Formulate or validate theoretical and/or numerical models by visualizing, analyzing, and evaluating data.	0%	13%	25%	63%	8
10	Use, adapt, and develop software to: interface with equipment; collect, visualize and analyze data; perform numerical analysis; and model physical systems.	0%	0%	25%	75%	8
11	Work cooperatively and effectively with peers and supervisors.	0%	13%	0%	88%	8
12	Recognize the limits of their own knowledge and skills, identify appropriate avenues for new learning, and pursue new knowledge and skills independently.	0%	13%	25%	63%	8
13	Develop solutions to problems by integrating facets of science, mathematics, technology, business, experience, practical skills, and communication skills.	0%	0%	38%	63%	8

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

13 - To what extent did KPU's Physics for Modern Technology program help you develop each of the following essential skills?

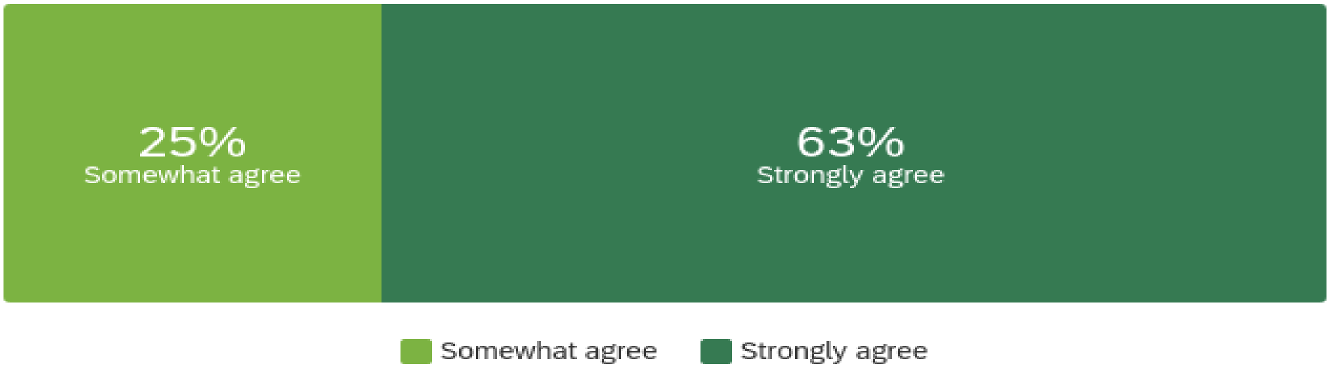


Note that "not at all" and "a small extent" categories are excluded from the chart for quick comparisons between items. Please use the frequency table below for the percentages for the "not at all" and "a small extent" categories.

#	Question	Not at all	A small extent	A moderate extent	A large extent	Total
1	Oral communication	0%	0%	63%	38%	8
2	Written communication	0%	13%	38%	50%	8
3	Reading comprehension	0%	13%	25%	63%	8
4	Group collaboration	0%	13%	13%	75%	8
5	Independent learning	0%	0%	25%	75%	8
6	Critical analysis	0%	0%	38%	63%	8
7	Problem resolution	0%	0%	38%	63%	8
8	Creativity and innovation	0%	38%	13%	50%	8
9	Leadership skills	0%	38%	38%	25%	8
10	Numeracy skills	0%	0%	13%	88%	8
11	Technical skills	0%	0%	13%	88%	8
12	Intercultural skills	0%	25%	38%	38%	8

Are appropriate work-integrated and/or community-engaged learning opportunities provided to help students acquire the learning outcomes?

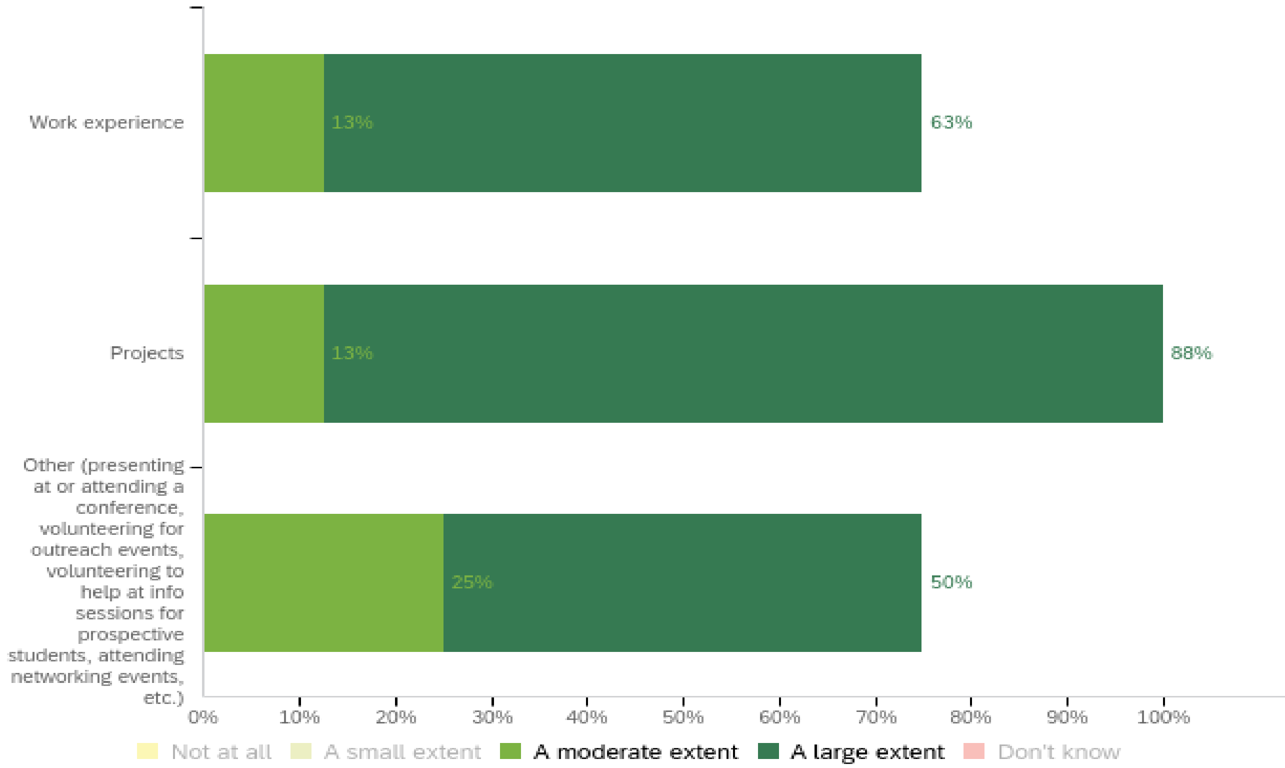
14 - To what extent do you agree that you had sufficient opportunities in the program to reinforce your learning through practical application of this learning?



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	To what extent do you agree that you had sufficient opportunities in the program to reinforce your learning through practical application of this learning?	Percentage
1	Strongly disagree	0%
2	Somewhat disagree	0%
3	Neither agree nor disagree	13%
4	Somewhat agree	25%
5	Strongly agree	63%
	Total	8

15 - Indicate the extent the work-integrated and/or community-engaged learning opportunities contributed to your learning.

