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Research Article

Understanding Factors that Encourage Research Productivity for Academic Librarians

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Abstract

Objective – This project identifies the factors that contribute to the success of librarians as active researchers. Research success is generally aligned with productivity and output, and the authors are therefore interested in understanding the factors that encourage research productivity. This

fills a gap in the literature on librarians as researchers, which has tended to focus on barriers rather than enablers.

Methods – For this quantitative study, we distributed an online survey to 1,653 potential participants across Canada and received 453 usable responses for a 27% response rate. The survey asked participants to report their research outputs and to answer questions that addressed three categories of factors: Individual Attributes, Peers and Community, and Institutional Structures and Supports. We then statistically analyzed participant responses in order to identify relationships between the research output variables (weighted output score and number of peer-reviewed articles) and the three categories, the factors within those categories, and the constituent components.

Results – Participants' research output consisted largely of presentations, non-peer-reviewed articles, peer-reviewed articles, and posters. All three categories of factors were significantly related to research output, both for a calculated weighted output score and for number of peer-reviewed articles. All of the factors identified within those categories were also significant when tested against weighted output score, but Intrinsic Motivations was not a significant factor when tested against number of peer-reviewed articles. Several components of factors were also not significant for number of peer-reviewed articles. Age was the only significant component of Demographics. Three components of Education and Experience were significant: whether participants had received research training after completing their MLIS, whether they were working on an advanced degree, and the institution where they had obtained their MLIS.

Conclusions – Research productivity is significantly impacted by all three categories: Individual Attributes, Peers and Community, and Institutional Structures and Supports. Fostering an environment that focuses on all of these areas will be most likely to promote research output for librarians. At the same time, this study's findings point to particular aspects that warrant further investigation, such as the nature and effect of institutional support and librarians' motivations for doing research.

Introduction

How do we know what enables librarians to be successful researchers? What particular factors contribute to librarians' dissemination of research? Why are some librarians more productive researchers than others?

These are important questions because scholarship, including the dissemination and publication of research, is a professional responsibility for many Canadian and American academic librarians. Recent initiatives and conversations from the United Kingdom and Australia suggest that librarians there are also considering ways in which they can support and embrace practitioner-led research. In North America, librarians are often evaluated on their scholarly output as a component of tenure and promotion requirements (Sassen & Wahl, 2014).

Research productivity can be an important element of librarians' career development and career progression; however, librarians' enthusiasm and capacity to achieve and maintain a scholarly record is inconsistent. While some librarians have excelled in this aspect of their responsibilities, others have struggled (Walters, 2016; O'Brien & Cronin, 2016). There have been numerous approaches to supporting librarians in their efforts to be productive researchers; however, the impact of

these supports has not been well studied.

Literature Review

The literature is replete with narratives and descriptions of the resources and structures available to support the research success of academic librarians. Common supports include writing support groups (Campbell, Ellis & Adebonojo, 2012; Exner & Harris Houk, 2010; Fallon, 2012; Tysick & Babb, 2006), journal clubs (Fitzgibbons, Kloda, & Miller-Nesbitt, 2017), support groups or forums for research conversations (Carson, Colosimo, Lake, & McMillan, 2014; Hall & McBain, 2014; Miller & Benefiel, 1998; Sapon-White, King & Christie, 2004), mentorship programs (Cirasella & Smale, 2011; Stephens, Sare, Kimball, Foster, & Kitchens, 2011), research skills development initiatives (Edwards, Jennerich, & Ward, 2009; Jacobs & Berg, 2013; McBain, Hall, & Culshaw, 2013; Schrader, Shiri, & Williamson, 2012), research leaves or release time, and funding (Smigielski, Laning, & Daniels, 2014). Alongside these supports, Canadian academic librarians are actively developing communities within and outside of their institutions to foster a positive research culture across Canada (Carson et al., 2014; Jacobs & Berg, 2013; Meadows, Berg, Hoffmann, Torabi, & Gardiner, 2013; Mierke & Williamson, 2017; Wilson, 2017). Two key initiatives towards this goal are the Librarians' Research Institute sponsored by the Canadian Association of Research Libraries (CARL, 2017) and the Centre for Evidence Based Library and Information Practice (C-EBLIP, 2017).

There are also numerous articles which describe the level, context, and environment in which librarians conduct their research and scholarship (Harrington & Gerolami, 2014; Pickton, 2016; Shaw & Szwajcer, 2016). Much of the research to date has focused on institutional context. Within these articles, authors often address the challenges that librarians face when conducting research and the barriers that may prevent them from being productive researchers (Black & Leysen, 1994; Brown, 2001; Fox, 2007; Kennedy & Brancolini, 2012; Lessick et al., 2016; O'Brien & Cronin, 2016; Powell, Baker & Mika, 2002; Shaw & Szwajcer, 2016; Spring, Doherty, Boyes, & Wilshaw, 2014). Commonly noted challenges and barriers include time constraints, lack of support, and lack of research training or experience. To a large extent, the literature highlights factors that impede rather than enable librarians to conduct research. However, some researchers have also asked librarians about their motivations for and perceived benefits of doing research, and those findings present a more positive view: librarians publish for both personal and professional development (O'Brien & Cronin, 2016), they value personally fulfilling research opportunities (Hollister, 2016), and they feel that research helps demonstrate the value of library services and contributes to their evaluation and improvement (Lessick et al., 2016).

Recently, there has been increasing interest in understanding the research productivity of librarians. In a survey of the research productivity of post-tenure librarians, Hollister (2016) asked respondents to share their perceptions of research production pre- and post-tenure. Interestingly, Hollister did not quantify the research productivity of individual respondents, but simply asked if respondents had produced particular types of research output. A majority of respondents reported having produced or intending to produce research post-tenure. Walters (2016) investigated the influence of four institutional variables (university-wide research activity, eligibility for sabbaticals, university control, and enrollment) on the scholarly productivity of librarians at research universities in the United States. He found that librarians' research productivity was influenced by university-wide research activity and faculty status. Baro and Ebhomeya (2012) investigated the research productivity of librarians in Nigeria. They found that there was no significant difference in research output between librarians and lecturing faculty. Despite obstacles of long hours, heavy workloads, and limited publication options, Baro and Ebhomeya

encourage librarians to recognize and embrace publication as a responsibility for promotion, in similar ways as Nigerian faculty have. As demonstrated by this research, interest may be shifting from a focus on barriers that prevent librarians' scholarly output toward a focus on understanding the level of research done by librarians and the contexts that foster their research productivity.

