Canadian Journal of Higher Education
Revue canadienne d'enseignement supérieur

Ethno-linguistic patterns of degree completion in BC universities: How important are high-school academic achievement and institution of entry?

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Citer cet article

Sweet, R., Pullman, A., Adamuti-Trache, M. & Robson, K. (2019). Ethno-linguistic patterns of degree completion in BC universities: How important are high-school academic achievement and institution of entry? *Canadian Journal of Higher Education / Revue canadienne d'enseignement supérieur*, *49* (3), 69–87. https://doi.org/10.7202/1066636ar

Résumé de l'article

Nous examinons le taux d'obtention du diplôme de baccalauréat dans le système d'enseignement supérieur de la Colombie-Britannique, notable pour la variété des voies qu'il offre vers la diplomation et sa population estudiantine ethniquement diversifiée. En utilisant un ensemble de données administratives longitudinales, nous regardons comment la probabilité d'acquérir un diplôme dans les universités de recherche, les universités d'enseignement et les universités techniques varie en fonction de l'origine ethnolinguistique de l'étudiant et de ses résultats au secondaire. Les estimations basées sur des modèles de régression logistique multiniveau montrent que dans l'ensemble, les étudiants de langue maternelle coréenne, tagalog ou vietnamienne sont moins susceptibles d'acquérir un diplôme que les étudiants de langue maternelle anglaise. De plus, le type d'établissement où un étudiant commence ses études supérieures est lié au taux d'acquisition ultérieur du diplôme pour tous les groupes ethnolinguistiques. Les étudiants qui intègrent une université de recherche, même avec des résultats moins bons au secondaire, sont plus susceptibles d'obtenir leur diplôme que les étudiants ayant obtenu de meilleurs résultats au secondaire, mais qui intègrent une université d'enseignement ou une université technique. Afin d'améliorer le taux de succès dans chaque catégorie d'établissement et groupe ethnolinguistique, notre étude souligne la nécessité de mener des recherches sur les raisons d'un taux de succès inférieur dans certains types d'établissements pour tous les groupes ethnolinguistiques, et particulièrement pour les étudiants de langue maternelle coréenne, tagalog et vietnamienne, indifféremment de leur niveau scolaire à la fin du secondaire ou du type d'établissement d'enseignement supérieur qu'ils ont intégré à la fin de leurs études secondaires.

ETHNO-LINGUISTIC PATTERNS OF DEGREE COMPLETION IN BC UNIVERSITIES: HOW IMPORTANT ARE HIGH-SCHOOL ACADEMIC ACHIEVEMENT AND INSTITUTION OF ENTRY?

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Abstract

We examine bachelor's degree completion in the British Columbia post-secondary system, which is noted for its multiple pathways to graduation and ethnically diverse student population. Employing an administrative longitudinal dataset, we compare how the probability of degree completion by students enrolled at research-intensive, teaching-intensive, and college-technical institutions differs by ethno-linguistic background and high school grades. Estimates from multi-level logistic regression models demonstrate that Korean, Tagalog, and Vietnamese speakers have lower probabilities of degree completion than English-speaking students. The type of institution a student initially enters is, however, an important correlate of degree completion for all ethno-linguistic groups. Students with lower high school grades who initially enter a research-intensive institution are more likely to graduate compared with higher-achieving students who enter a teaching-intensive or college-technical institution. To improve completion by institutional type and among ethno-linguistic groups, our study highlights the need for research on why degree completion is lower at certain institutions for all ethno-linguistic groups and consistently lower among Korean, Tagalog, and Vietnamese speakers regardless of their level of academic achievement in high school or the type of post-secondary institution they initially entered.

Keywords: post-secondary completion, British Columbia, ethno-linguistic background, high-school grade point average

Résumé

Nous examinons le taux d'obtention du diplôme de baccalauréat dans le système d'enseignement supérieur de la Colombie-Britannique, notable pour la variété des voies qu'il offre vers la diplomation et sa population estudiantine ethniquement diversifiée. En utilisant un ensemble de données administratives longitudinales, nous regardons comment la probabilité d'acquérir un diplôme dans les universités de recherche, les universités d'enseignement et les universités techniques varie en fonction de l'origine ethnolinguistique de l'étudiant et de ses résultats au secondaire. Les estimations basées sur des modèles de régression logistique multiniveau montrent que dans l'ensemble, les étudiants de langue maternelle coréenne, tagalog ou vietnamienne sont moins susceptibles d'acquérir un diplôme que les étudiants de langue maternelle anglaise. De plus, le type d'établissement où un étudiant commence ses études supérieures est lié au taux d'acquisition ultérieur du diplôme pour tous les groupes ethnolinguistiques. Les étudiants qui intègrent une université de recherche, même avec des résultats moins bons au secondaire, sont plus susceptibles d'obtenir leur diplôme que les étudiants ayant obtenu de meilleurs résultats au secondaire, mais qui intègrent une université d'enseignement ou une université technique. Afin d'améliorer le taux de succès dans chaque catégorie d'établissement et groupe ethnolinguistique, notre étude souligne la nécessité de mener des recherches sur les raisons d'un taux de succès inférieur dans certains types d'établissements pour tous les groupes ethnolinguistiques, et particulièrement pour les étudiants de langue maternelle coréenne, tagalog et vietnamienne, indifféremment de leur niveau scolaire à la fin du secondaire ou du type d'établissement d'enseignement supérieur qu'ils ont intégré à la fin de leurs études secondaires.

Mots-clés : diplôme supérieur, Columbie Britannique, origines ethno-linguistiques, résultats de fin d'études secondaires

Introduction

Among individuals who enroll in a bachelor's degree (BA/BSc) program, fewer than two-thirds complete their studies within 6 years (Childs, Finnie, & Martinello, 2017; Heslop, 2015). This disjuncture in admission and graduation rates raises policy concerns around government

expenditures, institutional effectiveness, and high school graduates' academic preparedness for post-secondary education (PSE) (Ministry of Training, Colleges and Universities, 2015). At the individual level, failure to successfully complete a degree disappoints aspirations, disrupts career plans, and often incurs financial penalties (Finnie, Childs, & Qiu, 2012; Ma & Frempong, 2013).

