

Undergraduate research opportunities in Canadian higher education: An initial study

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A type of work-integrated learning activity, undergraduate research, through undergraduate research opportunities (UROs), is becoming a prominent agenda in higher education. Currently, there is a gap in understanding the type of UROs offered in Canadian postsecondary institutions. To apprehend the country's landscape in facilitating UROs, the study focused on four U15 Group of Canadian Research Universities: Dalhousie University, University of Alberta, University of Toronto, and University of British Columbia. Research questions explored the rationale for promoting UROs, the types of UROs available, and how these offerings differ. Basic content analysis was used to analyze written text from publicly available sources. Findings from the study highlighted the different approaches to URO administration. Issues of access by undergraduates were also identified, including a lack of opportunities in the arts and humanities and those in specific student identity populations. Recommendations and future research are outlined to deepen our understanding and enhance undergraduate research for all.

Keywords: Undergraduate research, undergraduate research opportunities, higher education; apprenticeships

On a global scale, studies show low productivity and a shortage of skilled workers (Haan, 2012). For Canada, the economy and labor market are in flux due to global factors such as internationalization and restructuring of traditional sectors, underperforming in comparison to other nations (Goldenberg, 2006; Haan, 2012). A significant investment is required to build Canada's workforce, with increasing emphasis on developing workers to shape the economy (Goldenberg, 2006). This has resulted in the increasing engagement of higher education with workforce development (Harvey, 2000; Lester & Costley, 2010). The responsibility to develop skilled workers has now shifted towards postsecondary institutions (Harvey, 2000; Jackson, 2015; Lester & Costley, 2010), with the goal to "transform students by enhancing their knowledge, skills, attitudes, and abilities" (Harvey, 2000, p. 3). Employers expect graduates to perform immediately with relevant competencies in a professional work setting (Billett, 2009). At the same time, students and graduates see the value of work experience and internships for employability purposes (Kinash et al., 2016). The perceived need for graduates to be prepared for the world of work means that higher education institutions need to build relevant opportunities into the student experience.

One way to achieve this is through work-integrated learning (WIL). WIL has been used in a variety of literature to describe the numerous educational platforms designed to provide individuals "exposure to real-world work experience by deliberately integrating theory and work practices" (Smith, Ferns, & Russell, 2016, p. 197). These individuals are able to learn, apply their skills and knowledge, and build one's confidence (Jackson, 2015). As such, many believe that WIL is essential to providing individuals with the employability skills to be ready for work and career (Clarke, 2005; Jackson, 2015). WIL can help workers acquire desired professional skills, benefiting employers and organizations (Clarke, 2005). Moreover, higher education sees WIL as a strategic way to satisfy stakeholders and address the needs of the economy (Smith, 2012).

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Undergraduate Research in Higher Education

Undergraduate research (UR), one form of WIL, can be strategically leveraged in postsecondary institutions to address the demands and expectations of the global and shifting work environment (Brew, 2013; Dvorak & Hernandez-Ruiz, 2019; Murray, 2017). Professionals are expected to think critically, problem-solve, and make informed decisions (Brew & Mantai, 2017). The need for these skills in the workforce has led higher education institutions to utilize research and inquiry as a method to develop students with these proficiencies (Brew & Mantai, 2017). UR is student-focused and integrates teaching and research (Brew, 2013; Brew & Mantai, 2017; Jones & Lerner, 2019). These high-impact experiences (Kuh, 2003) are offered in a range of disciplines (Brew, 2013) and allow students to work on research project(s) conducted at the institution (Brew, 2003; Wallin & Adawi, 2018). UR leverages the mentor's expertise, resources, and experience but the student has the responsibility for and can make decisions on the research project (Hunter et al., 2007). Existing literature considers UR to be a powerful learning tool that complements traditional classroom learning (Falconer & Holcomb, 2008). Students involved in UR report greater satisfaction with their overall undergraduate experience compared to those who do not participate (Bauer & Bennett, 2003). In the last twenty years, there has been growing interest in UR and increases in the number of UROs at colleges and universities (Brew & Mantai, 2017; Murray, 2017). Higher education institutions have made efforts to promote UR (Fechheimer et al., 2011), working towards building a supportive culture, with the hope that all students can experience UR during their degree (Murray, 2017).