Still, while there is increasing interest in the research productivity of librarians, the factors which increase productivity for librarians have not yet been fully explored. Within other academic disciplines, research examining factors that contribute to research productivity are more common (Brew, Boud, Namgung, Lucas, & Crawford, 2016). Research productivity studies have used a variety of methods (e.g., self-reports, bibliometrics) across a wide array of contexts (e.g., different institutions or disciplines). The research environment of librarians is often suggested to be distinct from that of other academic disciplines, requiring unique supports and structures, due to the different nature of academic librarian work. Our previous study that identified literature on research productivity both within and outside of academic librarianship suggests many common factors (Hoffmann, Berg & Koufogiannakis, 2014). However, it is not known whether the statistically significant factors for librarians are the same as those of other academics, because there has been little empirical research about factors that influence the research productivity of librarians.

Aims

This study aims to fill a gap in the literature by identifying antecedents to the research success of librarians. Research success is generally aligned with productivity and output, and we are therefore interested in understanding the factors that encourage research productivity by way of research outputs.

Our goal is to develop a better understanding of the factors that influence librarians' research productivity in Canadian academic libraries. Table 1 shows the categories and factors examined in this study in order to address the following research questions:

1. What factors have a positive effect on research productivity?
2. Which of the three categories of factors – Individual Attributes, Peers and Community, and Institutional Structures and Supports – are most influential for librarians' research productivity?

Table 1
Factors Examined in this Study (Hoffmann et al., 2014)

Individual Attributes	Peers and Community	Institutional Structures and Supports
Demographics	Collaboration	Extrinsic Motivations
Education and Experience	Community	Institutional Supports
Intrinsic Motivations	Mentoring	
Personal Commitment to Research	Peer Support	
Personality Traits		

Methods

This quantitative study used an online survey for data collection. The online survey was based on previously published research that identified potential factors that may contribute to librarians' research productivity. The knowledge resulting from this first phase of the research was conducted via content analysis, and the results are described in a previous publication (Hoffmann et al., 2014). We considered the survey instruments used in those studies found via the content analysis to inform the development of survey questions. Building from the results of the first phase of the research, survey questions captured participants' research outputs and explored factors related to three categories: Individual Attributes (including demographics), Peers and Community, and Institutional Structures and Supports.

In developing the survey, we made several key decisions to address the research questions. As noted above, we wanted to draw on previous research, identified in the first phase of our project, to give the survey a solid foundation in the existing literature on research productivity. We wanted to determine relationships between factors and research productivity outputs, rather than simply describing participants' research environments, so we designed questions with binary yes or no answers, which could easily be used to calculate statistical measures. We also decided to focus on what individual participants did, rather than what was available to them; for example, we asked "Did you take a sabbatical or other research leave?" rather than "Do you have the option to take a sabbatical or other research leave?" We included a question for open-ended comments so that participants could elaborate on answers or add other factors that they felt we had not addressed, since we anticipated that the yes or no answers might leave participants feeling that the complexities of their situations were not captured.

We iteratively pre-tested the survey instrument with twelve librarians who understood the topic, but were not part of the specific population we intended to survey (Canadian university librarians), made adjustments based on feedback, and then re-tested the questions. The survey instrument is provided in Appendix A.

Potential participants were all librarians who worked at the 75 Canadian Research Knowledge Network (CRKN) member institutions, which are listed in Appendix B. We chose these institutions because they are the largest grouping of Canadian university academic librarians, and could therefore provide the largest sample of librarians who are likely to have research as part of their job responsibilities. Because our population included both English- and French-speaking universities, our survey and recruitment materials were professionally translated into French.

We mined the public websites of each CRKN member institution to obtain email addresses of potential participants. Each individual received an email invitation to participate in the study. We also recruited through listservs, Facebook, and Twitter. We emailed the study invitation to 1,683 potential participants in April 2016. We received "mail undeliverable" messages from 30 email addresses, so 1653 potential participants received the invitation.

We asked participants to detail the number of research outputs they had in the past five years. Most of the existing literature on research productivity has focused on peer-reviewed journal articles as the measure of research output. Based on our understanding of research conducted by librarians, we felt that it was also appropriate to include conference presentations, posters, non-peer-reviewed articles, and books. The types of research output that we included all had some aspect of vetting and featured a dissemination process that the researcher needed to follow. As such, we did not include blogs or other self-posted forms of

dissemination. In a comment field, we invited participants to elaborate on non-traditional forms of dissemination, such as blogs. Finally, we asked participants to only note their research output that was related to LIS. While some Canadian academic librarians work at institutions where they are explicitly allowed to research in any discipline, including creative works, others are at institutions that explicitly state that their research must be relevant to librarianship, and we wanted our survey to focus on the kind of research that we all have in common. Importantly, participants self-reported their research output, we did not ask for publication details, and so it was the participants themselves who determined whether their output was related to LIS. We did not ask participants to indicate their level of involvement or whether they were sole or a co-author on works reported.

Table 2
Weights for Each Type of Research Output

Output type	Weight
Poster	0.5
Presentation	1
Conference proceeding	1
Non-peer-reviewed article	3
Book chapter	5
Edited book	6
Peer-reviewed article	9
Authored book	10

In our analysis, we used a weighted output score to have one overall measure of productivity for each participant, and to account for the fact that not all outputs are equal. The weights for each type of output, noted in Table 2, were reached via a paired comparison analysis. In this process, we compared each type of output against every other type of output and then we assessed the relative potential impact and contribution of each pair in relation to dissemination. Once each pair had been weighted, we added the relative weights to arrive at an overall weight for each type of output. To calculate the weighted output score for each survey participant, we multiplied the overall weights by the number of research outputs of each type to arrive at a weighted output score. For example, if a participant gave their research output as two posters and two presentations, their overall weighted output score was three.

Results

We received 556 responses to the survey. After removing incomplete responses, we had 453 responses for a 27% response rate, representing 93% of the CRKN member institutions. Table 3 and Figures 1 and 2 summarize demographic characteristics of our survey respondents. Our participants comprised a representative sample of Canadian academic librarians, as compared to the 2015 census carried out by the Canadian Association of Professional Academic Librarians (CAPAL, 2016).

Table 3
Overview of Survey Respondents

		%
Gender	Female	78.5
	Male	21.5
	Other	< 1
Language	English	89
	French	11
Workplace category	Undergraduate	19
	Comprehensive	33
	Medical / Doctoral	49

Research Output

Participants disseminated a range of research output over the past five years, from none at all to multiple types and numbers of output. Presentations made up nearly half of the total reported output. Most of the participants' output consisted of presentations, non-peer-reviewed and peer reviewed journal articles, and posters – these four types accounted for 89.5% of the total output. Table 4 summarizes participants' reported research output.