Higher education policy researchers have responded by shifting attention from issues of equity in admissions to an exploration of the determinants of retention, program persistence, and degree completion (Finnie, Mueller, Sweetman, & Usher, 2008; Kelly & Schneider, 2012). In this paper, we contribute to the literature by using the British Columbia (BC) PSE system as a case study of the antecedents and correlates of degree completion for a youth cohort born in 1990—with a particular focus on how BA/BSc completion differs by students' ethno-linguistic status, high-school grade point average, and the type of institution they initially enter. British Columbia's PSE system is characterized by multiple pathways to a degree, including traditional four-year undergraduate and two-year degree transfer programs. In high choice, merit-based PSE systems, both admission and degree completion requirements are expected to balance equality of opportunity with academic excellence (Fisher et al., 2014). Our examination of degree completion determinants thus considers students' personal characteristics and social contexts in relation to their school and university experiences. We extend existing analyses by accounting for recent organizational reforms to the university system as well as changes in the student population, primarily its ethnic composition.

Literature Review

Determinants of BA/BSc Degree Completion

Studies of degree completion in Canada typically focus on the pathways followed by students as they navigate the PSE system (Conrad & Morris, 2010; Parkin & Baldwin, 2009) and determinants of degree completion (Finnie et al., 2008; Mueller, 2008). With the publication of the Youth in Transition Survey (YITS), nationally-representative longitudinal data became available for analyses of students' transition from high school to PSE, their

university experience, and eventual degree completion (Barr-Telford, Cartwright, Prasil & Shimmons, 2003; Finnie & Qiu, 2008; Motte, Qiu & Bussiere, 2008). Research on the determinants of completion using YITS data have examined social structures, student characteristics, and institutional features (Lambert, Zeman, & Allen, 2004). These studies reported a positive association between high school grades and degree completion (Christofides, Hoy, Milla & Stengos, 2015), as well as positive relationships between graduation and family socio-economic status (SES), being female, and attending an urban school (Childs, Finnie, & Martinello, 2017). Due to sampling limitations in YITS, however, ethnic or racial differences were not examined or were aggregated and treated as a single 'visible minority' category (e.g., Thiessen, 2009).

Other studies have employed alternative data sources to examine the relationship between high-school grade point average (HSGPA) and PSE graduation. In BC, Andres (2015) demonstrated that both SES and HSGPA are associated with participation and completion. Although this research summary observed higher graduation rates for women, their attainment was often gendered by field of study (Andres & Adamuti-Trache, 2007). Dooley, Payne, and Robb's (2012) study of BA/BSc completion at four Ontario universities also utilized social background factors and HSGPA information obtained from administrative records. It found that, while higher SES and being female were positively related to completion, neither measure had a significant effect on completion once HSGPA was included in the analysis.

Few Canadian studies have considered how BA/BSc completion differs by race, ethnicity, and immigration status. An exception is Abada, Hou and Ram (2009) who employed a cross-sectional national survey to study ethnic differences in educational attainment among second-generation immigrant youth. They reported that Asian-origin groups had particularly high levels of BA/BSc attainment, although marked variations in degree aspirations and attainment were observed. While expanding the scope of analyses to include a more detailed examination of ethnic differences in educational attainment, the study's data source did not contain information on HSGPA.

Research on degree completion also highlights the importance of the PSE experience itself. Institutions differ in faculty expertise and in the resources available to support students across a range of academic, financial, and social-emotional needs (Barr-Telford et al., 2003). Among the most widely utilized 'quality index' scales is the

annual Canadian university ranking report published by *Maclean's Magazine*. Approaches to the analyses of institutional quality—including ranking—have been examined by Finnie and Usher (2005) who indicated the conceptual and measurement difficulties involved. Related studies are limited in number and scope, dealing largely with the consequences of rising tuition and the prospect of debt as constraints on completion (Finnie & Qui, 2008).

Institutional Differentiation and Degree Completion

As a result of system expansion, Canadian universities have become differentiated in size, resources, and curricular scope such that a distinct 'status hierarchy' has emerged (Davies, Maldonado & Zarifa, 2014; Davies & Zarifa, 2012). In the BC system, expanded BA/BSc programming has resulted in distinctions among research-intensive universities (RIUs), teaching-intensive universities (TIUs), and college-technical institutes (CTs). With legislative change in 2002, many former community colleges were reconfigured to offer four-year programming with degree granting status. In addition to these new degree pathways, the 'college-to-university' transfer system remains in place. This pathway typically involves enrolling for one to two years at a CT, then transferring to either an RIU or TIU to complete the BA/BSc degree (Fisher et al., 2014).

Although BA/BSc programming across institutional types may be comparable, RIUs are more academically selective in admitting students, as seen in their higher entering HSGPA requirements (Arida, 2013). This has encouraged intense competition for admission to many RIU programs, resulting in claims of unequal access across SES, gender, and race-ethnicity dimensions (Cui & Kelly, 2013; Sweet, Robson & Adamuti-Trache, 2017). There nevertheless may be benefits to enrolling in an RIU that justify this level of competition. For example, data on CT transfer students in BC indicate much lower BA/BSc completion rates, although many complete two-year associate's degree programs (Cowin, 2013). These results are consistent with US-based studies with similar community college structures and transfer pathways (Goodman, Hurwitz, & Smith, 2015).

Selective admissions attempts to align a student's HSGPA with an institution's position in the PSE status hierarchy. There is evidence such academic matching

improves degree completion (Kelly & Schneider, 2012). However, the extensive literature on student-university match based on HSGPA also suggests the need for a broader assessment of the 'fit' between student characteristics and the general features of the institution attended (Kelly, Howell, & Sattin-Bajaj, 2016). Students choose institutions and programs in relation to financial, geographic, and cultural considerations and, where a better fit is achieved in these respects, completion rates improve (Howell, Pendar, & Kumar, 2016). Other fit patterns are found at the curricular level where students' choose majors or express preferences for the various course and program options in the BA/BSC program (Hallsten & Thaning, 2018).

Student Diversity

Historically, the profile of the traditional PSE student in BC (and Canada) has been English-speaking, white, middle-class, and male, although in the past 30 years the gender balance has shifted in favour of female attendance and the socio-economic base has broadened somewhat (Card, Payne, & Sechel, 2011; Lehmann, 2014). The BC student population has also become more culturally diverse, reflecting ongoing changes in the ethnic composition of the province. Currently, Asian-origin communities account for over 50% of the population in Metro Vancouver and 30% in the rest of the province, both markedly higher than the national average of 22% (Statistics Canada, 2015).

