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Examining Academic Performance Among Pathway and Non-Pathway Health Sciences Students

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Abstract

Pathway programs providing opportunities for students to more efficiently earn university degrees and college diplomas are proliferating in Canada and internationally. In Ontario, Canada, the University of Ontario Institute of Technology (UOIT) and Durham College (DC) have jointly provided pathway programs for over a decade. These programs, in fields including science, health sciences (allied health sciences, kinesiology, nursing), social science and humanities (legal studies, criminology, commerce), nuclear power, and education (adult education, early childhood studies), facilitate inter-institutional transitions, and enable college graduates to obtain a 4-year (honours) university degree with as little as two additional years of study. This paper provides a quantitative, comparative analysis of the academic performance of pathway students (college-to-university transfer students) and their non-pathway, traditional counterparts (students who enter university directly from secondary school) enrolled in UOIT's Bachelor of Health Sciences (BHSc) and Bachelor of Allied Health Sciences (BAHSc) programs, and the collaborative UOIT-DC Bachelor of Science in Nursing (BScN) program. Results indicate that pathway students in these health sciences and nursing programs generally outperformed their traditional classmates in overall academic achievement; such results supporting the conclusion that college diploma programs in these areas tend to provide adequate preparation for successful pathway program completion.

Keywords: pathway program, postsecondary education, health sciences, course grades

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Introduction

Programs facilitating college-to-university and university-to-college transitions are growing in Canada and around the world. These arrangements, often called "pathway programs," operate on the basis of articulation agreements between collaborating institutions, boosting the educational prospects of an increasing number of college and university students. In particular, in the Ontario health sciences education sector—an area served by college diploma and university degree programs—the number of college-to-university transfers has increased, with projections showing continued increases in Ontario and across the country in the foreseeable future.

This paper focuses on a pathway program offered by the Faculty of Health Sciences at the University of Ontario Institute of Technology (UOIT)—a relatively new, medium-sized university (Est. 2002), located in Oshawa, Ontario, Canada. The first of these pathway programs was instituted in 2009-2010 in conjunction with the School of Health and Community Services of Durham College (DC), a community college that shares its main campus with UOIT. In 2009-2010, the Kinesiology Diploma-to-Degree pathway was offered. Students who had completed a DC diploma in Fitness and Health Promotion could apply to complete a Bachelor of Health Science (Honours) (BHSc (Hons)) degree with a specialization in Kinesiology - Health and Wellness. Then, in 2012, students completing the DC Biotechnology Advanced diploma program (formerly Biotechnology Technologist diploma program), could apply for admission to one of the following UOIT degree programs: Bachelor of Allied Health Sciences (Hons) or Bachelor of Health Science (Hons) – Medical Laboratory Science. Further, UOIT and DC collaborate in the provision of a 4-year Bachelor of Science in Nursing (BScN) program, and a pathway program in which qualified graduates of a college-based Registered Practical Nursing (RPN) diploma

program may enter the 3-year UOIT-DC BScN degree program after successfully completing a series of three prerequisite "bridging" courses. Interestingly, this particular pathway program (commonly called the "DC/UOIT RPN to BScN bridging program") is the longest running nursing pathway program in Ontario. The pathway programs at UOIT are open to qualified graduates of any community college, and though large numbers have been DC graduates, diploma holders from virtually every other Ontario community college have taken advantage of UOIT's pathway opportunities.

In this paper, we provide a comparative quantitative analysis of the academic achievement (via Grade Point Average values, GPA) of Pathway students (college-to-university transfer students) and their "traditional" (non-pathway) classmates—all students enrolled in UOIT's BHSc, Bachelor of Allied Health Sciences (BAHSc), and BScN programs.