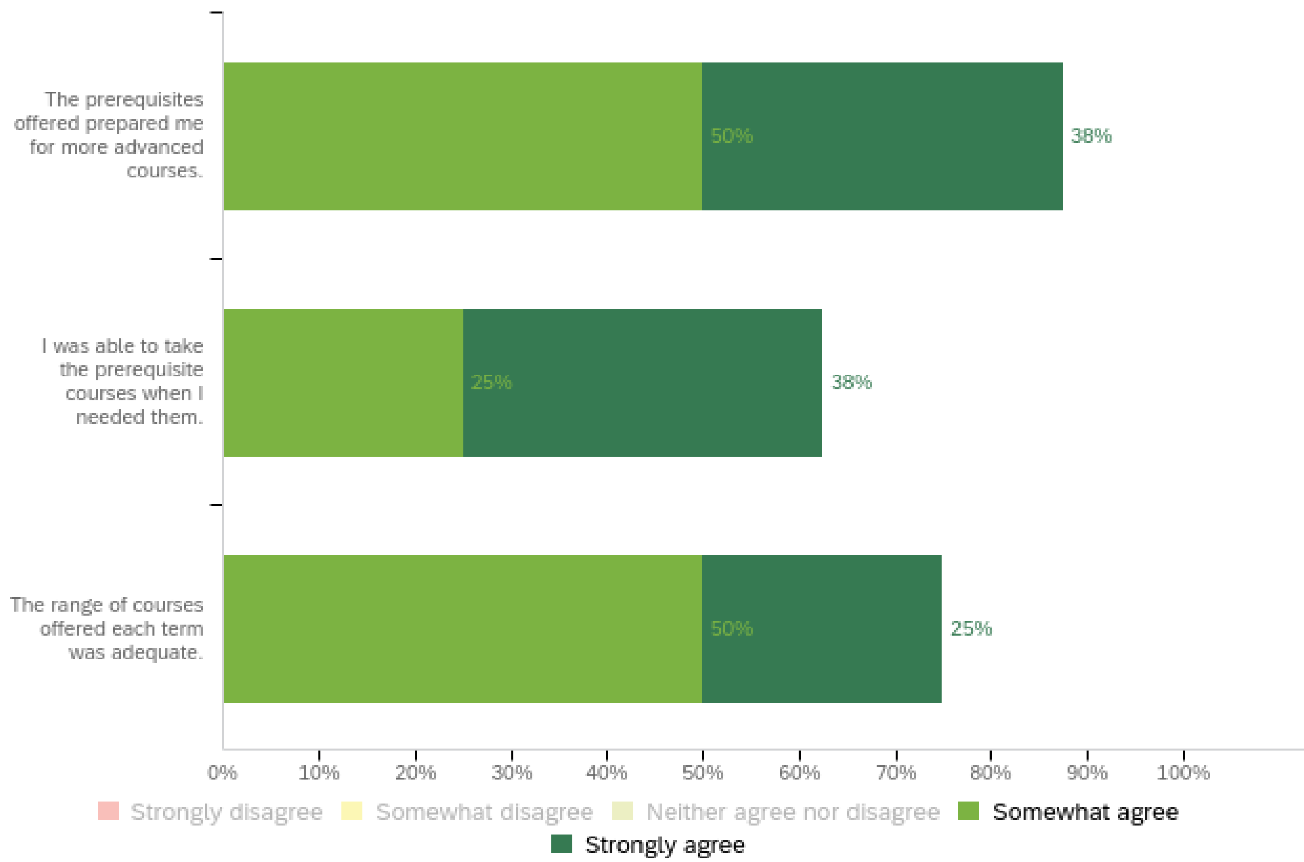


Note that "not at all", "a small extent", and "Don't know" categories are excluded from the chart for quick comparisons between items. Please use the frequency table below for the percentages for the "not at all" and "a small extent" categories.

#	Question	Not at all	A small extent	A moderate extent	A large extent	Don't know	Total
1	Work experience	0%	25%	13%	63%	0%	8
2	Projects	0%	0%	13%	88%	0%	8
3	Other (presenting at or attending a conference, volunteering for outreach events, volunteering to help at info sessions for prospective students, attending networking events, etc.)	0%	13%	25%	50%	13%	8

Does the program design ensure students are prepared for subsequent courses? / Are students making satisfactory progress in the program?

16 - Thinking of KPU's Physics for Modern Technology program as a whole, please indicate your agreement with the following.

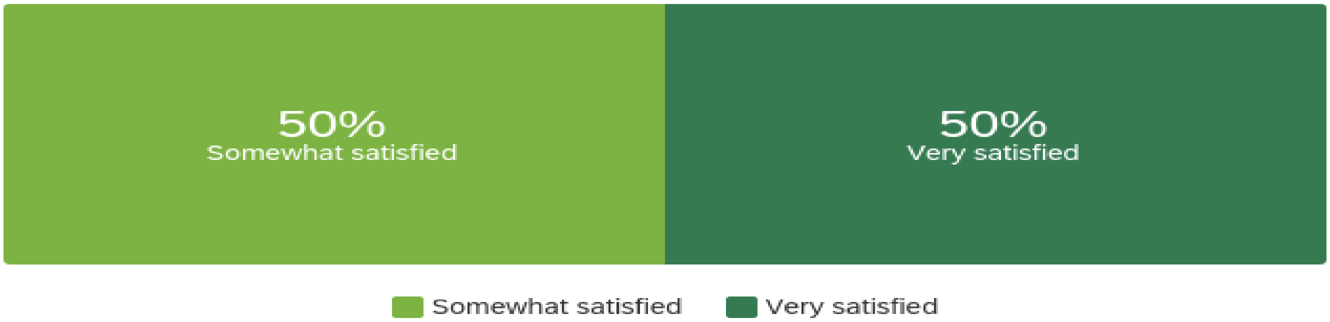


Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Question	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
1	The prerequisites offered prepared me for more advanced courses.	0%	13%	0%	50%	38%	8
2	I was able to take the prerequisite courses when I needed them.	0%	25%	13%	25%	38%	8
3	The range of courses offered each term was adequate.	0%	13%	13%	50%	25%	8

Does the instruction meet the needs of diverse learners?

17 - Overall, how satisfied are you with the instruction you have received in KPU's Physics for Modern Technology program?



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Overall, how satisfied are you with the instruction you have received in KPU's Physics for Modern Technology program?	Percentage
1	Very dissatisfied	0%
2	Somewhat dissatisfied	0%
3	Neither satisfied nor dissatisfied	0%
4	Somewhat satisfied	50%
5	Very satisfied	50%
	Total	8

18 - Thinking of how instruction is delivered across the program as a whole, please indicate the strengths of the program instruction.

Each professor had a unique specialty and allowed us to engage in depth for a wide range of subjects.

Covers many aspects of physics, engineering and programming.

Instructors were polite, knowledgeable, and available.

The professors are very engaging and passionate when teaching. There is both theoretical and applied versions of most topics which helps students understand better.

Since the 3rd and 4th year student all take the class together. The instructor are able understand the need of the student and tailor the content in a way that is easily understandable to the the student.

19 - Thinking of how instruction is delivered across the program as a whole, please provide any suggestions you have for improvement in program instruction.

Unsure

Although many subjects are covered there are not many opportunities to master a specific subject.