A challenge faced by practitioners, academics, and faculty is finding a common understanding and definition of UR (Murray, 2017). This is not surprising, considering the terminology needs to relate to multiple disciplines and contexts (Murray, 2017). For some, UR can be anything research-oriented; for others, UR is a specific set of activities available only to a small group of students (Brew & Mantai, 2017). Some argue that UR should be closely structured and guided while others consider UR as independent work (Brew & Mantai, 2017). The diverse perspectives and opinions of what constitutes UR have led to different forms, activities, and varieties in undergraduate research opportunities (UROs) (Brew & Mantai, 2017; Murray, 2017). The Council of Undergraduate Research (n.d.) defines UR as "an inquiry or investigation, conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline" (para. 4). However, many have argued for a broader definition to include the diverse varieties of UROs that would allow for all students to engage in this type of research and inquiry (Healey & Jenkins, 2018; Judge et al., 2012; Parker, 2018).

Types of Undergraduate Research Opportunities

With no universal UR institutional model (Murray, 2017), URO types differ across institutions (Brew, 2013; Murray, 2017). The common types of UROs found in literature are discussed, which include apprenticeships, research-oriented course and program offerings, and opportunities to disseminate research. The apprenticeship model is the "catch-all" term for the most common and traditional type of URO. It involves a one-to-one, student-to-faculty relationship where the student works on a research project supported by the faculty member (e.g., Hunter et al., 2007; Kardash, 2000; Seymour et al., 2003). The apprenticeship model has a variety of naming conventions – fellowships, internships, research scholarships, and grants to name a few (Murray, 2017), and can be paid or volunteer positions (Fechheimer et al., 2011). Apprenticeship projects are intended to be open-ended but defined in a way that results can be determined within a specific timeframe (Hunter et al., 2007). Through the apprenticeship, students model research skills from faculty members and have the opportunity to enhance their research practice (Kardash, 2000).

Unlike apprenticeships, course and program-based UROs are usually for academic credit and/or are part of degree requirements. Course-based approaches allow academics to reach a larger number of students and usually provide an entry to research (Brew & Mantai, 2017; Russell et al., 2008). Course-based UROs are limited in the type of research that can be done but can introduce students to foundational research processes and academic writing (Murray, 2017). Program-based approaches are similar to the apprenticeship model in that they involve one-to-one interactions with the faculty member (Moore et al., 2018). Where they differ from apprenticeships is that students receive academic credit for their work (Moore et al., 2018). Theses, capstones, and directed studies are the most common program-based UROs.

Disseminating research can be done through a range of platforms – conferences, symposia, publications, and academic journals (Murray, 2017). Undergraduate conferences hosted by colleges and universities allow undergraduates to present their research findings (Healey & Jenkins, 2018; Judge et al., 2012; Kardash, 2000). Students situate their work in a wider context and receive recognition (Walkington et al., 2017). Conferences can be discipline-specific (Hunter et al., 2007; Kardash, 2000; Murray, 2017) or multidisciplinary (Walkington et al., 2017).

Though UR is considered a WIL activity, it is important to note that not all types of UROs meet the definition of WIL. Further, in the context of UR, the traditional WIL partnership with the three stakeholders - the academic institution, the employer, and the student - may not be as clearly explicit since the academic institution at times, can concurrently act as the employer of the student's workplace. As such, it is important to distinguish which UROs types are considered WIL and who is deemed the employer in the partnership in supporting the student. Of the different URO types described in literature, the apprenticeship model and program-based courses best meet the attributes of WIL. These UROs allow students to apply their academic knowledge into practical settings, whether in industry or an academia. Considering the WIL partnership, the employer can be a professional within the industry or community. In the academic setting, often, the faculty member acts as the mentor and supervisor of the student. In both instances, the academic institution facilitates the administration of the WIL experience to support the student's overall learning and development. Evidently, it may be obvious that course-based UROs and opportunities to disseminate research generally would not meet the attributes of WIL. However, these types of UROs can still complement student learning, as well as their career and identity development. While conducting a research lab experiment for an UR course would not be considered a WIL activity, it may motivate students to deepen their learning by participating in a research WIL experience in the future. As for disseminating research, students would typically participate in a WIL activity before being able to share their findings with others. This additional experience of sharing one's research strengthens the value of that particular WIL activity as it completes the research experience and enhances student learning (Walkington et al., 2017).