Pathway Programs in Canada

Transferring between post-secondary institutions for the purpose of earning diplomas and degrees has only recently taken hold in Canada, with only British Columbia, Alberta, and Quebec having instituted fully integrated transfer systems. Notably, the sorts of articulation agreements governing the transfer of credits vary greatly between provinces and among participating colleges and universities. Articulation agreements may include arrangements in which receiving institutions accept credits from sending institutions on (i) a "single course" (i.e., course-by-course) basis, when individual courses are sufficiently similar; (ii) a "multiple course" basis, when individual courses are dissimilar but a particular group of courses is sufficiently similar; (iii) a "block credit" basis, when a significant number (block) of courses is deemed equivalent; and (iv) a "program credit" basis, when an entire program of courses is judged equivalent (Kirby, 2008).

The province of Ontario has 24 publicly funded colleges, known as Colleges of Applied Arts and Technology (CAATs). All 24 of Ontario's CAATs offer pre-health programs that help students improve their knowledge of chemistry, biology, mathematics, and physics. These programs prepare students to meet the requirements for competitive health programs at the college or university level. The pre-health programs are seen as a stepping stone or a pathway into diploma or degree programs, offering students the opportunity to grow in practical knowledge, and ensure they are ready to apply and begin a career in health and medical programs. The pre-health programs, while seen as a pathway toward entering into a diploma or degree program, do not necessarily guarantee admission into a college or university health care program. However, students taking the pre-health programs tend to apply themselves with determination and commitment in order to maintain a specific GPA. The practical knowledge they gain also helps to support and enhance their application and acceptance into college or university health care programs.

Across the country, various provincial bodies have been established to assist students interested in transferring from one of the province's institutions to another, including the British Columbia Council on Admissions and Transfer (BCCAT), the Atlantic Provinces Community College Consortium (APCCC), and the Ontario Council on Articulation and Transfer (ONCAT). These organizations help facilitate credit transfers by providing various print and online resources, including the BC Transfer Guide in British Columbia (BCCAT, 2013), the Memorandum of Understanding on Block Transfer Agreements (APCCC, 2013) in Atlantic Canada, and the Ontario Council on Articulation and Transfer (OnTransfer, n.d.) website resource in Ontario.

Though most Ontario high school graduates continue to enroll in CAAT programs for job-specific training, a growing number are pursuing these programs as a step toward a university degree (Bayard & Greenlee, 2009; Centre for Spatial Economics, 2010; Colleges Ontario, 2008; Skolnik, 1995). In the period 2000-2008, the proportion pursuing college credentials for continuing education purposes increased by 5%, while the proportion attending for job training purposes decreased by 6% (ACAATO, 2005; Colleges Ontario, 2008). College-to-university pathway programs providing up to two years' equivalency may result in the possibility of qualifying for a college diploma and a university degree in four years instead of six—the so-called 2+2 arrangement, resulting in 8%-29% cost saving per student (Trick, 2013).

Methods

This paper focuses on a small component of a much broader case investigating the development of pathway programs at UOIT (Percival et al., 2014). Though the broader study employed a mixed-methods research design involving analysis of qualitative and quantitative data (Teddlie & Tashakkori, 2006), the case reported here is restricted to a quantitative, comparative analysis of aggregate GPA data of pathway students enrolled in representative courses within UOIT's Health Sciences, Allied Health Sciences, and Nursing degree programs, and their traditional counterparts. The data collection and analysis phase of the study occurred between November, 2012 and March, 2013.

Research Objectives

The essential objective of the study reported here is to provide a comparative analysis of pathway and traditional students in a representative sampling of core Faculty of Health Sciences program courses to identify any significant challenges and/or successes experienced by the pathway students.

Data Sources, Collection, and Analysis

Data for the current study included GPA values for pathway and traditional 4-year students enrolled in representative UOIT Faculty of Health Sciences program courses in the 2012-2013 academic years. Comparisons were made at two basic levels: high level comparisons compared mean GPAs of students by program (traditional or pathway) and year; finer-grain comparisons compared mark distributions of individual students within specific courses or course groups.