For ethnic-immigrant groups, the PSE system offers a means of resolving social integration and mobility challenges (Costigan, Hua, & Su, 2010; Taylor & Krahn, 2013). Studies of the relationship between ethnicity, PSE participation, and educational attainment have employed an 'ethnic capital' framework that positions families within a network of community resources designed to support children's PSE aspirations as well as the dispositions underlying school engagement and achievement (Abada et al., 2009; Lee & Zhou, 2015). More recent theoretical formulations extend the notion of ethnic capital to better suit emerging 'majority-minority' regions—typically urban environments comprising highly diverse ethnic-immigrant communities and their constituent institutions. In these settings, differences in the educational values and practices of established and immigrant-ethnic student groups (and their parents) are frequently encountered and require resolution. Jimenez and Horowitz (2013), for exam-

ple, describe the formation of academic norms in selected California schools by ethnic-majority Asian students that differed from and eventually displaced those of the established student body. Crul, Keskiner and Lelie (2017) similarly describe successful educational trajectories of immigrant-ethnic youth that reconfigure ethno-racial hierarchies in 'super-diverse' European contexts. Several studies have outlined the shift to ethnic majority-minority status in major North American cities (Frey, 2014; Hiebert, 2015). The comparative educational success of Asian youth in these settings has been attributed in both academic and popular publications to expressions of ethnic capital—specifically, to differences in the educational values and actions of parents (Chua, 2011; Ng & Wang, 2019; Zhou & Kim, 2006). Other researchers acknowledge these cultural distinctions but point to a growing convergence in parents' aspirations for and commitment to their children's education, irrespective of ethnicity (Bornstein, 2012; Jimenez, 2017; Warikoo, 2018).

Purpose

In this paper, we frame our analysis of ethnic students' PSE transitions in relation to two constructs: ethnic capital and student-institution matching. The former attempts to explain student achievement as a consequence of parentally and culturally driven preparation during the K-12 period, while the latter sets out parameters for understanding the relationship between HSGPA and both selective admissions and degree completion. The principle of merit applied at admissions is based primarily on HSGPA, although other factors like SES, gender, and ethnicity are recognized as influencing students' academic achievement and consequently admission results. The logic of relying on HSGPA as the criterion of merit at admissions further assumes that PSE success builds on an academic foundation developed during the K-12 school period. Students' PSE experiences are nevertheless strongly influenced by the resources and opportunities available at institutions comprising the various pathways. Our analysis examines both the institutional influence of pathway choice and the role played by HSGPA in determining the linked transitions of university admissions and degree completion in a culturally diverse PSE system.

Analytical Approach

Data and Sample

Using BC Ministry of Education and Student Transitions Project administration files, we constructed a longitudinal dataset that allows examination of a student's progress through the K-12 and PSE systems. This student-level dataset captures students born in 1990 and for whom the earliest education records begin in 1993 and extend to 2016. Together the administrative records include information on high school (e.g., HSGPA and school-level median family income), student characteristics (e.g., ethno-linguistic status), and PSE (e.g., entry dates, institution, field of study).

Analysis is limited to a sub-set of students who graduated from a BC high school (typically in the 2007-2008 school year), entered a BA/BSC degree or university-transfer program, and for whom PSE completion information was available. Because previous research indicates the typical 'on-time' completion timeline is five to six years for "direct from high school students" (Heslop, 2015, p.14), we limit the sample to students who entered a BA/BSC program within two years of completing high school and thus had a chance to graduate 'on time' within the period covered by the data set[1]. The sample used for analysis also includes only students who graduated from a BC school district (both public and independent schools) and excludes students enrolled in offshore schools.

Variables

The dependent variable captures BA/BSc degree completion by 2016 (e.g., on-time completion) and is operationalized through a binary dummy indicator (0=non-completion, 1=completion). As listed in Appendix 1, among the 16,795 students in our sample who are identified as entering a BA/BSc or university transfer program, 60% completed a BA/BSc within the time period under study.

The main independent variables of interest are: ethno-linguistic status; the type of PSE institution a student first entered after high school graduation; HSGPA; and an interaction term between institutional type at entry and HSGPA. Seven categories represent ethno-linguistic status—English, European, South Asian, Chinese, Korean, Tagalog/Vietnamese, and Other—and were recorded in the K-12 administrative files as the main language spoken

at home. Three categories represent institutional type at PSE entry (RIUs, TIUs, and CTs); a categorization based on established institutional groupings in the BC PSE system (Heslop, 2015)[2]. Appendix 2 provides an overview of how each BC institution is categorized and indicates those removed from the analysis due to their small cluster sizes. HSGPA is based on a standard grade point average metric ranging from 1 to 4. This variable is also redefined as a categorical variable to represent four HSGPA groups: 24th percentile and under, 25th-49th percentile, 50th-74th percentile, and 75th percentile and above.

The analysis also includes several control variables that prior research suggests are associated with the outcome variable and which, additionally, may influence relationships between completion and the independent variables of primary interest in this study[3]. Indicators represent gender (male=0, female=1) and Indigenous status (0=no, 1=yes). Variables also capture participation in an English as a second/foreign language (ESL) program at any point during K-12 (0=no, 1=yes), the school grade level at which a student first appeared in the administrative data (primary, elementary, junior secondary, and senior secondary entry), and whether the last high school attended was located in Metro Vancouver (0=no, 1=yes). A continuous measure of median family income represents

SES at the school level[4]. PSE factors that may influence degree completion include field of study (FOS) recorded at entry (undeclared, STEM applied, STEM academic, non-STEM applied, and non-STEM academic)[5] and the gap between high-school graduation and PSE entry (immediate, one year, or two years).