As described above in the Methods section, we calculated a weighted output score for each participant. The distribution of participants' weighted output scores is shown in Figure 3. The mean score was 21. There were 53 participants who reported no output of any kind, many participants had very low weighted output scores, and a small number of

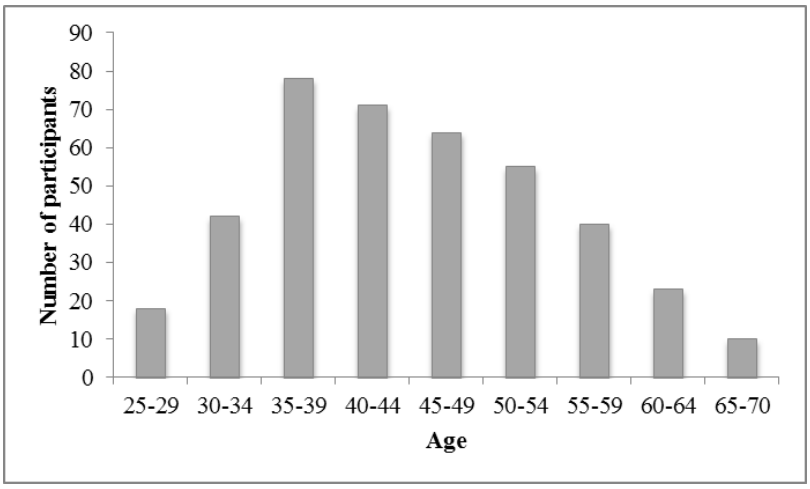

Figure 1
Age ranges of participants.

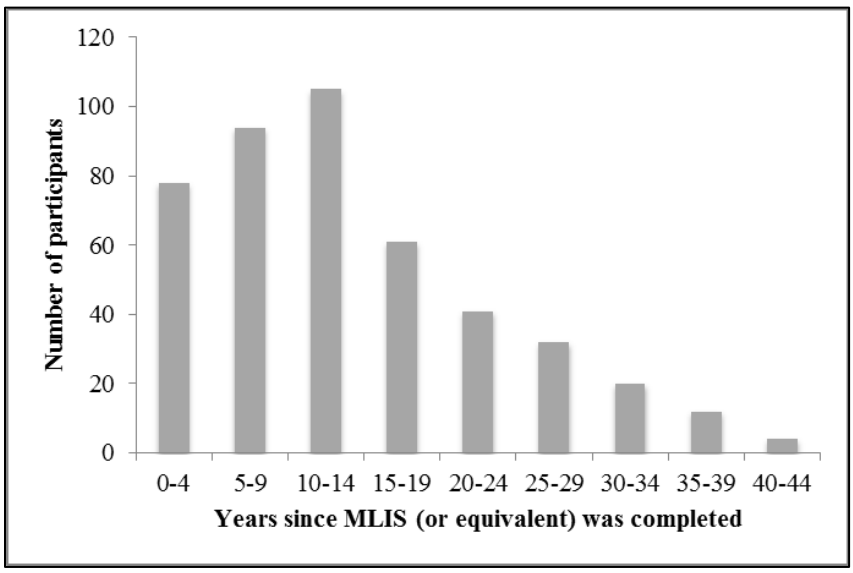

Figure 2
Number of years since participants completed their MLIS (or equivalent).

Table 4
Participants' Reported Research Output Over the Past Five Years (2011-2016)

Output type	Min.[a]	Max.[a]	Mean	Median	St. dev.	Total number reported	% of output reported
Presentation	0	27	4.1	3	4.7	1846	47.7
Non-peer-reviewed article	0	36	1.3	0	3.4	609	15.7
Peer-reviewed article	0	14	1.1	0	2.0	492	12.7
Poster	0	10	1.0	0	1.6	462	11.9
Conference proceeding	0	10	.6	0	1.4	283	7.3
Book chapter	0	3	.3	0	.5	116	3
Authored book	0	3	.1	0	.3	34	.1
Edited book	0	3	.1	0	.3	27	.1
Totals						3869	100

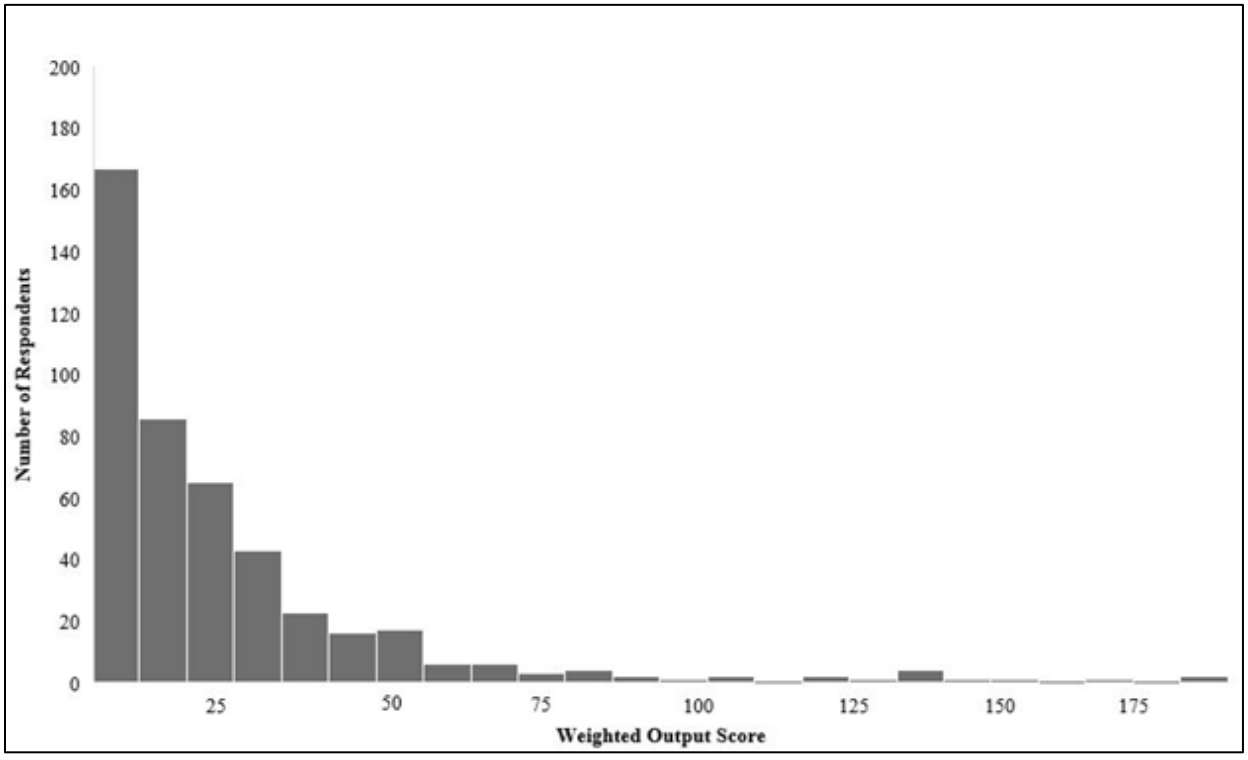

Figure 3
Histogram of participants' weighted output scores.