The higher level comparisons by program-year were provided by UOIT's Registrar. For each program-year combination (such as "Pathways, Year 3" versus "Traditional, Year 3"), the mean was taken for all students' GPAs for that combination. The GPAs to be averaged are cumulative up to the year being assessed. For example, if there were *n* students in the "Pathways, Year 3" combination, the mean was calculated of all *n* Year 3 Pathways students' cumulative GPAs.

Two non-standard situations were handled as follows: If any students in a class were from other programs (e.g., as electives), their marks were not included in the average for that program-year combination. If a particular student was making up courses at more than one-year level, the student's cumulative GPA was included in the calculations for student's nominal year-level (i.e., a "third year", even if he or she is also making up a second year course).

Finer-grain data were available to the researchers as individual, de-identified, course marks at the student-course level, within the program streams studied. Distributions of GPA values for representative courses within UOIT's Faculty of Health Sciences pathway programs were used as a measure of the degree to which the overall grades of pathway students differed

from those of their traditional classmates, assuming that lower overall course grades adversely affect pathway student success and prospects for pathway program completion.

The effect size and significance for higher-level comparisons between programs (traditional or pathway) were assessed formally using two-sample t-tests, with respect to overall program aggregates for GPAs. ANOVA could not compare GPAs at the year-by-year level because full raw data for each program-year combination were not accessible from the UOIT Registrar; and also because the overlapping "cumulations" of GPAs for successive years precluded independence of the cells.

Comparisons of the performance of cohorts by their distributions of individual grades were accomplished graphically (via comparative charts) and by formal statistical tests. Chi-square tests were used, where applicable, to test for differences in specific cohorts' grade distributions. When data were insufficient to use Chi-square tests (due to small counts in a grade category), alternative analyses were conducted as well with Resampling Stats in Excel® statistical software.

Results and Discussion

Aggregated GPA values for courses within UOIT's Faculty of Health Sciences pathways were used to measure the degree to which the overall grades of pathway students differed from those of their traditional classmates, assuming that lower overall course grades adversely affect pathway student success and prospects for pathway program completion.

Aggregate GPA Scores by Program

The results in Table 1, reflecting all courses in the program, suggest that pathway students achieved significant academic success in the UOIT Health Sciences and Nursing pathway programs (note that the GPA scores in Table 1 are based on a 4.3 scale).

Table 1: *Comparison of Traditional and Pathway Aggregate GPA Scores by Program*

Program	Year 1	Year 2	Year 3	Year 4	Year 5	Overall
Health Sciences						
Health Science (Traditional)	2.20	2.47	2.60	2.73	2.64	2.51
Allied Health Science (Pathway)			3.55	3.58	3.29	3.53
Nursing						
BScN (Nursing) (Traditional)	2.84	2.93	2.91	3.04	2.90	2.93
RPN to BScN Bridge (Pathway)		3.14	3.18	3.16	2.73	3.13
Overall	**2.38**	**2.75**	**2.90**	**3.01**	**2.77**	**2.80**

It is evident in Table 1 that pathway students within UOIT's Health Sciences and Nursing Programs generally outperformed their traditional classmates in overall academic achievement. Note that Table 1 includes values over five years because some students require an additional semester to complete the university program, while some traditional students may require additional time to repeat courses.

Sample Sizes and T-test Results

Table 2 lists additional details pertaining to the Overall Averages listed in the far right-hand column of Table 1.

Table 2: *Sample Size and Overall Standard Deviation Data*

Program	Overall n	Overall Standard Deviation
Health Science (Traditional)	2320	0.68
(Pathway)	162	0.56
Nursing (Traditional)	3123	0.54
(Pathway)	986	0.56

From these data, t-tests were performed to compare the mean overall performances of traditional versus pathway students within their respective programs. For Health Sciences, the difference in mean GPA performance (pathway versus traditional) was highly significant (T-value = 22.07, p-value = 0.000). The confidence interval for the effect (pathways minus

traditional) is in a clearly practically significant range: (0.9289 to 1.1111), on a scale of 0 to 4.3. Similarly, for Nursing, the difference in mean GPA performance was statistically significant (T-value = 9.86, p-value = 0.000). The confidence interval for the difference, however, is arguably less practically significant in size (pathways minus traditional: 0.1602 to 0.2398), on a scale of 0 to 4.3. In general, these results support the conclusion that college diploma programs in these areas provide adequate preparation for successful pathway program completion.