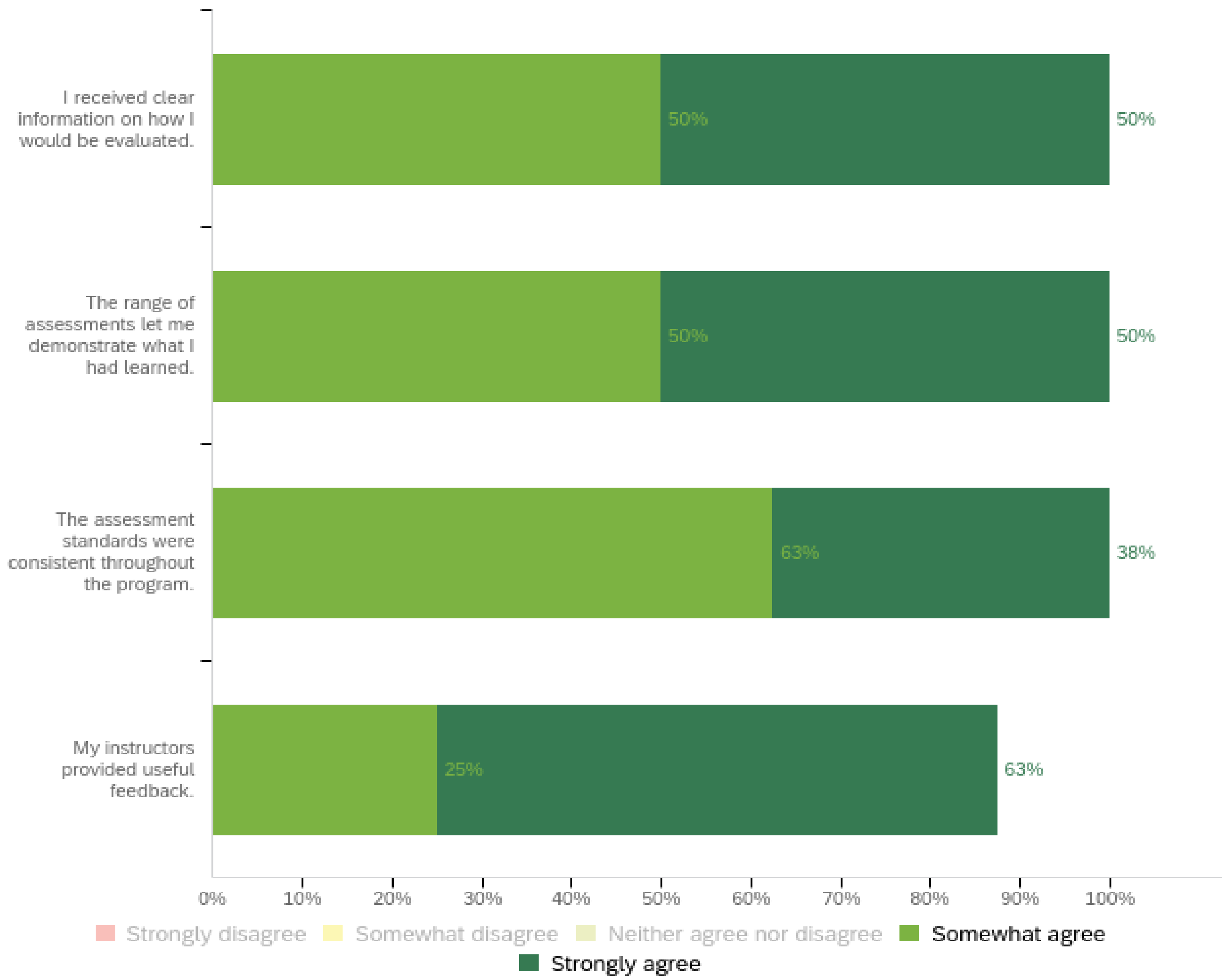
No suggestions

There is nothing that comes to mind.

Part of my 4th year was online, it has really change the dynamic between the teacher and student. Some instructor begin to doubt the integrity of the student right from the beginning even though we already been through years of academic. It like we have to constantly prove we have integrity to him.

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

20 - Thinking of how learning is assessed in the program as a whole, indicate your agreement with the following.



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	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.	0%	0%	0%	50%	50%	8
2	The range of assessments let me demonstrate what I had learned.	0%	0%	0%	50%	50%	8
3	The assessment standards were consistent throughout the program.	0%	0%	0%	63%	38%	8
4	My instructors provided useful feedback.	0%	0%	13%	25%	63%	8

Are graduates of the program successful?

Further Education

21 - Have you pursued further education since completing KPU’s Physics for Modern Technology program?

#	Have you pursued further education since completing KPU’s Physics for Modern Technology program?	Percentage
1	Yes	25%
2	No	75%
	Total	8

22 - Please list the name of the program and the institution where you enrolled after completing KPU’s Physics for Modern Technology program.

BCIT
Simon fraser university M.Sc physics

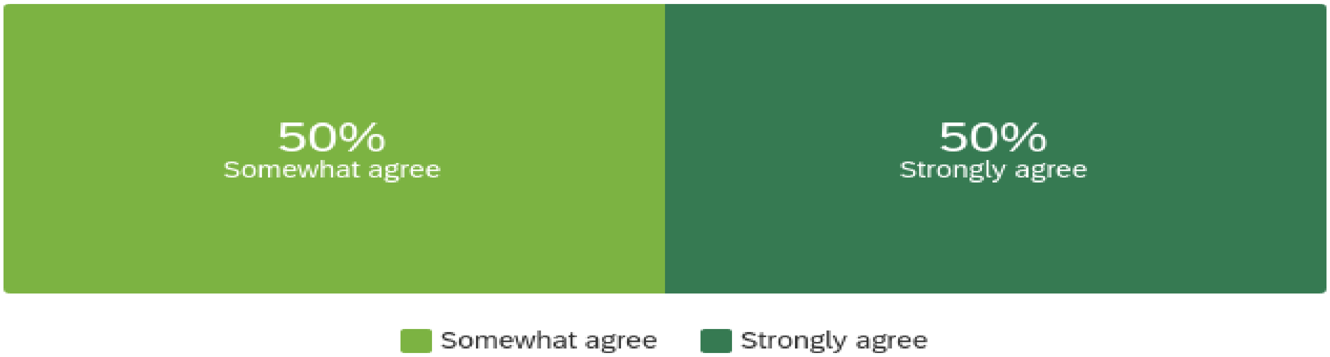
23 - What is the highest credential you have earned or are currently pursuing since completing KPU’s Physics for Modern Technology program?

#	What is the highest credential you have earned or are currently pursuing since completing KPU’s Physics for Modern Technology program? - Selected Choice	Percentage
1	Diploma	50%
2	Associate’s Degree	0%
3	Bachelor’s Degree	0%
4	Master's Degree	0%
5	Doctorate	0%
6	Professional designation (Please specify)	0%
7	Other (Please specify)	50%
	Total	2

Q23_7_TEXT - Other (Please specify)

I started but didn't complete a masters degree at SFU. I've now applied to UBCs physics for engineering.

24 - To what extent do you agree that the KPU's Physics for Modern Technology program prepared you well for further education?



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	To what extent do you agree that the KPU's Physics for Modern Technology program prepared you well for further education?	Percentage
1	Strongly disagree	0%
2	Somewhat disagree	0%
3	Neither agree nor disagree	0%
4	Somewhat agree	50%
5	Strongly agree	50%
	Total	2

Employment

25 - Are you currently employed in a field related to what you studied at KPU?