participants had very high weighted output scores. We used a box plot in SPSS to identify extreme values. All weighted output scores above 67 were identified as outliers and removed from the analysis. As well, we decided to focus our analysis on those participants who had demonstrated some regular engagement in research and therefore we set a lower limit for a weighted output score of three, and removed all participants with weighted output scores below that.

Since the distribution of weighted output scores does not approximate a normal distribution, we used non-parametric statistical tests to examine the relationship between weighted output score and the identified factors. We used the Mann-Whitney U test with variables that have two nominal groups, the Kruskal-Wallis ANOVA for variables with more than two groups, and Spearman's rho for correlations of ordinal variables. For the Mann-Whitney and Kruskal-Wallis tests, the null hypothesis is that there is no difference in the distributions; when the null hypothesis is rejected, the difference in the distributions is found to be significant at the .05 level.

Effect of Factors on Research Productivity

The questions in the survey addressed eleven factors (Table 1) that made up the three overarching categories: Individual Attributes, Peers and Community, and Institutional Structures and Supports. Each question mapped to one of the factors, as shown in Appendix A. Some questions or factors straddle more than one category; however, for simplicity, each question was mapped to one factor within one category (Hoffmann et al., 2014). To confirm mappings for the yes or no questions, we ran correlations of the responses. In our previous research we had identified a single factor of Motivations for Research, which we further refined into two factors, Intrinsic Motivations and Extrinsic Motivations, as we analyzed the correlations.

To analyze the effects of our identified factors on research productivity, we tested at three levels: the three overarching categories in aggregate, selected factors within those categories,[1] and the individual questions that formed the components of the factors. For each of those three levels, we tested against two measures of research productivity: weighted output score and number of peer-reviewed journal articles.

All three categories were significant, both for weighted output score and number of peer-reviewed articles. In other words, many elements contribute to librarians' research productivity. There was no single category – not Individual Attributes, nor Peers and Community, nor Institutional Structures and Supports – that emerged as being clearly more important than the others, but rather all three were significantly correlated with research output. However, there were noteworthy findings within the eleven factors which made up the three categories, especially when we tested against different measures of research productivity.

Within the factor of Demographics, only age was significant, and it was only significant when tested against the weighted output score; there was no difference in the distribution of number of peer-reviewed articles over various age ranges. The significance in age came from lower weighted output scores for participants in the age ranges 55-59 and 60-64, as shown in Table 5. The other components of Demographics evaluated were gender, marital status, and whether a respondent cared for dependents. None of those were significant, neither for weighted output score nor number of peer-reviewed articles.

[1] We could not test Demographics or Education and Experience as factors, only the individual questions comprising those factors, because the forms of the questions did not lend themselves to being combined in aggregate.

Table 5
Median Research Productivity for Age Range

		Weighted output score			Peer-reviewed articles		
Age range	N	Min.	Max.	Median	Min.	Max.	Median
25 - 29	7	7	53	13.5	0	4	0
30 - 34	31	3	52	15.0	0	2	0
35 - 39	58	3	66.5	16.5	0	4	1
40 - 44	57	3	60	17.0	0	4	1
45 - 49	50	3	54.5	20.5	0	4	1
50 - 54	37	3	59	17.0	0	4	1
55 - 59	22	3	61	10.5	0	6	0
60 - 64	15	3	67	9.0	0	2	0
65 - 70	5	3	45	20.0	0	5	0

Table 6
Median Research Productivity for Institutions Where Participants Obtained their MLIS

		Weighted output score			Peer-reviewed articles		
Institution[a]	N	Min.	Max.	Median	Min.	Max.	Median
University of Alberta	26	3	60	25.0	0	4	1
University of British Columbia	33	4	55	16.0	0	4	1
Dalhousie University	29	3	61	14.0	0	5	0
McGill University	34	3.5	59	21.5	0	4	1
Université de Montréal	28	3	46.5	11.75	0	6	0
University of Toronto	56	3	67	17.25	0	5	0
U.S. Programs[b]	14	3	48	11.75	0	2	0
Western University	96	3	66.5	17.0	0	2	1

Within the factor of Education and Experience, there were three significant components for both weighted output score and for number of peer-reviewed articles. Participants who had received research training after completing their MLIS and those who were currently working on an additional advanced degree were more likely to have higher research output. Also, there was a statistically significant difference between institutions from which participants received their MLIS. Table 6 presents median scores by institution for both measures of research

productivity. Specifically, post-hoc Mann-Whitney tests indicate that graduates of Université de Montréal had significantly lower output (both weighted output score and number of peer-reviewed articles) than graduates of McGill, Alberta, British Columbia, or Western. Graduates from U.S. programs also reported a significantly lower number of peer-reviewed articles than those from McGill, Alberta, British Columbia, or Western, and they had significantly lower weighted output scores than participants from McGill or Alberta. None of the other aspects of Education and Experience were significant, for either measure of research productivity.

The other nine factors were comprised of the yes or no questions, and we tested both the factors and the individual components. When we tested the nine remaining factors against the weighted output score, all of them were significant. However, when we tested the factors against the number of peer-reviewed articles, Intrinsic Motivation was no longer a significant factor, and there were many fewer components that were significant on their own. Tables 7, 8, and 9 show the significant components for the categories of Individual Attributes, Peers and Community, and Institutional Structures and Supports, respectively.

Within the Individual Attributes category (Table 7) there is a lot of variation in which components are significant when tested against weighted output scores or number of peer-reviewed articles. When peer-reviewed articles was used as the measure of research productivity, none of the Intrinsic Motivation components are significant and only 8 out of 29 components in the category are significant. The Peers and Community category (Table 8) shows less variation in which components are significant when tested against weighted output scores or number of peer-reviewed articles. Most components in the Peer Support factor are not significant, but most components of the other factors are significant. Within the Collaboration factor, the component "I have done research on my own" is one where answering "No" meant higher collaboration; however, participants who answered "Yes" were more likely to have higher weighted output scores.