Comparison of Traditional and Pathway Aggregate GPA Performance

It is interesting to note that the trends in Table 1 (for students enrolled in Health Sciences and Nursing pathways) tend to align with similar patterns in other UOIT pathway programs, as shown in Table 3.

Table 3: *Comparison of Traditional and Pathway Aggregate GPA Performance in BHSc, BScN, and other Degree Programs.*

UOIT GPA Distributions	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Overall**
Program						
Business						
Business (Traditional)	2.32	2.52	2.58	2.65	2.58	2.53
Business Bridge (Pathway)		2.90	3.39	3.35	3.25	3.20
Business GENU (Pathway)			3.04	3.29	3.07	3.15
Information Technology						
IT (Traditional)	2.27	2.55	2.63	2.79	2.42	2.53
IT Bridge (Pathway)		2.70	3.06	3.45		2.98
Health Sciences						
Health Sciences (Traditional)	2.20	2.47	2.60	2.73	2.64	2.51
Allied Health Sciences (Pathway)			3.55	3.58	3.29	3.53
Nursing						
Nursing (Collaborative)	2.84	2.93	2.91	3.04	2.90	2.93
Nursing Post-PN (Pathway)		3.14	3.18	3.16	2.73	3.13
Justice						
Justice Studies (Traditional)	2.21	2.54	2.73	2.89	2.82	2.63
Justice Bridge (Pathway)		2.64	2.96	3.04	2.79	2.86
Communications						
Communication (Traditional)	2.37	2.83	3.01	3.10	2.92	2.78
Communications Bridge (Pathway)		3.12	3.40	3.69		3.37
Legal Studies						
Legal Studies (Traditional)	2.52	2.91	3.10	2.96	3.30	2.88
Legal Studies Bridge (Pathway)		2.76	3.02	3.26		2.95
Overall	2.38	2.75	2.90	3.01	2.77	2.80

Grade Distributions for Core *Health Sciences Program* Courses.

In addition to analyzing aggregate GPA scores of the BHSc and Nursing programs as a whole, grade distributions of representative BHSc and BScN courses were also compiled at the individual-student level, and the specific grades of pathway students and their traditional classmates compared (Figure 1). Note that the values in Figure 1 are based on nearly 14,000 data points comprising 2,251 pathway course attempts and 11, 680 traditional, four-year program course attempts.

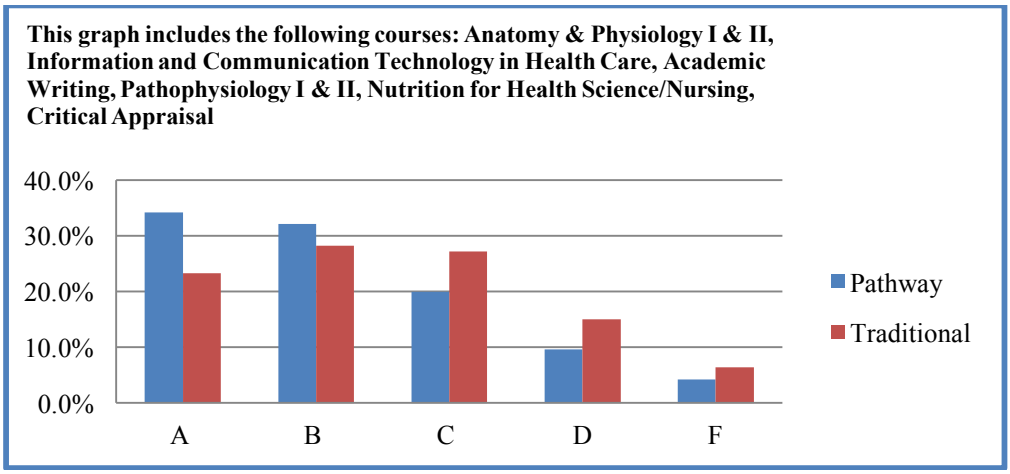

Figure 1. Grade distributions for core *Health Sciences Program* courses.