#	Are you currently employed in a field related to what you studied at KPU?	Percentage
1	Yes	75%
2	No	25%
	Total	8

26 - Were you previously employed in a field related to what you studied at KPU?

#	Were you previously employed in a field related to what you studied at KPU?	Percentage
1	Yes	50%
2	No	50%
	Total	2

27 - Which of the following best describes your current employment situation?

#	Which of the following best describes your current employment situation?	Percentage
1	In a full-time position	83%
2	In a part-time position	0%
3	In a contract position	17%
4	In a casual or temporary position	0%
5	Self-employed/consultant	0%
	Total	6

28 - What is your position/role/job title?

Manufacturing Technician
Software Developer
Manufacturing Technician
Cyclotron operator/engineering technologist
Data Scientist
Hardware System Technician

29 - Could you specify the organization where you are currently employed? This information will help us better determine KPU graduates' career trajectories.

Ideon Technologies
Altair Engineering
Advanced cyclotron systems inc
SFU
Weir Motion Metrics

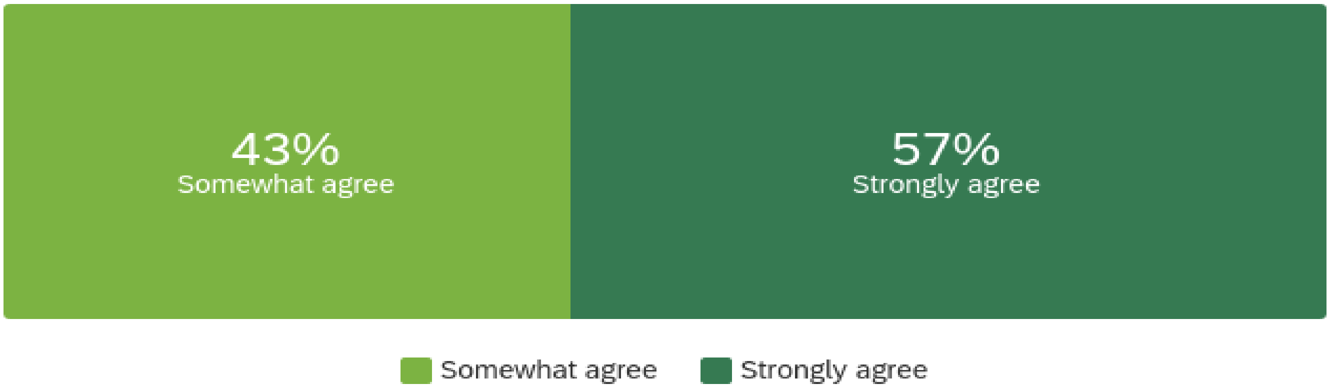
30 - Which of the following best describes your employment situation? (This was asked to respondents who chose "yes" in Q26).

#	Which of the following best describes your employment situation?	Percentage
1	In a full-time position	100%
2	In a part-time position	0%
3	In a contract position	0%
4	In a casual or temporary position	0%
5	Self-employed/consultant	0%
	Total	1

31 - What was your position/role/job title?

No results to show

32 - Based on your experience since graduating, to what extent do you agree that the program prepared you well for an entry-level job in the industry?



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories. Use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Based on your experience since graduating, to what extent do you agree that the program prepared you well for an entry-level job in the industry?	Percentage
1	Strongly disagree	0%
2	Somewhat disagree	0%
3	Neither agree nor disagree	0%
4	Somewhat agree	43%
5	Strongly agree	57%
	Total	7

33 - Please identify the skills/knowledge area(s) you felt were missing in the program for an entry-level job in your industry.

Hands tools
I was missing some key programming knowledge that, without the physic background, would have prevented me from obtaining an entry level software development job.
Data analysis in business setting.
There is a fair amount of mechanical engineering knowledge (mechanics of materials, thermodynamics) that I think would be useful
None that come to mind
we learn a lot of coding but since they are not align, therefore wont as useful as other skills

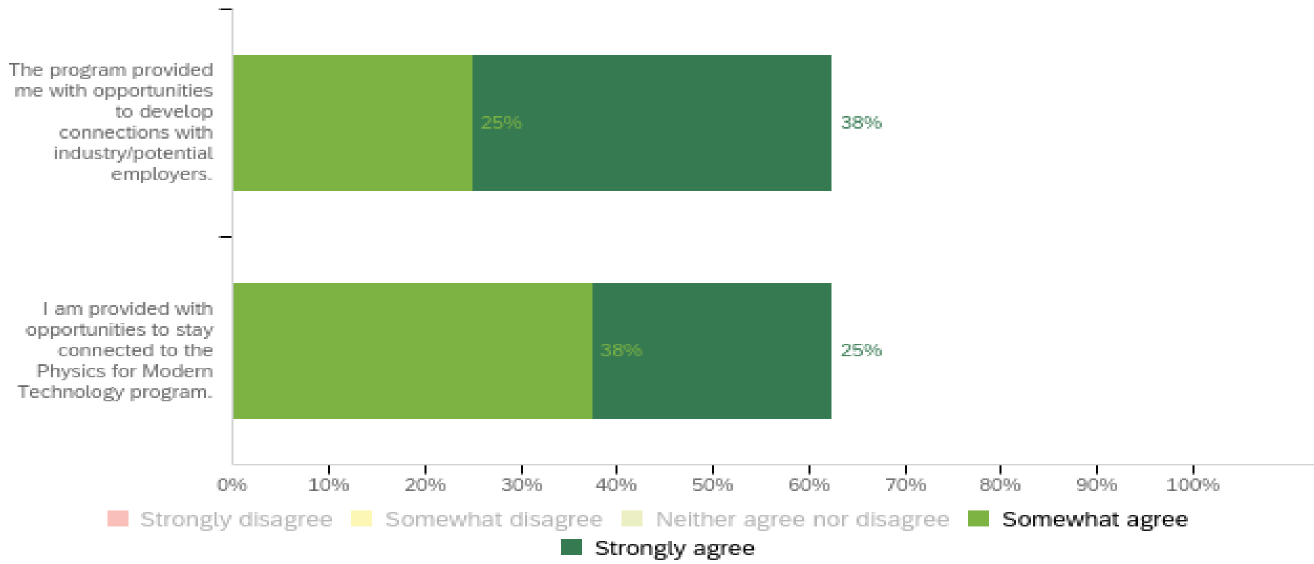
34 - Would you be confident hiring someone (whom you don’t personally know) who graduated from this program?

#	Would you be confident hiring someone (whom you don’t personally know) who graduated from this program?	Percentage
1	Yes	100%
2	No	0%
	Total	6

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

Alumni Connections

35 - Please indicate the extent you agree with the following statements:



Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	Question	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Total
1	The program provided me with opportunities to develop connections with industry/potential employers.	0%	13%	25%	25%	38%	8
2	I am provided with opportunities to stay connected to the Physics for Modern Technology program.	0%	0%	38%	38%	25%	8

36 - What can the program do to build better connections with alumni?