The Institutional Structures and Supports category (Table 9) also shows little variation. Interestingly, the component "I do research only because it is a requirement of my job" is the only one that is not significant against weighted output score and is significant against number of peer-reviewed articles, and those who answered "Yes" were more likely to have produced lower numbers of articles.

Table 7
Components of the Individual Attributes Category and Their Significance as Determined by the Mann-Whitney U Test, Significant at the .05 Level

Factors and Components	**Weighted output score**	**Number of peer-reviewed articles**
Intrinsic Motivations		
I do research to contribute to more informed decision making in librarianship.	–	–
I do research to contribute to better library services.	–	–
I do research for my personal interest.	–	–
I do research for professional growth.	–	–

I do research to contribute to greater library visibility on campus.	–	–
I do research to advance my career.	significant	–
I do research to build stronger relationships with faculty members.	significant	–
I do research to build a professional reputation for myself.	significant	–
I do research to contribute to a stronger profession.	significant	–
Personal Commitment to Research		
I always have a research project that I'm working on.	significant	significant
I schedule dedicated time for research.	significant	significant
I am currently working on a research project.	significant	significant
I have participated in activities that support LIS research (e.g. peer review, editor of a journal, providing writing assistance to a colleague, etc.).	significant	significant
I do research that is meaningful to my practice.	significant	–
I consider research to be a priority.	significant	–
I believe it is important for librarians to contribute to the profession via research.	significant	–
I read research literature on a regular basis.	significant	–
I work on research outside of regular work hours.	significant	–
I have used personal funds to support my research and dissemination (e.g.: personal professional development funds or self funded).	significant	–
Personality Traits		
I can achieve my research goals.	significant	significant
I am confident that I have the ability to do research.	significant	significant
I finish the research projects that I start.	significant	significant
I can easily identify questions that could be answered through research.	significant	significant
I enjoy speaking with colleagues about my research.	–	–

I enjoy presenting at conferences.	–	–
I do research to satisfy my curiosity.	–	–
Publishing gives me a personal sense of satisfaction.	significant	–
I enjoy doing research.	significant	–
I enjoy writing for publication.	significant	–

Table 8
Components of the Peers and Community Category and Their Significance as Determined by the Mann-Whitney U Test, Significant at the .05 Level

Factors and components	**Weighted output score**	**Number of peer-reviewed articles**
Collaboration		
I have done research with other people (co-researchers) at my institution.	significant	significant
I have done research with other people (co-researchers) from other institutions.	significant	significant
I have done research on my own.	significant	–
Community		
I feel like I belong to a research community.	significant	significant
I have consulted with an expert to get help on a specific aspect of my research.	significant	significant
I have a network of peers at my institution with whom I talk about research.	significant	significant
I know people who have similar research interests to mine.	significant	significant
I attend conferences in order to connect with others who have similar research interests.	–	–
I have a network of peers from other institutions with whom I talk about research.	significant	–
Professional associations are a source of research community for me.	significant	–
Mentoring		
I have been mentored in relation to research activities.	significant	significant
I have mentored others in relation to their research activities.	significant	significant

Peer Support		
I have participated in a peer support group related to research.	significant	significant
I ask my colleagues for feedback on my research.	–	–
I have participated in a journal club.	–	–
I have participated in a writing group.	–	–

Table 9
Components of the Individual Attributes Category and Their Significance as Determined by the Mann-Whitney U Test, Significant at the .05 Level

Factors and components	Weighted output score	Number of peer-reviewed articles
Extrinsic Motivations		
I have received merit increments or promotion due to my research activities.	significant	significant
I am (formally or informally) expected to participate in research and scholarship.	–	–
I do research only because it is a requirement of my job.	–	significant
Institutional Supports		
I have received funding for my research.	significant	significant
I have hired a research assistant to help with research tasks.	significant	significant
I have taken a sabbatical or other kind of leave to work on a research project.	significant	significant
I have space where I am able to work effectively on my research.	significant	significant
I have time to do research within my job.	significant	significant
I am encouraged and supported by my library to do research.	–	–

Finally, we examined participants' open-ended comments. Most comments corresponded to one of the factors that we had identified, especially to elements of Institutional Structures and Supports: time and perceived institutional support. Within comments about time, some participants specifically said that they did not have time for research because they had an administrative role, which is an area we did not explore. An unexpected theme emerged around precarious employment; participants who were in contract or part-time positions described an inability to plan for research (for example, because of the time needed to submit research ethics applications) and less supported by their institutions to do research.

Discussion

Returning to our research questions, we found that the three categories – Individual Attributes, Peers and Community, and Institutional Structures and Supports – all had a positive effect on librarians' research productivity. This is an important finding, since it reinforces that many elements contribute to librarians' research productivity. Figure 4 is a visual representation of how the three categories work together. An environment that embraces all three areas, by encouraging individual attributes, fostering peer and community interaction, and providing institutional supports, will be likely to promote research productivity among librarians.

While our findings unquestioningly show that all three categories have a significant effect on research productivity, they also show that within those categories, there are components that are particularly interesting or that warrant further examination.

For a female-dominated profession such as librarianship, it is both interesting and encouraging that gender did not have a significant effect on research productivity, especially since gender has been shown to be significant for academics generally (Aiston & Jung, 2015).

Within the factor of Education and Experience, it is not surprising that graduates of the Université de Montréal have significantly lower research output; until 2007 when the University of Ottawa's program started, Montréal's was the only Canadian MLIS program offered in French, and many of the participants who commented in French said that research was not part of their job responsibilities. Since librarians have long bemoaned the inadequacy of research training received in MLIS programs (Black & Leysen, 1994), it is perhaps also not surprising that having received such training was not significant. However, it is encouraging that participants who received research training after completing their MLIS and those who were working on advanced degrees reported significantly higher productivity. Further examining these components may help to understand how such experiences can best help librarians in their research endeavours.

A close examination of the Institutional Structures and Supports category shows that three components are not significant for weighted output score:

- I am encouraged and supported by my library to do research.
- I am (formally or informally) expected to participate in research and scholarship.
- I do research only because it is a requirement of my job.