Student Benefits from Undergraduate Research Opportunities in Relation to Work-Integrated learning

The rationale for promoting UR in higher education is evident in the extensive literature on student benefits following participation in these research activities, which further aligns with WIL outcomes. Student benefits include research (e.g., Hunter et al., 2007; Kardash, 2000; Seymour et al., 2003) and non-technical (e.g., critical thinking, problem solving, communication) skills development (e.g., Bauer & Bennett, 2003; Hunter et al., 2007; Seymour et al., 2003). There are also reported gains in career insights (e.g., Alderton & Manzi, 2017; Hunter et al., 2007; Seymour et al., 2003) and academic success (Falconer & Holcomb, 2008; Kuh, 2003; Murray, 2017). Students develop feelings of increasing self-confidence (Hunter et al., 2007; Lopatto, 2010; Petrella & Jung, 2008) and higher sense of community

(Alderton & Manzi, 2017; Hunter et al., 2007). Through UR, educational institutions are preparing the future workforce for an increasingly competitive job market (Russell et al., 2008). Some employers from diverse industries see the value of research and the positive contributions that it can bring to organizations; candidates who have research experience are also more competitive (Murray, 2017). The line between academia and the workplace sector is blurring as graduates with doctorates are working outside of academic institutions (Murray, 2017). In the context of WIL, UR in higher education is critical, especially with the growing demand for research skills in non-academic sectors (Murray, 2017).

Research Purpose

Presently, there is a lack of knowledge around the types of UROs offered in Canadian postsecondary institutions, with much of the UR literature in higher education originating from the United States, Australia, and the United Kingdom. With little attention to UR in Canadian higher education, this research paper aims to shed some light on UROs in this context. Considering the decentralized higher education system in Canada, it is unclear if Canadian universities are utilizing similar approaches to providing students with UR experiences. Studying universities' approaches to facilitating UROs can help practitioners, administrators, and faculty strengthen UR experiences across the nation. The study may also identify potential areas in UR that require additional support, resources, and areas for future research.

The intent of this paper is to better understand Canada's landscape in facilitating UROs within higher education and identify opportunities to enhance UR. This is achieved by collecting publicly available information on existing UROs across selected Canadian university institutions and analyzing these opportunities. Research questions are as follows:

- What are the rationales for promoting UROs in Canadian postsecondary institutions?
- What type of UROs are available in selected Canadian postsecondary institutions?
- What differences are evident in UROs across selected Canadian postsecondary institutions based on publicly available sources?

The research methodology of the paper is initially outlined followed by a summary of the findings. Lastly, a detailed discussion analyzing the results across the selected Canadian institutions and recommendations (practice and future research) conclude the paper.

METHODS

For the study, basic content analysis was used as outlined by White and Marsh (2006). This included identifying the appropriate data, determining the sampling unit, establishing the data collection unit and coding scheme, coding the data, and analyzing the coded data (White & Marsh, 2006). Four Canadian institutions from the U15 Group of Canadian Research Universities were chosen since these universities make up 80% of all competitive university research within the nation. Selected institutions were also determined by region within Canada. Based on the criteria, the following institutions were chosen: Dalhousie University (Atlantic), the University of Alberta (Prairies), the University of Toronto (Central Canada), and the University of British Columbia (West Coast). For the purposes of this research paper, UROs are defined as optional research-based activities outside of formal classroom settings (not for academic credit) in which undergraduate students participate in. Based on this definition, data on apprenticeships, conferences, and research journals were analyzed. Other UROs that did not fit into these categories were also considered provided they were not for academic credit.

In terms of the data source and collection process, written text from public websites were gathered for analysis. Applicable Faculties, Schools, and departmental websites were reviewed to find URO-related information, looking for webpages titled “Student Research Opportunities” or “Undergraduate Research Opportunities”. Professional and graduate degree programs and Faculties were omitted since they are irrelevant to UR. UROs dated 2019 and onwards were only considered since these are current offerings available to students.

As per White and Marsh (2006), an iterative deductive coding process was used for the study, with clearly defined coding schemes for apprenticeships, conferences, and research journals. Coding categories were developed based on the factors identified for analysis as well as URO characteristics from the literature. For all three URO types, the academic discipline was considered, distinguishing UROs that included all disciplines, ones specific to the sciences and engineering only, and those that are just for arts, humanities, and social sciences students. Apprenticeship UROs had additional coding categories: employment type (paid/unpaid, full-time/part-time roles); when (summer and/or academic year) and the location (within Canada or abroad) the URO took place; and student eligibility considering year level and GPA. Each URO was categorized to one of the following types: apprenticeships, conferences, and research journals. Once the typology of the URO was determined, it was then coded using the coding scheme specific to its type. After all UROs had been coded, the analysis involved tallying the code names of each category for all four institutions into frequency tables. To analyze the data among institutions, specific factors were used to determine patterns and differences: governance and administration of UROs; and UROs by typology, discipline (in particular, the hard sciences and engineering with arts and humanities), and student identity populations.