In general, it is evident in Figure 1 that there is a general upward shift in the grades distributions for pathway students in comparison to their traditional counterparts. Significance was not formally tested for this effect at this level, because the aggregated data are not all independent: most individual students took more than one these courses.

Individual Course-Level Analyses

Further, the Figure 1 pattern is seen to persist at the individual course level. For example, when analyzing grades within the *Academic Writing: Perspectives in Health* course (Figure 2), it is again clear that pathway students outperformed their traditional, four-year counterparts.

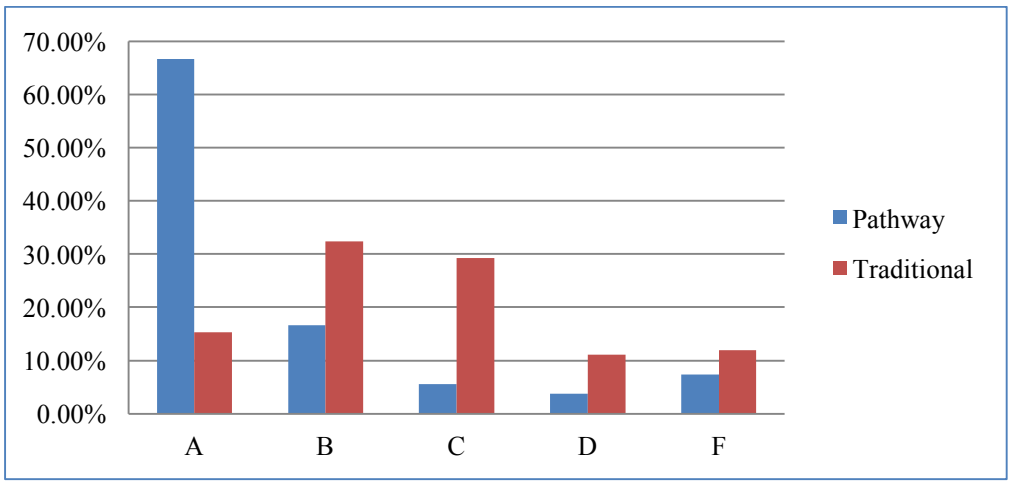

Figure 2. Distributions by grade for the *Academic Writing* course.

A Chi-squared test performed on the data in Figure 2 (Chi-Sq = 79.584, DF = 4, p-value = 0.000) indicates a large-magnitude, significant difference between the grades achieved by pathway and traditional students, supporting the conclusion that pathway students performed significantly better in the *Academic Writing* course than their traditional counterparts. Furthermore, the difference between the groups' performance was not just a difference in overall means (which could happen just by more "B"s than "C"s), but is evident in how grades are distributed across the complete grade spectrum from "F" to "A". The Chi-square results confirm that this full grade distribution is *different* for the two groups; but clearly, in Figure 2, we see that the difference in distributions is *systematic*: Pathways students are seen as less likely to obtain lower grades and more likely to obtain higher ones.

Some other courses' results are less conclusive. An example is the grade comparison between pathway and traditional students in another course within the Nursing program: the *Health and Healing: Synthesis Professional Practice* course—a course taken only by students in the *BScN (Nursing)* and *RPN to BScN bridging (pathway)* programs (Figure 3).