Analysis

Given the selective nature of admissions in the hierarchical BC system, a student's HSGPA largely determines their entry to an RIU, TIU, or CT. As Figure 1 illustrates, the distributions of HSGPA among incoming TIU and CT students are similar, while the HSGPAs of incoming RIU students are higher on average. As expected, students with higher HSGPA are more likely to initially enter an RIU. As the descriptive statistics in Appendix 1 also show, RIU students have higher degree completion rates on average (i.e., 75% compared to 43% among TIU student and 35% among CT students). From descriptive statistics alone, however, it is unclear whether the higher observed RIU completion rates are due to institutional effects or the academic preparedness of the incoming student population.
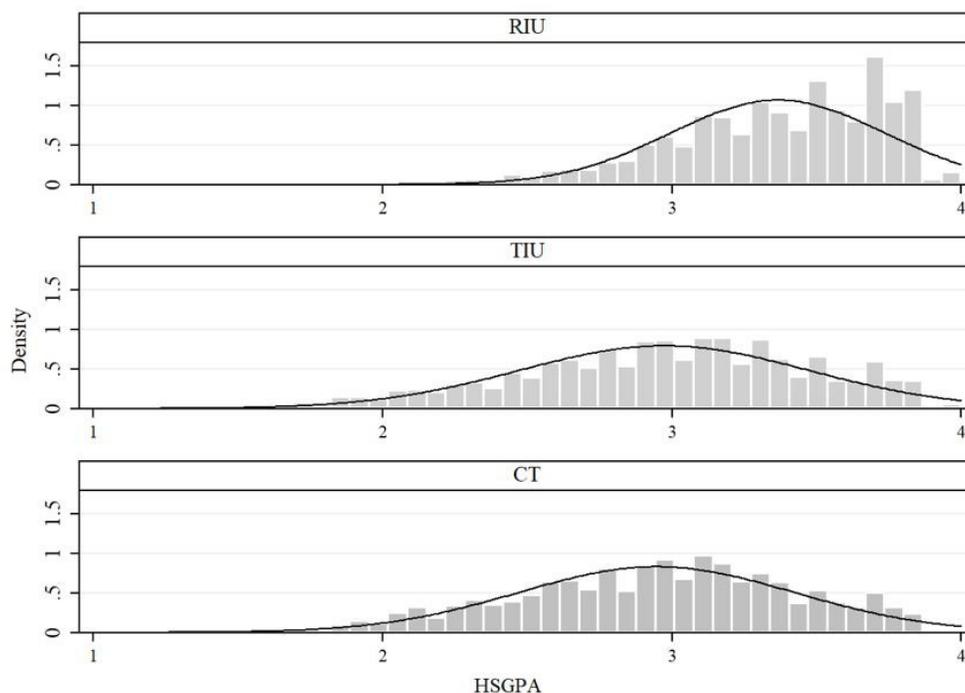

Figure 1. Frequency distribution of HSGPA across institutional type at entry

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In order to address this confounding effect, we generate inverse probability (IP) weights (Hernán & Robins, 2018). The weights are created by calculating the inverse of a student's probability of attending an RIU based on their HSGPA (i.e., a student who is more likely to attend an RIU given their HSGPA is less influential on the overall model). To determine how IP weights influence the overall results, all analyses are run both with and without weighting. As well as accounting for the confounding effect between HSGPA and institutional type at entry, the IP weights also provide insight into how pathway choice may result in differential outcomes for ethno-linguistic groups.

The modeling approach is based on multilevel logistic regression that accounts for PSE institutional clustering. It examines how ethno-linguistic category, institutional type at entry, and HSGPA—as well as the interaction between institutional type at entry and HSGPA—are associated with BA/BSC completion. Because institutional clustering has an important impact on the results, a baseline logistic regression (i.e., Model 0) shows how completion for each ethno-linguistic group differs from English-speaking students without accounting for the institutions each student was most likely to initially attend. Model 1 then provides the multilevel specification while Model 2 adds institutional type at entry, HSGPA, and an interaction term between these two indicators. Model 3 adds all control variables.

In this analysis, the regression coefficients are transformed into average marginal effects (AME). As described further in the results section, each categorical variable is interpreted as the predicted probability (i.e., percentage point difference) of completion compared to the reference group. To further examine how completion differs in relation to the main variables of interest, we construct graphs that show the AME of HSGPA, institutional type, and ethno-linguistic group on BA/BSc completion. Unlike the regression results, which compare the predicted probability of completion to a reference group (e.g., completion at CT vs. RIU), these Model 3 estimates generate AME that represent "the partial effect averaged across the specified population" (Wooldridge, 2016, p. 844). These estimates are produced without IP weights.

Results

Figure 2 provides a descriptive overview of ethno-linguistic differences in the institution type at initial enrollment. Most Chinese and Korean speakers enrolled in an RIU and were under-represented within TIU or CT pathways. Conversely, a larger proportion of South Asian language students initially enrolled in a TIU but were under-represented in RIUs. Finally, apart from English language speakers, far fewer students enrolled in the CT pathway.
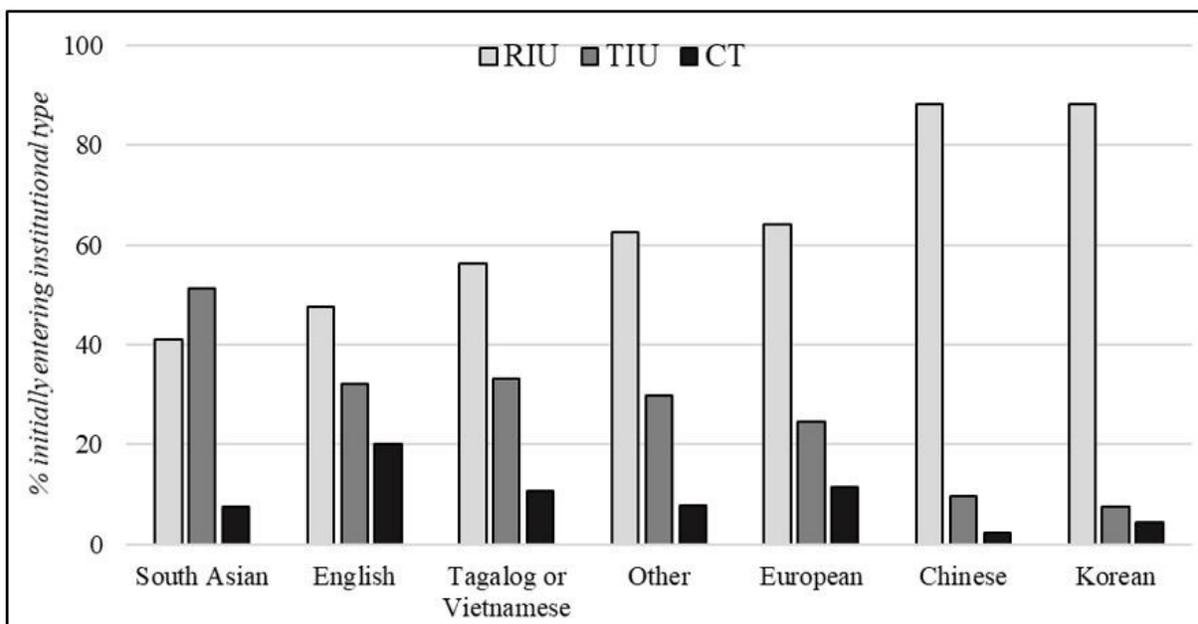