Scope and Limitations

The research study excluded research courses/activities that are for academic credit. Excluding this type of URO may not provide a holistic view of URO offerings across Canadian postsecondary institutions. The study lacks generalizability since data from only four Canadian postsecondary institutions are collected. Though the sample is small, this can be the start to better understanding UR in the Canadian context. Additionally, with the data source originating only from publicly available websites, some UROs may be missed if universities omitted this information online and/or if URO descriptions were not updated. There may also be potential error on the researcher not being able to find all relevant UROs. To minimize this issue, the general search for “undergraduate research opportunities” using Google’s search engine was included as part of the data collection process.

RESULTS

Table 1 summarizes the total number of UROs (by type) found in each institution for the study (with Appendix A outlining detailed frequency counts of the code categories by URO type and institution as per the coding scheme). To understand the relative URO offerings for each university, Table 1 also includes the total number of full-time and part-time undergraduate fall enrolment in 2020 (numbers in parenthesis) based on data from Universities Canada. For each institution, a summary of the findings is described. This includes information on apprenticeships, conferences, research journals, other non-credit based UROs, and general observations from reviewing UR websites.

TABLE 1: Frequency counts of UROs by type for each institution.

Institution	URO Type	Count
Dalhousie University (15,865 undergraduates)	Apprenticeships	11
	Conferences	10
	Research Journals	8
	Other	0
	TOTAL	29
University of Alberta (33,659 undergraduates)	Apprenticeships	23
	Conferences	6
	Research Journals	7
	Other	9
	TOTAL	45
University of Toronto (74,000 undergraduates)	Apprenticeships	35
	Conferences	9
	Research Journals	36
	Other	9
	TOTAL	89
University of British Columbia (55,035 undergraduates)	Apprenticeships	59
	Conferences	16
	Research Journals	13
	Other	1
	TOTAL	89

Dalhousie University

In total, Dalhousie University has the least number of UROs among the selected institutions in this study. The institution has a majority of apprenticeships that are paid, full-time positions which are offered in the summer term (May to August). Some apprenticeships from the university target certain student groups: The Summer Research Program for Non-Medical Students supports African and Indigenous students; Imhotep's Legacy Academic Summer Student Research Scholarship is for African undergraduates; and the Michael J. Keen Award offers a research opportunity for female students. Almost half of the apprenticeships require students to be in year three or four of their studies and/or obtain a "B" average to be eligible. At Dalhousie University, undergraduates are able to disseminate research through conferences and research journals. However, conferences are hosted outside of the institution and predominantly cater to sciences students. Further, there are more arts and humanities UR journals than those in sciences and engineering. No other UROs have been identified beyond apprenticeships, conferences, and research journals. Information pertaining to UROs are housed differently depending on the Faculty and the department.

University of Alberta

The University of Alberta has the second highest count of UROs (45). Apprenticeships at the university are paid, full-time positions that occur in the summer term. The I-STEAM Pathways program is the only apprenticeship that supports a specific student group - the program enables Indigenous undergraduates to gain research experience in the field of science and environmental fields in engineering, law, and policy. Approximately half of the apprenticeships require students to be in year three or four and/or maintain a "B" average to be eligible. Both conferences and research journals are

administered by the university. Most research journals target students in the arts and humanities. If available, “Student research opportunities” pages for the University of Alberta are usually highlighted on the main Faculty webpages instead of through departmental pages. One unique URO offering at the University of Alberta is the research certificate. Undergraduates can pursue this opportunity by completing a combination of selected research-based courses, conducting their own research project, and presenting at a conference. This is an optional, not for credit activity for students who want additional accreditation to showcase their research experience. Another unique feature is a central unit known as the Undergraduate Research Initiative (URI). URI provides research opportunities and information sessions to students of all disciplines. It also offers advising appointments, hosts events and workshops, and administers funding opportunities (e.g., URI Undergraduate Research Stipend, i-STEAM Pathways program). The unit organizes an annual UR conference and advertises publication opportunities to undergraduates.