Linkedin page to follow
I can't offer any incentives beyond good food and/or money but that is likely out of the question UBC does alumni events. They would be a good resource for suggestions.
I am still in contact with some of the professors.
Have party/info on Academic opportunity after the program , host competition for the current student in which where the current student and alumni can connect

Appendix I

Discipline/Sector Survey Report

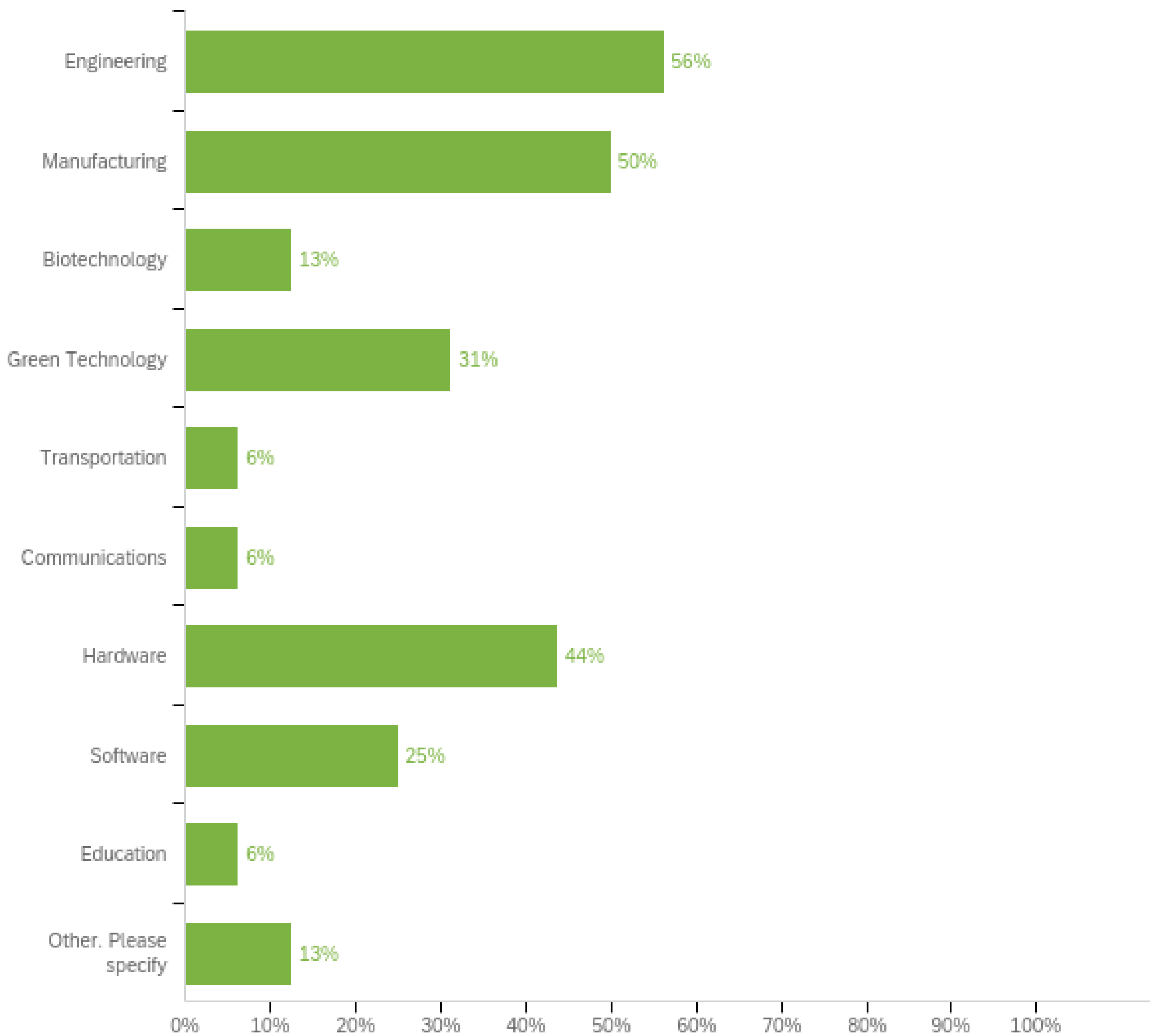
Physics for Modern Technology Program Review - Discipline/Sector Survey Results

The discipline/sector survey was sent to 27 discipline/sector representatives. A total of 16 representatives responded. The response rate is 59%.

Note: The data includes open-ended comments. In order to preserve integrity and objectivity, OPA does not do value-judgment editing (i.e. we do not fix spelling errors, syntax issues, punctuation, etc.). Comments are included verbatim – with one exception: if individuals or courses are named, OPA redacts the name of the instructor or course. This rule applies to whether the comment is good, bad or indifferent

About Your Organization/Role

1 - Which sector best describes your organization/business? Please select all that apply.



#	Answer	Percentage	Count
1	Engineering	56%	9
2	Manufacturing	50%	8
3	Biotechnology	13%	2
4	Green Technology	31%	5
5	Transportation	6%	1
6	Natural Resources	0%	0
7	Communications	6%	1
8	Hardware	44%	7
9	Software	25%	4
10	Education	6%	1
11	Government	0%	0
12	Other. Please specify	13%	2
	Total		16

Note: The last row presents the total number of respondents. The total number of responses for this question is greater than the number of respondents. Therefore, the percentage total exceeds 100%.

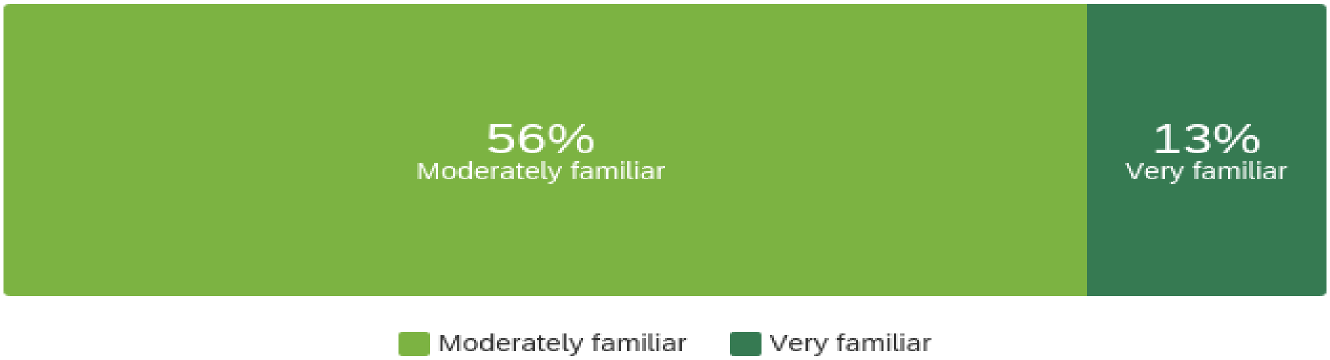
Q1_12_TEXT - Other. Please specify

scientific equipment for materials and life sciences
Professional Association

2 - What is your current job title/role?

Director of Engineering
President
Physics Professor
CTO
Production Manager
Electrical Engineer
Chief Technology Officer
Founder, general operations and planning.
CEO
Snr Technologist
VP Product Development
Retired member, volunteer as an application file reviewer and team lead for Technology program and technical specialist program accreditations.
Business Development Manager
research and development physicist.
Lead Research Scientist/Engineer
Director of manufacturing

3 - How familiar are you with KPU's Physics for Modern Technology program?