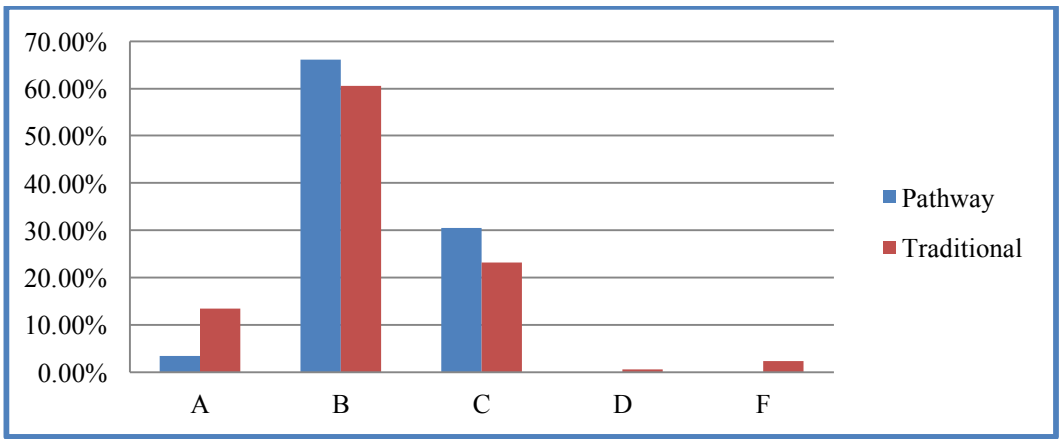

Figure 3 Distributions by grade for the *Health and Healing: Synthesis Professional Practice* course.

For this course, the grade distribution for pathway and traditional students is roughly equivalent across the entire grade range. This tends to demonstrate that pathway and traditional students were about equally prepared for this course. For these data, because of low sample sizes for the "D" and "F" categories, the Chi-squared test could not be used for testing whether the two groups' grade distributions were different. An alternative test for distribution shift was employed (see Goodman, 2012), and a p-value of 0.263 was returned, indicating that, consistent with Figure 3, there was no significant difference in achievement and performance between the two groups of students in this course. It is interesting to note that this is the final theory course taken in year four, so perhaps the traditional BScN collaborative students reach knowledge levels equal to the pathway bridging students by this stage of their education.

Finally, a course that must be taken by all students enrolled in the Health Sciences or Nursing programs at UOIT (Pathway students and traditional students) was analyzed. The *Critical Appraisal of Statistics in Health Science* course (Figure 4) tends to be a particularly challenging course for students, in general, particularly owing to its heavy focus on mathematical and quantitative analysis.

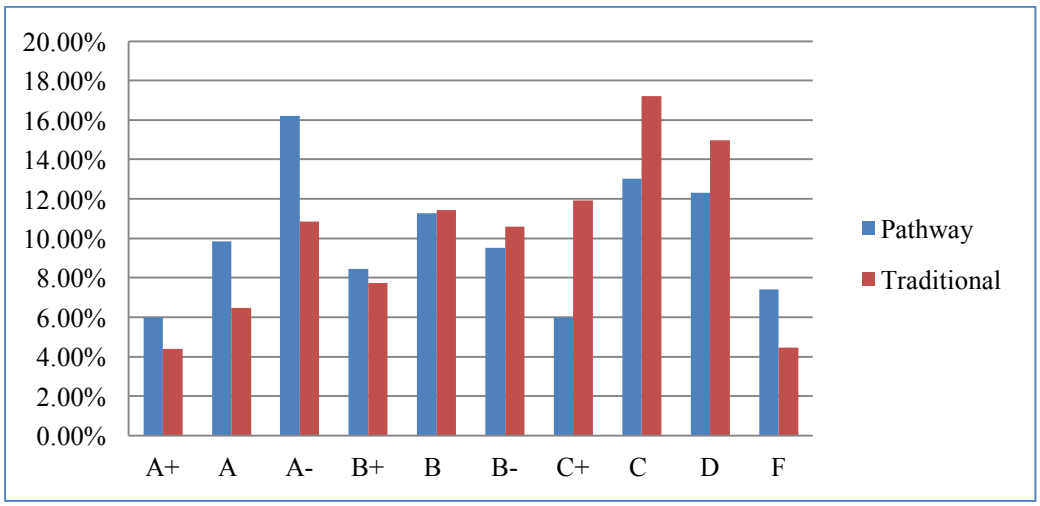

Figure 4. Distributions by grade for the *Critical Appraisal of Statistics in Health Science* course (segmented).