However, the last of these components is significant when tested against number of peer-reviewed articles; those who answered "No" are more likely to have higher numbers of articles. In other words, participants who do research for reasons other than a job requirement publish more peer-reviewed articles. This suggests that intrinsic rewards might be stronger motivators than institutional expectations, although the components that we examined for Intrinsic Motivations were not significant when tested against number of peer-reviewed articles. As

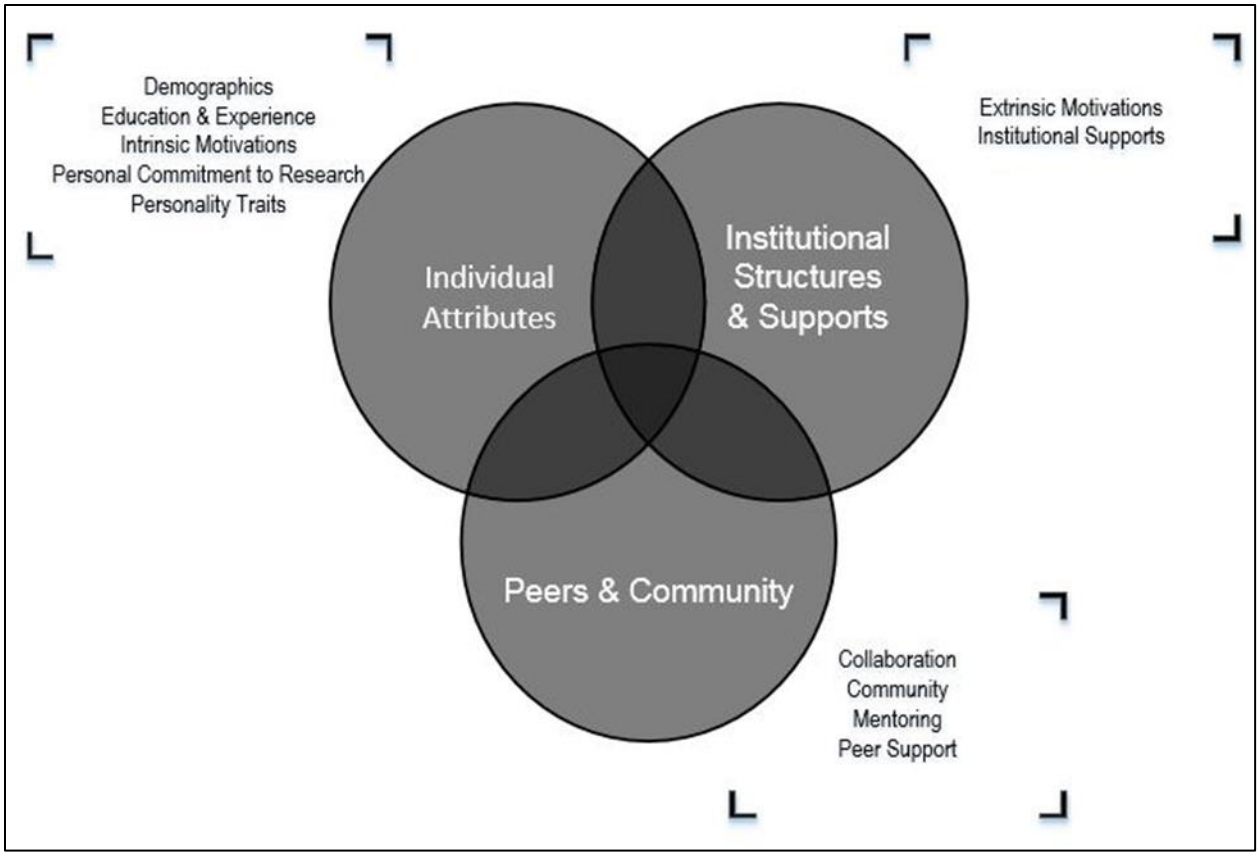

Figure 4
Three categories contributing to librarians' research productivity.

such, more investigation is needed into what motivates librarians to do research, especially for publication of peer-reviewed articles.

In considering these results, it is evident that some librarians who feel that they have the expectation and support to do research are productive researchers, while others are not. Similarly, some librarians are productive researchers despite feeling unsupported and not being expected to do research. It is reasonable to imagine that institutional expectations are "powerful motivators" (Hollister, 2016, 369) and yet these findings do not support that.

This is a provocative finding when considered together with the open-ended comments that participants provided, where they overwhelmingly expressed a desire to experience a supportive institutional environment for research, and frustration with library environments that were not supportive or that conveyed mixed messages. For example, participants said that research was "an unfunded mandate," that "management … values our research activity as long as our 'regular' work doesn't suffer," and that "we are not encouraged to devote much time to research, yet we are expected to in order to obtain continuing status, prestige, annual report grades [sic], etc."

Institutional factors therefore warrant more study. What do librarians mean by "feeling supported" to do research? What does it mean that so many participants wanted to feel supported and expressed frustration with a perceived lack of support, and yet these factors did not have a significant effect on research output? What role do institutional expectations

play as motivators for producing research? In our previous study (Hoffmann et al., 2014), we had identified a factor of Positive Organizational Climate, which we did not explore in this study. The current research points to the need to investigate organizational climate in order to gain a fuller understanding of librarians' research productivity.

We also see some striking differences in factors and components that are significant when tested against weighted output score, but are not significant when tested against number of peer-reviewed articles. This is especially evident in the Individual Attributes category; Intrinsic Motivation is only a significant factor when considered against weighted output score, and there is considerable variation in which components are significant.

These findings suggest that, as a collective, librarians must first consider what type of research output they value, in order to have the clearest possible understanding of the factors that will foster their productivity. If librarians want to encourage dissemination of peer-reviewed articles, they may want to focus on a narrower range of factors in order to foster that research output. While peer-reviewed articles are the standard measure of productivity in many disciplines, and by extension, they are considered the goal output for researchers in those disciplines, it is not clear that they are the primary desired research output for librarians. This is seen in the number of peer-reviewed articles reported by our participants, only 12.7% of the total reported research output. This is also supported by Shaw and Szwajcer's findings (2016) that only 32% of their sample of conference presentations were also published as peer-reviewed articles. In contrast, Tsafe, Chiya, and Aminu's (2016) analysis of Nigerian librarians found that 69% of total output was journal articles, although they did not distinguish between peer-reviewed and non-peer-reviewed articles, perhaps indicating that dissemination preferences vary by geography.

This apparent tension around the type of research outputs that are highly valued may be related to uncertainty about the value attributed to research that is closely tied to the practice of librarianship. Again looking at the Individual Attributes category, several of the components that are not significant when tested against peer-reviewed articles reflect a focus on professional engagement:

- I do research to build stronger relationships with faculty members.
- I do research to build a professional reputation for myself.
- I do research to contribute to a stronger profession.
- I believe it is important for librarians to contribute to the profession via research.
- I do research that is meaningful to my practice.