Note that "not at all familiar" and "slightly familiar" 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 familiar" and "slightly familiar" categories

#	How familiar are you with KPU's Physics for Modern Technology program?	Percentage
1	Not at all familiar	6%
2	Slightly familiar	25%
3	Moderately familiar	56%
4	Very familiar	13%
	Total	16

4 - When you think about KPU's Physics for Modern Technology program, what are the top three characteristics that come to mind?

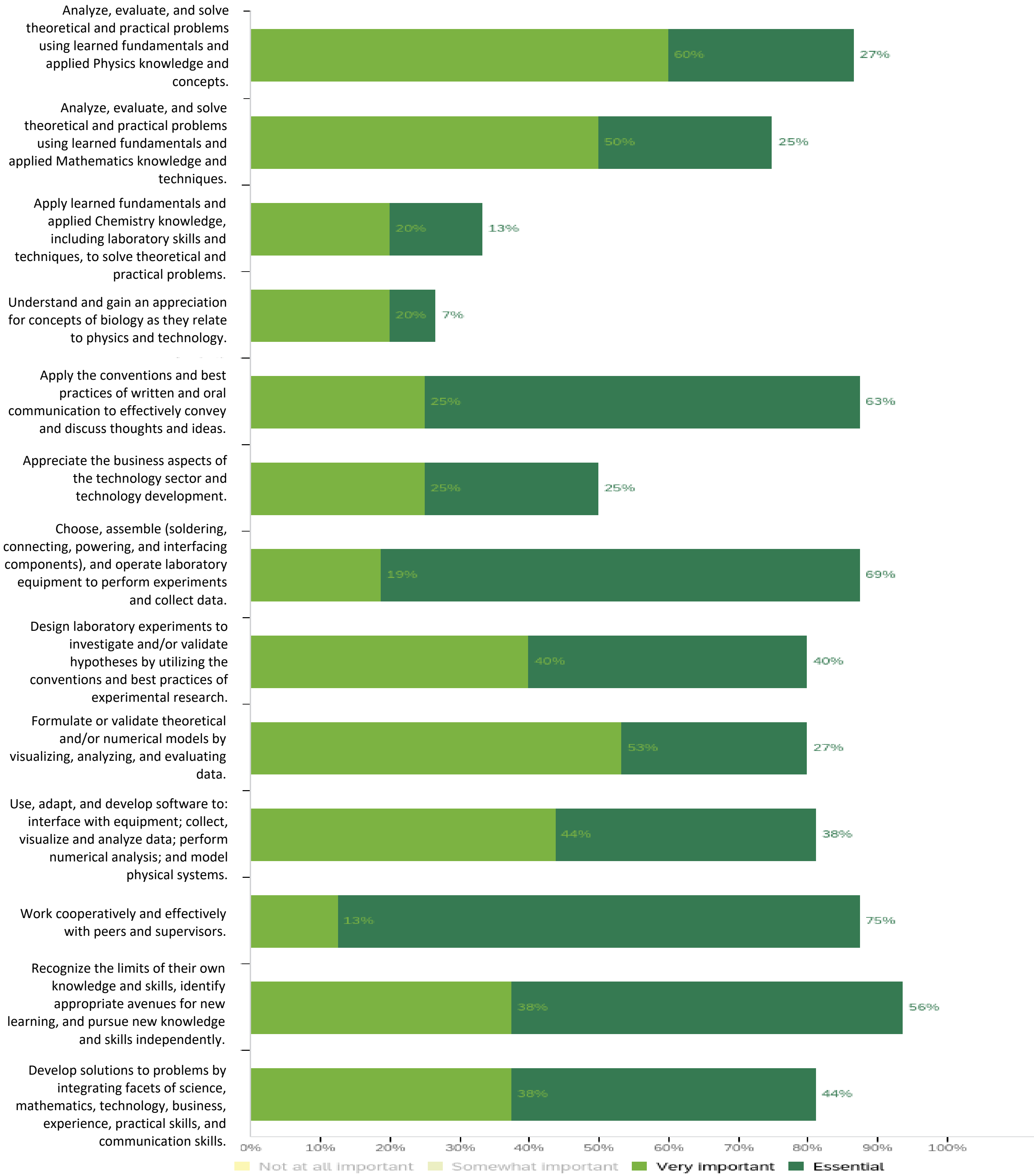
Characteristic #1	Characteristic #2	Characteristic #3
Practical knowledge	Applied / practiced techniques	Research & Development
Enginneering	Physics	Application
Advanced	More electrical based	New technology area
Real world focus	Relevant knowledgeE	Engaged instruction and learning
job-oriented	up to date	flexible
Robotics	Programming	Physics
Focused on employable skills	Teaching	Physics
Great balance between theory and practice	Well equipped labs and competent lab assistants	Wide range of forward-looking physics topics
Hands on	Intense	Balanced
Different from other programs	Practical	Accessible

QUESTIONS ON CHAPTER 3: PROGRAM RELEVANCE AND DEMAND

Program Relevance

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

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



Note that 'Not at all important' and 'Somewhat important' categories are excluded from the chart. Use the frequency table below to review the proportion of 'Not at all important' versus 'Somewhat important' responses.

#	Question	Not at all important	Somewhat important	Very important	Essential	Total
1	Analyze, evaluate, and solve theoretical and practical problems using learned fundamentals and applied Physics knowledge and concepts.	0%	13%	60%	27%	15
2	Analyze, evaluate, and solve theoretical and practical problems using learned fundamentals and applied Mathematics knowledge and techniques.	0%	25%	50%	25%	16
3	Apply learned fundamentals and applied Chemistry knowledge, including laboratory skills and techniques, to solve theoretical and practical problems.	40%	27%	20%	13%	15
4	Understand and gain an appreciation for concepts of biology as they relate to physics and technology.	40%	33%	20%	7%	15
5	Apply the conventions and best practices of written and oral communication to effectively convey and discuss thoughts and ideas.	0%	13%	25%	63%	16
6	Appreciate the business aspects of the technology sector and technology development.	0%	50%	25%	25%	16
7	Choose, assemble (soldering, connecting, powering, and interfacing components), and operate laboratory equipment to perform experiments and collect data.	0%	13%	19%	69%	16
8	Design laboratory experiments to investigate and/or validate hypotheses by utilizing the conventions and best practices of experimental research.	0%	20%	40%	40%	15
9	Formulate or validate theoretical and/or numerical models by visualizing, analyzing, and evaluating data.	0%	20%	53%	27%	15
10	Use, adapt, and develop software to: interface with equipment; collect, visualize and analyze data; perform numerical analysis; and model physical systems.	0%	19%	44%	38%	16
11	Work cooperatively and effectively with peers and supervisors.	0%	13%	13%	75%	16
12	Recognize the limits of their own knowledge and skills, identify appropriate avenues for new learning, and pursue new knowledge and skills independently.	0%	6%	38%	56%	16
13	Develop solutions to problems by integrating facets of science, mathematics, technology, business, experience, practical skills, and communication skills.	0%	19%	38%	44%	16

6 - What other skills, training or knowledge should an entry-level applicant have to be hired into your organization?