University of Toronto

The University of Toronto is tied for the highest number of UROs (89) among the selected institutions in this study. Apprenticeships at the University of Toronto are predominantly paid, full-time positions that are offered in the summer term. There are no apprenticeships that support specific student identity groups. Apprenticeships that have additional academic criteria require students to be in their third or fourth year of studies and/or maintain a “B+” average. One particular apprenticeship at the University of Toronto is worth mentioning. The University of Toronto Excellence Summer Research Awards (UTEA) provide research opportunities to undergraduates from all disciplines. A \$6,000 stipend is awarded to the student. What is notable is that the top-up amount requirement from faculty supervisors depends on the discipline. For UTEAs in the social sciences and humanities, a \$6,000 stipend is awarded to the student without faculty needing to top-up. On the other hand, UTEAs in the natural sciences and engineering only provide \$4,875 to the student, with a mandatory minimum top-up (\$1,125) from the faculty. Conferences are administered by the institution. The university has the highest number of research journals among the selected institutions, with the majority of them in the arts and humanities. The Faculties of Science and Applied Science promote UROs, often through an “Undergraduate student research” page but the types of UROs listed vary greatly. Most arts and humanities webpages do not highlight UROs. Alternative UROs include research grants (five) and travel funds (two) to help undergraduates offset equipment costs and subsidize research-related activities. Two student clubs have also been identified – one promotes academic journal discussions while the other brings together a community of individuals interested in UR.

University of British Columbia

The University of British Columbia (UBC) is tied for the highest number of UROs (89) with the University of Toronto. Apprenticeships within Canada are primarily paid, full-time positions that are offered in the summer term. Paid part-time positions are fewer in comparison, taking place during the academic year. UBC has the highest count of volunteer (unpaid, part-time) positions promoted on their webpages. This does not necessarily mean that other universities in this study do not offer volunteer positions, but rather, they may not advertise such opportunities as UBC does. For research abroad apprenticeships, almost all are unpaid, full-time positions occurring in the summer term. Two apprenticeships support specific student groups. The Aboriginal Undergraduate Research Mentorship Program caters to Indigenous students in STEM fields. Similarly, the Quantum Pathways program not only supports Indigenous students in quantum material, physical sciences, and engineering, it is also open to female and racialized students. Some UROs require a “B+” or “B-” average in order to be

eligible while others require students be in year three or four of their studies. It is worth highlighting that UBC is the only institution that offers paid apprenticeships supporting arts and humanities students –the Faculty of Creative and Critical Studies Undergraduate Student Research Awards and Quinn Research Assistantship). Conferences and research journals are all organized by the institution. Research journals in the arts and humanities have a higher frequency count compared to journals in the sciences and engineering. Similar to other institutions, UROs are highlighted differently depending on the Faculty/School/department. One research-oriented club worth mentioning is the Undergraduate Research Opportunities. It is a student-run initiative that helps undergraduates from all disciplines obtain research opportunities. The club organizes mentorship programs, networking events, and other research-related services to support students in acquiring research experiences.

DISCUSSION

Several factors are used to gain deeper insights into the current Canadian higher education URO landscape. Governance and administration of UROs allow for understanding of how postsecondary institutions are facilitating these opportunities and whether similar approaches are used. UROs are further analyzed to determine any patterns based on typology, offerings by academic discipline (especially between the hard sciences and arts), and whether certain opportunities are targeted to specific student populations. Frequency counts from the additional analysis of the aforementioned factors can be found in Appendix B. Considering these factors, recommendations and future research are provided to enhance WIL and UR at Canadian research-intensive universities.

Governance and Administration of Undergraduate Research Opportunities

To address the first research question, the rationale for promoting UROs can be found in institutional strategic plans. Among the universities included in this study, they see benefits in engaging undergraduates in research. For faculty, UR allows them to identify and mentor potential research members and graduate students. For students, this inquiry-based method is seen as a lifelong benefit. Through research, students develop problem solving, creativity, communication, and teamwork skills. Further, it provides them the opportunity to apply their learning, utilize research skills, and contribute to new knowledge. Aligned with WIL outcomes, these experiences facilitate the necessary skills and knowledge for any career. As a way to enhance UR, universities highlight one approach in their strategic documents - to increase the number of UROs available by scaling up existing UR programs.