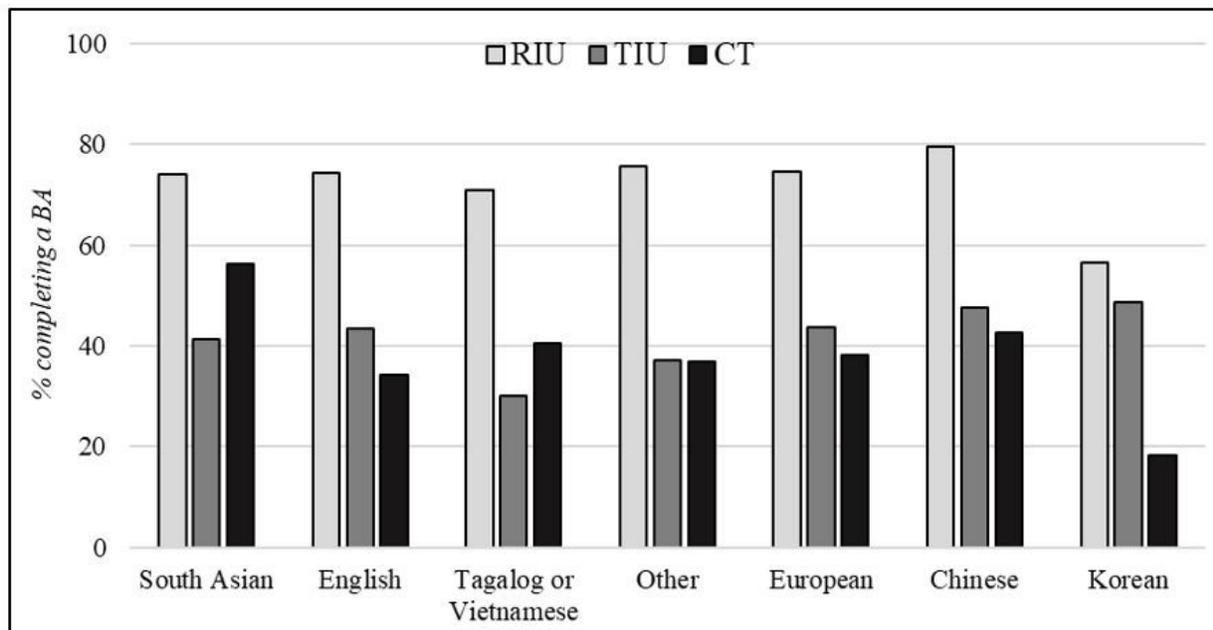*Figure 2.* Institutional type at entry by ethno-linguistic group

Figure 3. Degree completion rate by ethno-linguistic group and institutional type at entry

Figure 3 provides descriptive statistics on ethno-linguistic differences in BA/BSc completion by institutional type at entry. In comparing students' degree completion rates across RIU, TIU and CT pathways, students from all ethno-linguistic groups who initially enter an RIU are more likely to graduate. Among RIU students, Korean speakers have lower attainment while Chinese speakers have slightly higher attainment in comparison with other ethno-linguistic groups. Tagalog/Vietnamese speakers have lower attainment at TIUs compared to other TIU students. Chinese and Tagalog/Vietnamese speakers have higher attainment at CTs compared to other CT students.

Comparing degree completion in relation to institutional type at entry for the various ethno-linguistic groups suggests the RIU pathway results in high completion rates for only some groups. Chinese speakers have high completion rates at RIUs and are equally successful when entering TIU and CT programs. Despite similarly high levels of initial enrolment in RIUs, Korean speakers' degree completion rates are relatively low. This contrasts with their performance at TIUs, although relatively few Korean speaking students choose this pathway. Students who speak a South Asian language who initially enroll in TIUs have relatively low degree completion rates. While the CT pathway enrols relatively fewer students from the various ethno-linguistic groups (apart from English speakers), Tagalog/Vietnamese speakers who enrol in these institutions do relatively well.

Table 1 estimates the predicted probability (i.e., AME) of BA/BSc completion by ethno-linguistic group, HSGPA, and institutional type at entry—with and without IP weight and control variables. Model 0 first estimates a baseline logistic regression that does not account for the effect of institutional clustering. The results are effectively the same as those presented in Appendix 1. That is, compared to English speaking students, European language speakers are 6.5 percentage points more likely to graduate, Chinese speakers are 19 percentage points more likely to graduate, and the Other group of language speakers are 4.9 percentage points more likely to graduate.

Table 1. Regression estimates of BA/BSc completion, AME

	Baseline	Multilevel Logit			Multilevel Logit		
	Logit	Without IP weights			With IP Weights		
	Model 0	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Ethnolinguistic groups (ref: English)							