Participants who focus on peer-reviewed articles may therefore be less motivated to tie their research to their practice. Or it may be that other venues are perceived to be better for disseminating research that is related to practice. In open-ended comments, participants again expressed uncertainty around this element. For example, "there can be pressure from within your library to do certain types of research (very practice-oriented to your specific library), which might not align with your personal research interests," and "... I mentioned that I was not highly interested in research but enjoyed presenting at conferences and feel that research and conference presenting are different, my supervisor sees these two as research."

As mentioned above, Canadian academic librarians have been working to develop a research culture for themselves. As this continues, it will be helpful to include conversations about how we, as a profession, want to value and promote various types of research output, what we mean by research that is tied to practice, and how we value that research. Further study of these questions may also result in more informed conversations.

Overall, this study confirms that the categories and factors we identified in our previous research are relevant and important. The issue of precarious employment in academia has gained attention in recent years, although challenges with contract or part-time work are not new (Feldman & Turnley, 2004), and this may be an additional element to explore in future studies.

The tool that we have developed may be useful for examining research productivity in the future, perhaps as research culture becomes more finely tuned for Canadian academic librarians. It may also be useful for surveying other populations beyond Canada in order to see if there is any variation in which factors are significant and to see what more we can learn about librarians' research output and productivity.

There are several limitations to our chosen study design. Our study participants were self-selected, so the results reflect a self-selection bias. As well, we were not able to control participants' responses to ensure that they were replying as we intended. For example, questions about research output asked participants to provide counts for the last five years, but it is possible that someone reported publications over their career. The questions with bivariate variables (yes or no answers) were helpful for our analysis, but also limited the level of detail in the responses and restricted the scope of possible statistical tests that we could run. Because we focused our analysis on participants who had some regular engagement with research, as determined by weighted output scores between 3 and 67, we do not know what factors are significant for the participants excluded from analysis. Finally, the quantitative approach of this study means that we are not able to capture the full complexity of individual factors; though we can identify which factors are statistically significant, but we cannot explain why this is the case. We are also not able to take into account the context of the individuals who participated in the survey; for example, whether a particular situation in someone's institution or personal life has affected their research productivity.

Conclusions

The findings from this quantitative study contribute to a greater understanding of librarians' research productivity and the factors that contribute to research success. While we might have hoped for the findings to reveal a 'magic bullet' for research output, they instead reveal even more complexity. Research productivity is significantly impacted by individual qualities, by interaction and support from peers and community, and by strong institutional supports. These findings suggest that librarians and library administrators focus on all three of these areas in order to promote research productivity.

At the same time, these findings raise additional questions and highlight aspects where more investigation is needed. Our participants' expressed desire for supportive institutional climates is in tension with the finding that feeling supported by one's institution and feeling expected to do research are not significantly related to research output. Further examination of librarians' motivations for doing research, and of the interplay between intrinsic and extrinsic motivations, may help to illuminate the role of a supportive institutional climate.

Also related to motivations, our findings suggest that it will be important to explore questions about the value of research that is closely related to practice and the value of various types of research output. This may help to build a more cohesive research culture and may also help reveal factors that are key for different types of research, since we saw that the significance of some factors, and of some components within factors, varied depending on the measure of research productivity that we examined.

We plan to further extend this research with qualitative exploration into one or more of the areas above. We hope that this study's findings will prompt others to also explore librarians' research from the perspective of enablers rather than barriers.

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Appendix A
Survey Instrument (English Version)

In the survey text below, each question is annotated with an abbreviation to indicate the factor to which it is mapped. These annotations are provided for this paper and were not included in the survey instrument.

D	Demographics
EE	Education and Experience
EM	Extrinsic Motivations
IM	Intrinsic Motivations
IS	Institutional Supports
PCR	Personal Commitment to Research
PT	Personality Traits
COL	Collaboration
COM	Community
M	Mentoring
PS	Peer Support

Factors Influencing Research Productivity

The survey is expected to take less than 20 minutes and includes questions related to: a.) Education and Professional Experience; b.) Factors Influencing Research Productivity; c.) Demographic Information; d.) Research Outputs;

Some of the questions are simple yes or no questions and require you to choose the best answer that reflects your situation or your feelings.

The study seeks participation from Canadian academic librarians (at CKRN institutions) who are and who are not active researchers. For this study, we are using the definition of research provided by the Tri-Council Policy Statement: Research is "defined as an undertaking intended to extend knowledge through a disciplined inquiry and/or systematic investigation."

The researchers are interested in Canadian academic librarians' contributions to library and information studies (LIS) research. While it is recognized that librarians may undertake research outside of LIS, the researchers are gathering information in this study only on LIS-related research.

By taking this online survey I am indicating that I have read the information letter and voluntarily agree to participate in the research study.

Please remember to print a copy of the information letter for your records.

Where do you currently work? EE
Drop-down menu of the 75 CKRN institutions.

Do you have tenure (or equivalent) or are you in a tenure-track (or equivalent) position? EE

- Yes
- No

What year did you complete your MLIS degree (or equivalent)? EE
Drop-down menu of years

Where did you obtain your MLIS degree (or equivalent?) EE

- Dalhousie University
- McGill University
- University of Alberta
- University of British Columbia
- Université de Montréal
- University of Ottawa
- University of Toronto
- Western University
- Other, please specify...

During your MLIS program (or equivalent), did you complete any of the following: EE
Check all that apply.

- research methods course
- independent research study
- thesis

Since completing your MLIS (or equivalent), have you taken any formal research training? EE
Check all that apply.

- university-level research course
- full- or half-day research workshop
- CARL Librarians' Research Institute
- Thinking Qualitative Workshop Series
- online non-credit research course
- Other, please specify...

Do you have an advanced degree in addition to your MLIS (or equivalent)? EE
Check all that apply.

- Yes, thesis-based Masters
- Yes, non-thesis-based Masters
- Yes, PhD
- No additional degree
- Other, please specify...

Are you currently working towards an additional degree? EE
Check all that apply.