Practical exposure to industry-standard software & tools.
They must have some prior teaching experience.
Soldering skills, electronics testing, drawing reading , prepare design documentation. Excellent work ethics should have to be hired into our organization.
Understanding the basics of alternative energy systems, such as fuel cell fundamentals, battery technologies, power electronics fundamentals, motor control fundamentals
Willingness to travel extensively (in Canada and abroad) Networking
Understanding of the importance of documentation, using research discoveries to make SOP suggestions
Programming languages such as C and Python are key for the efficient and successful work of any applicant.
Knowledge of standards and codes UL Electrical Panel CSA Electrical code CompTIA Structured Cabling ISA 5.1 NETWORKING AUTOCAD
Of particular interest in my current organisation is a good working knowledge of Python and an understanding of LED optics.
An appreciation of the fundamentals of climate change and the role of all scientists in studying and addressing those issues
Better understanding of standard business practices
Typically we ask prospective employees to prepare a presentation of their choice. Being able to convey coherently to an audience is critical. Hands on experience with gadgets, lab instruments (scopes etc). Some programming skills in an analytical language (python, matlab/octave etc).
The list provided is fairly comprehensive.
Able to work in team environment, able to use hand tools and computer, able to follow a process and work safely in an organized way, able to communicate issues and opportunities and present ways for improvements

7 - What are the emerging trends in the sector that KPU Physics for Modern Technology students should be prepared for? These trends might include technology, sustainability, and innovation. Please be as specific as you are able to.

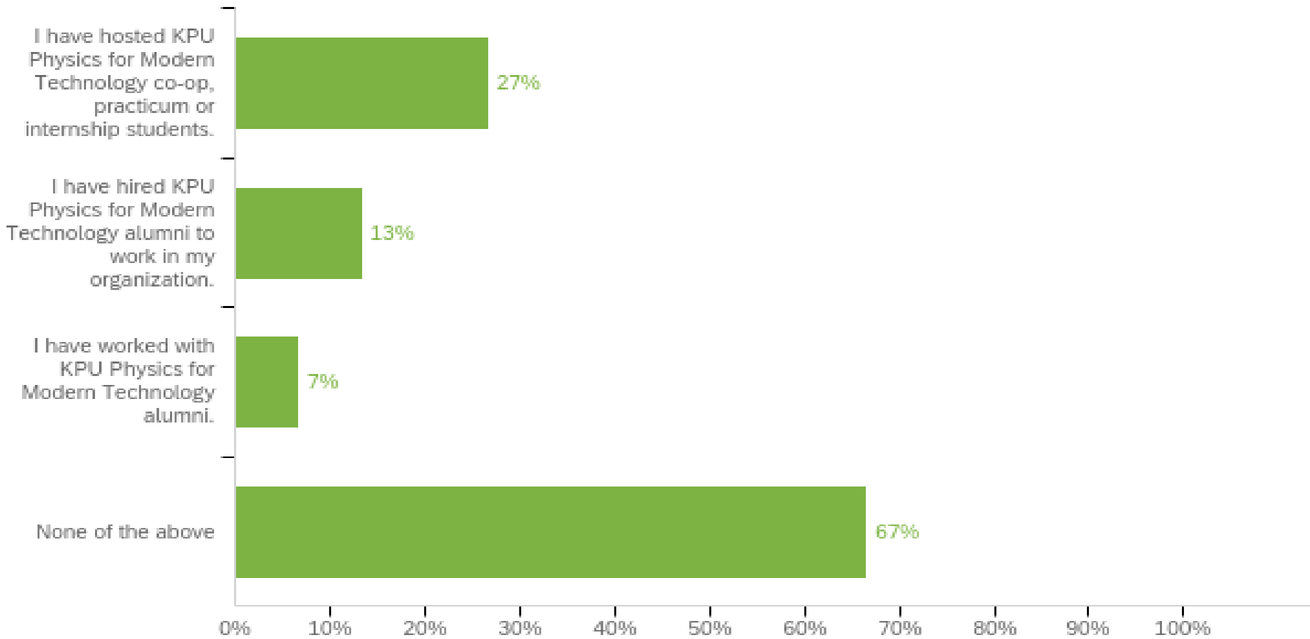
Characteristics and limitations of renewable energy sector.
Quantum materials technologies, quantum computing and communications, sustainable energy
Design for manufacturing, User experience for the man to machine interface Understanding of industrial engineering
I don't have any specifics on this.
Large scale hydrogen production and storage.
Machine learning Automation Supervision and maintenance of complex operations or devices working in a network/workflow.
Machine learning, visualization and data mining, databases
- Proper knowledge and skillsets related to IoT technologies - Design and development of basic UIs for the purpose of product testing and iteration - Knowledge of product management for the purpose of identifying the needs of end users and the answer to "why" we develop certain products or features.
Climate change will be huge. Carbon capture, technologies that avoid carbon emissions also. AI and Machine Learning are an obvious home for physicists and are major trends.
Too many to focus on, other than perhaps the evolution of alternate energy generation systems and mitigation of climate change challenges
Innovation and product development process
Sensing of kinds is getting so cheap these days that it is everywhere. A base knowledge of sensing techniques (magnetic, temperature, flow, pressure, distance (laser, eddy current, inductive, optical, vision) is helpful. On the computational side, a working knowledge of Linux is essential.
There's lots of emerging trends. Ones that come to mind are photonics and AI. However, what is really important is good fundamentals, such as in math and optics (in these cases) and the rest can be learned.

QUESTIONS ON CHAPTER 4: EFFECTIVENESS OF INSTRUCTIONAL DELIVERY

Career and Further Education Preparedness

Are graduates of the program successful?

8 - Which of the following best describes your previous experience with students and/or alumni in KPU's Physics for Modern Technology program? Please select all that apply.



#	Answer	Percentage	Count
1	I have hosted KPU Physics for Modern Technology co-op, practicum or internship students.	27%	4
2	I have worked with KPU students on class projects.	0%	0
3	I have hired KPU Physics for Modern Technology alumni to work in my organization.	13%	2
4	I have worked with KPU Physics for Modern Technology alumni.	7%	1
5	None of the above	67%	10
	Total		16

Note: The last row presents the total number of respondents. The total number of responses for this question is greater than the number of respondents. Therefore, the percentage total exceeds 100%.

9 - Based on your experience, how prepared were KPU's Physics for Modern Technology co-op, practicum or internship students to work in your organization?

#	Based on your experience, how prepared were KPU's Physics for Modern Technology co-op, practicum or internship students to work in your organization?	Percentage
1	Not at all prepared	0%
2	Somewhat prepared	25%
3	Very well prepared	75%
	Total	4

10 - Based on your experience, how prepared were the KPU Physics for Modern Technology students you worked with on class projects?

No results to show

11 - Based on your experience, how prepared were KPU's Physics for Modern Technology alumni to work in your organization?

#	Based on your experience, how prepared were KPU's Physics for Modern Technology alumni to work in your organization?	Percentage
1	Not at all prepared	100%
2	Somewhat prepared	0%
3	Very well prepared	0%
	Total	1

12 - Please comment on ways in which the program is preparing students well for work.

Good knowledge for the general ideas our products making here. Good work ethics.

N/A

We only had one student joined us as an intern but in general she was very enthusiastic and open to learn, she had the proper knowledge for python and PCB design and circuit board work.

13 - Please comment on ways the students' preparation for work could be improved.

More communication with managers on problems came up or any ideas to suggest to improve the work process.