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	Baseline		Multilevel Logit			Multilevel Logit	
	Logit		Without IP weights			With IP Weights	
	Model 0	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
European	0.065***	-0.012	0.0049	-0.0029	-0.026	-0.0100	-0.017
	(0.017)	(0.012)	(0.013)	(0.016)	(0.015)	(0.016)	(0.017)
South Asian	-0.0042	0.019	0.041*	0.023	0.0072	0.034	0.017
	(0.017)	(0.015)	(0.019)	(0.027)	(0.015)	(0.023)	(0.030)
Chinese	0.19***	0.016	0.043*	0.027	-0.0094	0.028	0.015
	(0.009)	(0.016)	(0.019)	(0.015)	(0.018)	(0.017)	(0.012)
Korean	-0.020	-0.20***	-0.18***	-0.15***	-0.25***	-0.21***	-0.19***
	(0.022)	(0.031)	(0.024)	(0.031)	(0.044)	(0.036)	(0.045)
Tagalog/Vietnamese	-0.022	-.073***	0.068***	0.083***	-0.095**	-0.088**	-0.100**
	(0.027)	(0.015)	(0.021)	(0.015)	(0.029)	(0.031)	(0.032)
Other	0.049**	-0.022	0.016	0.0046	-0.037*	0.011	0.0030
	(0.019)	(0.013)	(0.011)	(0.012)	(0.018)	(0.018)	(0.012)
Institutional type at entry (ref: RIU)							
TIU			-0.17*	-0.18*		-0.12	-0.12
			(0.081)	(0.079)		(0.074)	(0.073)
CT			-0.27***	-0.27***		-0.20*	-0.19**
			(0.070)	(0.061)		(0.078)	(0.070)
High-school GPA (ref: 1-24 per.)							
25-49 percentile			0.13***	0.11***		0.15***	0.14***
			(0.011)	(0.015)		(0.013)	(0.018)
50-74 percentile			0.23***	0.21***		0.26***	0.24***
			(0.022)	(0.027)		(0.023)	(0.029)
75-99 percentile			0.28***	0.26***		0.31***	0.29***
			(0.029)	(0.034)		(0.027)	(0.035)
Interaction terms (Ref: RIU)							
TIU*25-50			0.037***	0.031*		0.0027	0.00014
			(0.010)	(0.015)		(0.012)	(0.017)
TIU*50-75			0.084***	0.085***		0.050*	0.052
			(0.022)	(0.025)		(0.024)	(0.028)
TIU*75-100			0.13***	0.13***		0.10***	0.10**
			(0.029)	(0.034)		(0.029)	(0.036)
CT*25-50			0.070**	0.067**		0.038	0.039
			(0.021)	(0.023)		(0.023)	(0.026)
CT*50-75			0.033	0.037		-0.0008	0.0061

	Baseline Logit		Multilevel Logit Without IP weights		Multilevel Logit With IP Weights		
	Model 0	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
			(0.038)	(0.041)		(0.040)	(0.044)
CT*75-100			0.071*	0.075*		0.043	0.047
			(0.031)	(0.036)		(0.032)	(0.037)
Controls				Included			Included
Observations				16,795			

Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; The baseline logit model presents the results without accounting for the clustering effect of institution of entry (n=22). The multilevel logit models demonstrate how the results change with the inclusion of the main independent (Model 2) and control variables (Model 3). Model three controls for: gender; Indigenous ancestry; prior K-12 ESL training; if a student's high school was located in Metro Vancouver; timing of entry to the BC K-12 system; field of study at PSE entry, and timing of PSE entry.

Because institutional type at entry varies by ethno-linguistic status, the multilevel specifications that account for this differ from the baseline logistic regression model. Models 1 to 3 illustrate that differences in the predicted probabilities of degree completion between English and Chinese, European, and Other language students are greatly reduced once a model accounts for the institutional clustering effect. However, new ethno-linguistic differences emerge in relation to institutional type at entry. These are seen in estimates that show degree completion rates for some groups are lower than would be expected given their admission to PSE institutions with high graduation rates overall. More specifically, compared to English speakers, Model 1 without IP weights estimates that Korean language speaker have graduation rates that are 20 percentage points lower and Tagalog/Vietnamese speakers have graduation rates that are 7.3 percentage points lower. Once IP weights are included in Model 1, Korean language students have estimated graduation rates that are 25 percentage points lower and Tagalog/Vietnamese speakers have rates that are 9.5 percentage points lower compared to English speaking students. The inclusion of control variables also alters the results, reducing the AME for Korean language speakers and increasing the AME for Tagalog/Vietnamese speakers.

Model 2 demonstrates that, as expected, the likelihood of BA/BSc completion is associated with institutional type at entry. Model 2 without IP weights estimates that students who initially enter TIUs are 17 percentage points less likely to graduate compared to students who enter RIUs, while students who first enroll in CTs are an estimated 27 percentage points less likely to graduate. However, the inclusion of IP weights reduces these coefficients and eliminates the statistically significant difference between TIUs and RIUs.

Also as expected, Model 2 demonstrates that HSGPA is associated with degree completion. In Model 2 without IP weights, students with average HSGPA in the 25th to 49th percentile have a predicted probability of completion that is 13 percentage points higher compared to students at the 24th HSGPA percentile and under. This difference widens as students with a HSGPA in the 50th to 74th percentile have a predicted probability of completion that is 23 points higher and students with a HSGPA at the 75th percentile or above have a predicted probability of completion that is 28 points higher. The inclusion of control variables in Model 3 reduces the AME by a few percentage points, while the inclusion of IP weights increases the AME by a few percentage points.

Model 2 also includes categorical-by-categorical interactions between institutional type at entry and HSGPA to estimate whether the difference in completion rates by institutional type (e.g., RIU vs. TIU and RIU vs. CT) differs by HSGPA quartile (e.g., compared to the 1st-24th percentile). In Model 2 without IP weights, the RIU vs. TIU completion rate difference narrows at higher HSGPA quartiles—that is, it narrows by 13 percentage points compared to the completion rate difference for students in the 1st-24th percentile group. Among students with lower HSGPAs, completion rates are higher for those who initially attend RIUs compared to TIUs. Among students with higher HSGPAs, completion rates are more similar re-

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gardless of whether they attend an RIU or a TIU although a difference in favor of RIUs still exists. By contrast, the CT vs. RIU completion rate difference does not narrow for high HSGPA students to the same degree. That is, students who enter CT have lower degree completion rates than those who enter RIUs and this difference narrows only slightly (i.e., 7 percentage points in Model 2 without IP weight) for students in the highest HSGPA quartile compared to the lowest quartile. Finally, the inclusion of control variables in Model 3 does not produce dramatic changes although IP weights in Model 2 and 3 reduce the size and significance of the interaction terms, especially for CTs.

In summary, the IP weights—which account for the probability that high achieving high school students will initially enter an RIU—provide additional understanding of ethno-linguistic differences in BA/BSc completion. In comparing the results of Model 2 with and without IP weights, we see that weighting reduces the size and significance of the AME for Chinese and South Asian speakers. This result suggests that high achieving Chinese and South Asian language groups are more likely to initially go to RIUs and also more likely to complete a degree. However, the IP weights have the opposite result when comparing completion rates between Korean/Tagalog/Vietnamese and English language students. Here, the inclusion of IP weights increases the AME for these

groups. This result suggests that high achieving Korean and Tagalog/Vietnamese speakers are more likely to initially enroll in RIUs but are less likely to complete a degree. To examine these patterns in greater depth, we next compare ethno-linguistic groups at the same achievement level in terms of how their probability of completion differs by institutional type at entry.