The data in Figure 4 indicate a positive trend for the performance of pathway students in the *Critical Appraisal of Statistics in Health Science* course. The Chi-squared test results indicate sizeable, significant differences between the two groups' grades distributions (Chi-Sq = 26.722, DF = 9, p-value = 0.000), supporting the conclusion that pathway students academically outperformed traditional students in this course. Again, the confirmed "shift" in grade distribution for pathway students was specifically toward the "A" range.

Grade Distributions for all Faculties Combined

It is interesting that the comparative grade distributions of pathway and traditional students for all faculties combined (Figure 5) are similar to those within just the Faculty of Health Sciences. The graph in Figure 5 clearly indicates that across all faculties, greater proportions of pathway students achieved "A"s and "B"s than their traditional counterparts.

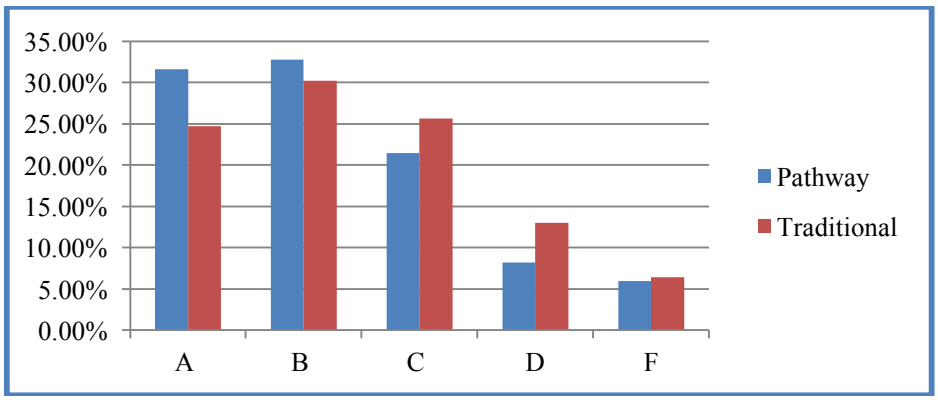

Figure 5. Aggregated grade distributions for core courses of all faculties and all programs.

However, not all of the underlying data points represented in Figure 5 are independent; the 46,000 data points represent different course attempts, not individual students, who each took several courses. Overall, there were 9,789 pathway course attempts and 36,505 traditional four-year program course attempts.

Conclusions

The pathway programs discussed in this paper provide opportunities for college students to transition from a college-based Health Sciences diploma program into UOIT's BHSc and BScN post-RPN bridge programs. Analysis of the aggregate GPA data in this limited study has clearly indicated that pathway students tended to academically outperform their traditional, four-year university counterparts by a significant margin in almost all of the courses within these programs. In general, pathway programs, such as those collaboratively administered by DC and UOIT, appear to serve a useful purpose by enabling college graduates to successfully pursue university degrees (and desired careers) in less time and with lower cost than traditionally possible. However, though the results in this case tend to indicate that pathway students outperformed their traditional peers in terms of grades, the broader study on which this case is based, indicated that pathway students experience some significant non-academic challenges as they transition into the university's social, cultural, and organizational environment (Percival et

al., 2014). Future research should focus on the value of the bridging semester for supporting the transition from college to university and on the types of complementary programs necessary to enable the integration of the two cohorts.

Limitations

There were a number of significant limitations in this study. Some of these were indicated in the discussion; however, a particularly significant limitation applies to the "high-level" analyses conducted in relation to the data in Tables 1-3. In these tables, the GPAs averaged in the "Overall" columns were not all totally independent; the cumulations in these "Overalls" overlap. It is recommended that in future similar studies, analyses are performed using individual years' GPA scores, not cumulative GPA data.

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