N/A

Having more in-depth hands-on experience in working with real-life products would get them ready for the market. Aside from the theoretical and lab experiments the students do, they must build the acumen of why devices and technologies designed in certain way so that they can build a more realistic vision about what really entice them when building a career path.

QUESTIONS ON CHAPTER 3: PROGRAM RELEVANCE AND DEMAND

Student Demand

14 - What is the current demand in your sector for graduates of programs like this one?

#	What is the current demand in your sector for graduates of programs like this one?	Percentage
1	Very little demand	0%
2	Some demand	81%
3	A lot of demand	19%
	Total	16

15 - How do you think the demand will change over the next 5 to 10 years?

#	How do you think the demand will change over the next 5 to 10 years?	Percentage
1	It will likely decrease	0%
2	It will likely stay the same	31%
3	It will likely increase	69%
	Total	16

Program's Connections

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

16 - How satisfied are you with the opportunities you have to stay connected to KPU's Physics for Modern Technology program?

Note that "neutral" and "negative" categories are excluded from the chart, leaving only the "positive" categories to enable quick comparisons between items. For items with low positive percentages, use the frequency table below to review the proportion of "neutral" versus "negative" responses.

#	How satisfied are you with the opportunities you have to stay connected to KPU's Physics for Modern Technology program?	Percentage
1	Very dissatisfied	0%
2	Somewhat dissatisfied	0%
3	Neither satisfied nor dissatisfied	20%
4	Somewhat satisfied	27%
5	Very satisfied	53%
	Total	15

17 - What can KPU's Physics for Modern Technology program do to build better connections with the discipline/sector?

More foundational knowledge in core physics subjects (e.g., quantum mechanics) would better connect students in this program to technology applications of burgeoning areas of physics.
Stay connected with the coop program coordinators. Review job postings on our website on a regular basis.
Continued outreach, eventually the time will come when we are ready for students.
I believe in order to make it more efficient, KPU can hire/assign one person who will liaise between industry and the students, who can understand the challenges industry has and how to translate them into the programs students take and how to connect students with the right skill sets to those companies.
I think the current activities and practices within the program are ideal.
Perhaps try get some speakers to come through and talk about industrial application of physics ?
I know that the program tries hard to develop these connections. Maybe some work to get field trips to some of the leading physics based companies would be helpful. (General Fusion, D-Wave, or Honeywell).
I will recommend to ask the student to find a Co op position as a ENG level and not lower. if it is not at the line where they will continue after they graduate they will miss the opportunity to understand what is really required from them in the future in order to utilize their degree better

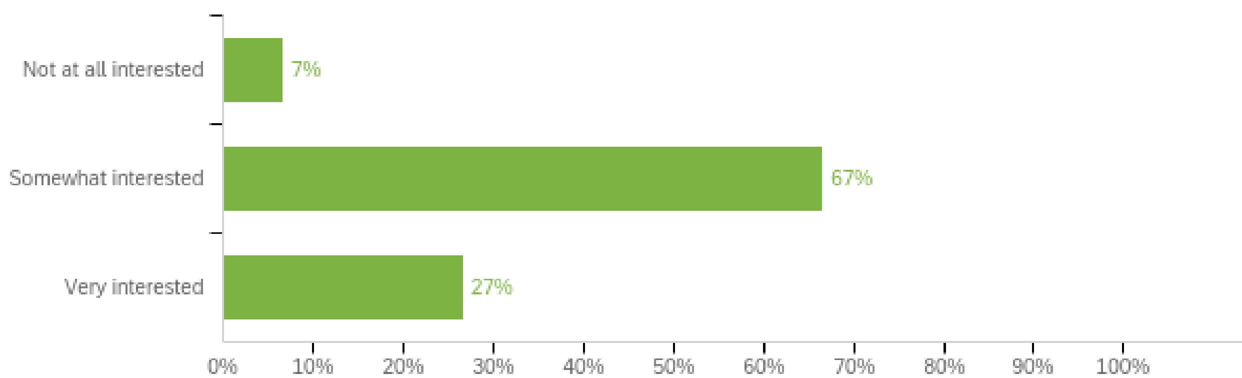
18 - Have you attended meetings of the Physics for Modern Technology programs' advisory committee?

#	Have you attended meetings of the Physics for Modern Technology programs' advisory committee?	Percentage
1	Yes	67%
2	No	33%
	Total	15

19 - How responsive is the program to external advice?

#	How responsive is the program to external advice?	Percentage
1	Not responsive enough	0%
2	Somewhat responsive	40%
3	Very responsive	60%
	Total	10

20 - Please rate your level of interest in participating projects that connect program students with the industry or sector.



#	Please rate your level of interest in participating projects that connect program students with the industry or sector.	Percentage
1	Not at all interested	7%
2	Somewhat interested	67%
3	Very interested	27%
	Total	15

21 - Please share any project ideas you have to connect program students with the industry.

No project I can think of at the moment.
This would be a good topic to see how project generators could connect with students.
Facility tours of interested businesses for students might help the businesses scope out students that are especially interested in their industry.
Sorry- the question is a little vague!
None at this time
As I mentioned before, a speaker series would be a good idea. Assuming that in person lectures are on these days.

Appendix J

List of specialized equipment used in the 2nd, 3rd, and 4th year of the Physics for Modern Technology program.

(Note: this list does not include standard benchtop laboratory instruments such as power supplies, function generators, oscilloscopes, multimeters etc, which are used widely throughout the program. Neither does it include generic smaller components such as resistors, capacitors, inductors, switches, diodes, transistors, operational amplifiers, sensors etc.)

Course	Specialized equipment
PHYS 2030 – Classical Mechanics	Forced oscillations apparatus Coriolis apparatus Coupled oscillator apparatus
PHYS 2040 – Thermal Physics	Thermal Expansion Apparatus Adiabatic Gas Law Apparatus Stefan-Boltzmann Apparatus Entropy of Mixing Apparatus Refrigeration/Heat Pump Apparatus Absolute Zero Apparatus Planck's Law Apparatus
PHYS 2600 – Electronics	National Instruments myDAQ (student data acquisition device)
PHYS 2610 – Sensors & Actuators	Photoelectric sensors Inductive proximity sensors Resistance Temperature Detectors (RTD) Linear Variable Differential Transformer (LVDT)
PHYS 3610 – Introduction to Control PHYS 3620 – Process Control	Allen Bradley Micro 850 PLC Velocio Ace 222v10 PLC Festo Basic Level , TP 101 pneumatic training kit Festo Process Automation basic Edukit
PHYS 3700 – Signal & Image Processing	
PHYS 3710 – Applied Optics & Optoelectronics	Multi-Wave Liquid Crystal Variable Retarder Thermoelectric laser power meter Fiber optics connectorizing and polishing kit Raspberry Pi

PHYS 3900 – Project in Physics & Technology PHYS 4199 – Senior Project I PHYS 4299 – Senior Project II	Rasie3D printer Formlabs 3D printer Voltera V-One PCB printer Ultra-Linear Measurement Condenser Microphone High field water cooled electromagnet Microfluidic fabrication system Arduino microcontrollers Raspberry Pi Lock-in amplifier Scanning Electron Microscope Sputter coater
PHYS 4700 – Solid State Physics: Theory and Practice	Earth's Field Nuclear Magnetic Resonance apparatus Scanning tunneling microscope Gouy balance for magnetic susceptibility measurements