Figure 4 presents the AME of BA/BSc completion for the three institutional types or pathways, by ethno-linguistic group, and with each group's average HSGPA values indicated as percentile ranges. These results are derived from Model 3 without IP weights. Across institutional types, the probability of degree completion is positively associated with HSGPA. Completion is lowest for all ethno-linguistic groups who enter at the 24th percentile and lower; and highest for those groups who enter institutions in the 75th percentile or above. However, completion is more likely if initial enrolment is in an RIU, irrespective of ethno-linguistic group or HSGPA. Lower HSGPA students who initially went to RIUs have higher completion probabilities than higher HSGPA students who initially enrolled in TIUs or CTs. This contrast is more pronounced in the case of CT enrolments. For example, students with an HSGPA at or above the 75th percentile who initially enter a CT have an estimated AME that is lower than that of RIU entrants with an HSGPA between the 50th and 74th percentiles.
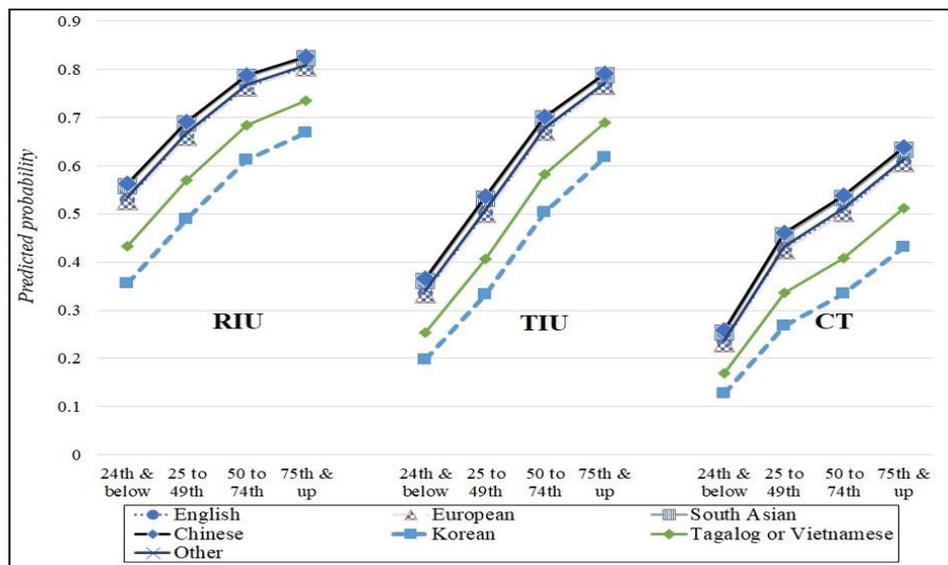

Figure 4. Predicted probability of degree completion by HS-GPA, ethno-linguistic group and institutional type at entry

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Degree completion probabilities do, however, vary by language group across institutional types and HSGPA percentile ranges. Chinese and South Asian students with lower HSGPA's (24th percentile and below) who entered an RIU have considerably higher probabilities of graduating than those who entered a TIU who in turn perform better than those who initially enrolled in a CT program. For high achieving students (75th percentile and above) in these same ethno-linguistic groups the likelihood of degree completion is highest among RIU entrants. The difference between RIU and CT completions for these groups is particularly pronounced. Completion probabilities for English, European, and Other Language speakers follow a similar pattern across institutional types and HSGPA ranges. By contrast, Korean and Vietnamese /Tagalog speakers consistently lag the predicted performance of other ethno-linguistic groups irrespective of HSGPA or whether they initially enrolled in an RIU, TIU, or CT.

Discussion

The main findings from our analyses suggest, first, that institutional stratification guides pathway admissions and, in combination with HSGPA, is instrumental in degree completion. Secondly, there is considerable variation in degree completion across ethno-linguistic groups, irrespective of pathway choice (i.e., institutional type at entry) or HSGPA. With respect to pathways, our results indicate lower predicted completion rates for TIU and CT students compared to RIU students. The lower completion predictions for these pathways raises both equity and administrative issues. The first of these is whether and how TIU and CT students differ from those entering an RIU (Davies, 2005; Stephan, Rosenbaum, & Person, 2009). Prior research demonstrates that CT students in particular face barriers to completion, such as family and work responsibilities (Andres, Adamuti-Trache, Yoon, Pidgeon & Thomsen, 2007). Additionally, CT students may encounter logistical challenges when transferring from a two-year college to a four-year university program. Although such pathway transfers are coordinated with the aim of minimizing time to graduation (Heslop, 2015), they remain an added complication in the timely progression to degree completion.

The probability of degree completion rises in relation to HSGPA across all pathways in a hierarchical system (Kelly & Schneider, 2012). However, our more detailed analysis of different HSGPA levels illustrates particular benefits to

gaining admission to an RIU. Completion probabilities at RIUs are greater not only for high-performing students but also for those with comparatively low HSGPAs. Conversely, students with higher HSGPA's who enter a TIU or CT are less likely to graduate with a BA/BSc than students with lower HSGPA's who attend an RIU. Although academic selectivity supports and reinforces student-institution match, these anomalous cases of 'overmatch' (low HSGPA - high selectivity) and 'undermatch' (high HSGPA - low selectivity) further demonstrate how accessing more selective institutions promotes degree completion (Dillon & Smith, 2015).

Our results show marked differences in the probability of degree completion by ethno-linguistic status—principally among Asian language students who make up the majority of non-English speakers in BC's post-secondary system. Although Chinese language speakers have higher completion rates overall, this difference is largely explained in the model that accounts for institution at entry. By contrast, the non-completion rate for Korean and Tagalog/Vietnamese language speakers increases once the model accounts for this factor.

This variability necessarily raises questions about the factors that underlie academic success for some ethno-linguistic groups but not others. Previous research highlights the importance of students' preparation during the K-12 school period and in Canada this has generated discussion and debate about cultural stereotypes and the effectiveness of ethnic capital in preparing students for competitive PSE entry (Gilmour, Bhandar, Heer, & Ma, 2010). Other research attempts to counter stereotypes of Asian exceptionalism by reframing analyses to reflect educational contexts as experienced by students of different ethnicities (Cui, 2015; Poon, Squire, Kodama & Byrd, 2016). Our analysis of the varied trajectories of ethno-linguistic groups enrolled in a stratified PSE system emphasizes the linkages between high school achievement, undergraduate admissions, and graduation. In doing so we draw attention to the institutional complexities encountered by students of diverse ethnicities as they pursue a bachelor's degree.