- Yes, thesis-based Masters
- Yes, non-thesis-based Masters
- Yes, PhD
- No additional degree

- Other, please specify…

Please indicate whether or not each statement applies to you.
(presented in random order)

PCR	I consider research to be a priority.	Yes | No
PCR	I am currently working on a research project.	Yes | No
PCR	I always have a research project that I'm working on.	Yes | No
PCR	I do research that is meaningful to my practice.	Yes | No
PCR	I believe it is important for librarians to contribute to the profession via research.	Yes | No
PCR	I work on research outside of regular work hours.	Yes | No
PCR	I schedule dedicated time for research.	Yes | No
PCR	I have participated in activities that support LIS research (e.g. peer review, editor of a journal, providing writing assistance to a colleague, etc.)	Yes | No
PCR	I have used personal funds to support my research and dissemination (e.g.: personal professional development funds or self funded).	Yes | No
PCR	I read research literature on a regular basis.	Yes | No
IS	I am encouraged and supported by my library to do research.	Yes | No
IS	I have time to do research within my job.	Yes | No
IS	I have space where I am able to work effectively on my research.	Yes | No
IS	I have taken a sabbatical or other kind of leave to work on a research project.	Yes | No
IS	I have hired a research assistant to help with research tasks.	Yes | No
IS	I have received funding for my research.	Yes | No
COM	I have a network of peers at my institution with whom I talk about research.	Yes | No
COM	I have a network of peers from other institutions with whom I talk about research.	Yes | No
COM	I know people who have similar research interests to mine.	Yes | No
COM	Professional associations are a source of research community for me.	Yes | No
COM	I attend conferences in order to connect with others who have similar research interests.	Yes | No
COM	I feel like I belong to a research community.	Yes | No
COM	I have consulted with an expert to get help on a specific aspect of my research.	Yes | No
COL	I have done research with other people (co-researchers) at my institution.	Yes | No
COL	I have done research with other people (co-researchers) from other institutions.	Yes | No
COL	I have done research on my own.	Yes | No
PS	I have participated in a peer support group related to research.	Yes | No

Please indicate whether or not each statement applies to you.
(presented in random order)

PS	I have participated in a writing group.	Yes | No
PS	I have participated in a journal club.	Yes | No
PS	I ask my colleagues for feedback on my research.	Yes | No
EM	I have received merit increments or promotion due to my research activities.	Yes | No
EM	I am (formally or informally) expected to participate in research and scholarship.	Yes | No
EM	I do research only because it is a requirement of my job.	Yes | No
PT	I enjoy doing research.	Yes | No
PT	I enjoy writing for publication.	Yes | No
PT	I am confident that I have the ability to do research.	Yes | No
PT	I can achieve my research goals.	Yes | No
PT	I enjoy presenting at conferences.	Yes | No
PT	I enjoy speaking with colleagues about my research.	Yes | No
PT	Publishing gives me a personal sense of satisfaction.	Yes | No
PT	I can easily identify questions that could be answered through research.	Yes | No
PT	I do research to satisfy my curiosity.	Yes | No
PT	I finish the research projects that I start.	Yes | No

IM	I do research to advance my career.	Yes | No
IM	I do research for my personal interest.	Yes | No
IM	I do research to contribute to better library services.	Yes | No
IM	I do research for professional growth.	Yes | No
IM	I do research to build a professional reputation for myself.	Yes | No
IM	I do research to contribute to more informed decision making in librarianship.	Yes | No
IM	I do research to contribute to greater library visibility on campus.	Yes | No
IM	I do research to build stronger relationships with faculty members.	Yes | No
IM	I do research to contribute to a stronger profession.	Yes | No
M	I have been mentored in relation to research activities.	Yes | No
M	I have mentored others in relation to their research activities.	Yes | No

What is your gender? D

- Female
- Male
- Other

What month and year were you born? D

What is your marital status? D

- single
- married
- living with partner
- divorced
- separated
- widowed
- Other, please specify...

Do you have children or adults who depend on you for care? D

- Child(ren) under 18 years of age
- Child(ren) over 18 years of age
- Other adult dependent upon me for care
- No children or dependent adult

Can you think of other factors that were not fully captured in the previous questions that have affected your research productivity? If so, please share them here.
Open text box

Thinking back over the last <u>five</u> years, please indicate how many times you have disseminated your LIS-related research in each of the following venues:
The researchers are interested in the research outputs of Canadian academic librarians related to library and information studies (LIS). While it is recognized that librarians may undertake research outside of LIS, do research that is not disseminated, or disseminate research in non-traditional formats, in this question the researchers are gathering information about specific ways of disseminating LIS-related research.

presented a poster at a conference (both peer reviewed and not)	drop-down 0-50

gave an oral presentation at a conference (both peer reviewed and not)	drop-down 0-50
published in conference proceedings	drop-down 0-50
published a non-peer reviewed journal article	drop-down 0-50
published a peer reviewed journal article	drop-down 0-50
published a chapter in a book (contributed chapter)	drop-down 0-50
authored a book (solo or co-author)	drop-down 0-50
edited a book (collection of contributed chapters)	drop-down 0-50

The scholarly landscape is changing and researchers are disseminating their research outputs in new ways. Please list any ways that you have disseminated your research that were not included in the previous question.
Open text box

Appendix B
Canadian Research Knowledge Network (CRKN) Member Institutions

Acadia University
Algoma University
Athabasca University
Bishop's University
Brandon University
Brock University
Cape Breton University
Carleton University
Concordia University
Concordia University College of Alberta
Dalhousie University
École Polytechnique de Montréal
HEC Montréal
Kwantlen Polytechnic University
Lakehead University
Laurentian University
MacEwan University
McGill University
McMaster University
Memorial University of Newfoundland
Mount Allison University
Mount Royal University
Mount Saint Vincent University
Nipissing University
NSCAD University
OCAD University
Queen's University
Royal Military College of Canada
Royal Roads University
Ryerson University
Saint Mary's University
Simon Fraser University
St. Francis Xavier University
The King's University College of Alberta
Thompson Rivers University
Trent University
Trinity Western University
Université de Moncton
Université de Montréal
Université de Sherbrooke
Université du Québec:
- École nationale d'administration publique
- École de technologie supérieure
- Institut national de la recherche scientifique
- Université du Québec à Chicoutimi
- Université du Québec à Montréal
- Université du Québec à Rimouski
- Université du Québec à Trois-Rivières
- Université du Québec en Abitibi-Témiscamingue
- Université du Québec en Outaouais
- Télé-université du Québec

Université Laval
Université Sainte-Anne
University of the Fraser Valley
University of Alberta
University of British Columbia
University of Calgary
University of Guelph
University of Lethbridge
University of Manitoba
University of New Brunswick
University of Northern British Columbia
University of Ontario Institute of Technology

University of Ottawa
University of Prince Edward Island
University of Regina
University of Saskatchewan
University of Toronto
University of Victoria
University of Waterloo
University of Windsor
University of Winnipeg
Vancouver Island University
Western University
Wilfrid Laurier University
York University