Limitations and Future Research

Our research is constrained by several factors. First, the findings do not generalize beyond British Columbia. Other jurisdictions have different structures and policies that uniquely shape their students' experiences and out-

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comes. Secondly, the provincial administrative data we employ enables a detailed tracking of educational trajectories but lacks the personal information needed to adequately describe students' social relations as well as their subjective understanding of the university experience. Additionally, these data limit our ability to fully define key variables. For example, ethno-linguistic categories merge multiple regional languages. Also, home language is but one proxy for ethnicity. Information on students' race, ethnic status and, in the case of immigrants, their country of origin remain largely absent from government data (Robson, 2018). Given the current ethnic composition of Canadian campuses and projected immigration flows, greater attention to the collection and use of race-ethnicity data would facilitate future analyses of equity and inclusion in diverse and increasingly stratified provincial PSE systems (Zarifa, 2012).

It is also important to note that the various vertical and horizontal structures of Canadian PSE may not be adequately represented by the typologies we employ in this paper. However, the application of a more finely graduated institutional scheme requires larger and broader institutional samples available only at the national level. As well, different field of study categorizations may yield different results (Graham, Frederick, Byars-Winston, Hunter, & Handelsman, 2013; Iannelli, Gamoran & Patterson, 2018). Again, these distinctions could be better examined with more comprehensive institutional and student samples.

Degree completion is only one of many milestones students reach in the course of their educational careers (Andres, 2015). Our research has examined PSE admissions and degree completion and demonstrated the linkages between these transitions and an individual's early academic achievement. Analyses of different outcomes would provide additional insight into the effects of institutional stratification and ethnicity. For example, how transitions to the labour market differ at the intersection of institution attended and ethno-linguistic status would be an important extension to consider in future research (Betts, Ferrall & Finnie, 2013; Lessard-Phillips, Boliver, Pampaka & Swain, 2018).

Acknowledgements

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Notes

1   Importantly, many students who are identified as non-completers within our study are likely to go on to complete a degree. As Heslop (2015) notes, the median time for degree completion is 5.7 years in BC and this length of time increases with the number of institutions a student attends and the number of credentials earned prior to degree completion.

2   The RIU, TIU, and CT categories typify various university programs in BC and represent the PSE 'pathways' students choose in pursuit of a degree. While all such pathways involve a 4 year baccalaureate program of study and may involve transfer across categories, we consider only the institution at which the student was initially registered or the 'institution at entry'.

3   These control variables also offer insight into other important socio-demographic factors that are related to completion. However, the results section does not interpret them as the analysis has not been designed with the intent of examining these group differences. Following Spector and Brannick (2011), we believe that "attention to demographics should focus on mechanisms that explain relations with demographics rather than on the demographics themselves" (p. 297). Thus, it will be necessary for future studies to have an explicit focus on other group differences in relation to PSE outcomes.

4   The BC Ministry of Education assigns a median family income value to each school, a measure that matches household income from the 2001 and 2006 Census to all students' home postal codes. Following Caro, McDonald and Willms (2009), this information was used to construct a derived income variable representing the average school-level income across all schools attended by the student. The resulting variable is used in the analysis to approximate the socio-economic status of a student's family. A limitation of this approximation is that school catchment areas can be large and/or diverse and thus contain households with very different socio-economic characteristics.

5   The typology was constructed with reference to previous work by Horn and Zahn (2001) and Quadlin (2017) to differentiate between work-orientated fields of study within STEM and non-STEM fields. The STEM applied category includes engineering, computer science, natural resources, kinesiology, health-related disciplines. The STEM academic category includes math, physical sciences, biology, and cognitive science. The non-STEM applied category includes communications, business, education, law, and social work. The non-STEM academic category includes English and languages, liberal and fine arts, history, philosophy, and social sciences.

Appendix 1. Descriptive Statistics

Variables	N	Proportion who graduate with a BA
Total	16795	0.601
Institutional type at entry		
RIU	9618	0.749
TIU	4718	0.429
CT	2459	0.354
Ethnolinguistic groups		
English	10463	0.563
European	828	0.628
South Asian	955	0.559
Chinese	2946	0.756
Korean	519	0.543
Tagalog/Vietnamese	349	0.542
Other	735	0.612
High-school GPA		
1-24 percentile	4305	0.322
25-49 percentile	4246	0.563
50-74 percentile	4312	0.728
75-99 percentile	3932	0.809
Student characteristics		
Male	7236	0.561
Female	9559	0.632
Non-Indigenous	16248	0.610
Indigenous	547	0.346
No past ESL training	11483	0.571
Past ESL training	5312	0.667
Metro Vancouver high school	10078	0.653
Non-Metro Vancouver high school	6717	0.524
Timing of BC K-12 entry		
Primary	13795	0.595
Elementary	1333	0.623
Junior sec	691	0.603
Senior sec	976	0.660

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Variables	N	Proportion who graduate with a BA
FOS at PSE entry		
Undeclared	9814	0.560
STEM applied	1986	0.695
STEM academic	1227	0.635
Non-STEM applied	2062	0.705
Non-STEM academic	1706	0.579
Timing of entry to PSE		
Immediate	13248	0.628
1 year	2474	0.469
2 year	1073	0.578

Appendix 2. Institutional information and categorizations

Name	RIU	TIU	CT	Low *n*
British Columbia Institute of Technology			*	
Camosun College			*	
Capilano University		*		
College of New Caledonia			*	
College of the Rockies				*R*
Douglas College			*	
Emily Carr University of Art and Design		*		
Kwantlen Polytechnic University		*		
Langara College			*	
North Island College			*	
Northern Lights College			*	
Nicola Valley Institute of Technology				*R*
Coast Mountain College			*	
Okanagan College			*	
Royal Roads University				*R*
Selkirk College			*	
Simon Fraser University	*			
Thompson Rivers University		*		
University of British Columbia	*			
University of British Columbia Okanagan	*			
Justice Institute of BC				*R*
University of the Fraser Valley		*		
University of Northern British Columbia	*			
University of Victoria	*			
Vancouver Community College				*R*
Vancouver Island University		*		

NOTE: "r" denotes institutions removed from analysis.