The University of Alberta is the only institution among those studied that has a central unit dedicated to supporting UR – Undergraduate Research Initiative (URI). This is in contrast to the other three institutions in which a dedicated unit is absent. Overall, this decentralized approach lacks consistency and structure. Within the same institution, Faculties do not highlight UROs the same way; the same can even be said among departments within the same Faculty. Considering the loosely coupled system of Canadian higher education, the decentralized approach to administering UROs aligns with its organizational structure. Faculties are able to manage autonomously without reliance on other units and can make their own decisions. Though the University of Alberta has URI, not all UROs found in this study are managed by the unit. The university appears to be utilizing a hybrid model, administering UROs under URI and through Faculties, which can be beneficial. URI can house research information and services in one place, making it easier for students unfamiliar with UR to find what they need. Second, Faculties can have autonomy to offer additional URO resources and funding on their own accord.

Typology

Comparing the three types of UROs in the study, apprenticeships (128) have the highest frequency, followed by research journals (64), and conferences (41). This is not surprising, considering that most literature studies focus on apprenticeships. Subsequently, full-time apprenticeships (93) are more common than part-time positions (32). Likely, this is to ensure that students can commit to the position without having to concurrently manage their coursework (Alderton & Manzi, 2017; Murray, 2017). Upon further analysis of apprenticeships across institutions, paid, full-time positions are the most common (67) and occur in the summer term. In contrast, paid, part-time positions typically occur in the academic year and have the lowest frequency count (fourteen). The part-time nature can offer students the flexibility to pursue work concurrently with their studies. As such, it is unclear why these apprenticeships have the lowest frequency count. Further studies between full-time and part-time research positions are required to understand current findings. Unpaid, full-time apprenticeships have the second highest frequency count (26). These positions are typically research abroad opportunities in the summer term. Unpaid, part-time positions (eighteen were found in the study) are offered during the academic year and are generally volunteer roles. These unpaid apprenticeships exist perhaps as a result of the current systemic support (or lack of) for UR at universities. From the literature, current challenges around recognition of and limited resources to support faculty in hiring undergraduates and/or their research may influence this decision (Brew & Mantai, 2017; Evans, 2010; Moore et al., 2018).

Minimum requirements, by grade and year level, to participate in apprenticeships are analyzed across institutions. Sixty-five of 128 apprenticeships found in this study do not indicate a minimum grade requirement. However, the ones that do require students to hold a minimum "B" average in order to be eligible. Fifty-four of 128 apprenticeships do not specify a year level requirement. Apprenticeships indicating a minimum year level require students to be in year three or four. In summary, apprenticeships advantage moderately high-achieving students ("B" average) who are in their upper year of studies.

Presenting at conferences and publishing in UR journals are available to students in all of the institutions studied. Conferences and submission deadlines for journals are held in the academic year – dates are usually between January to April. The timing of conferences and submissions to research journals taking place in January to April may be to allow time for students to conduct research in the fall (September to December) and then present their findings in the subsequent term.

Disciplines

Analyzing by academic discipline, specifically between sciences and engineering with arts and humanities can shed light on the number of opportunities available to certain students (see Appendix B for details). Across all institutions, there are higher counts of apprenticeships for students in the sciences and engineering compared to those that are for all disciplines and are only for arts and humanities students. Further, only Dalhousie University and UBC offer apprenticeships for students in the arts and humanities. These findings are consistent with the lack of equitable access to UROs by discipline as outlined in the literature. One reason for the higher number of apprenticeships in the sciences and engineering is due to inequities in funding between these disciplines (Murray, 2017). The results indicate significantly more paid apprenticeship offerings for sciences and engineering students compared to the two paid arts apprenticeships found in this study. This discrepancy may also be due to the characteristics of the disciplines themselves (Murray, 2017). For the study, the promotion of UR

and UROs online is apparent in the sciences and engineering webpages. However, the same cannot be said for the arts and humanities.

Within the sciences and engineering, there are similar number of opportunities for disseminating research, whether it is through conferences (fourteen) or research journals (twelve). These findings differ in the arts and humanities, where there are significantly more opportunities to publish in research journals (41) than to present at a conference (seven). Overall, most conferences are geared towards the sciences and engineering. Across all four institutions, research journals in the arts and humanities are the most frequent, and this is the only URO type where there are more opportunities within the arts compared with sciences and engineering. From the results, publishing in research journals may be the primary method of engaging in UR in the arts and humanities.

Student Identity Populations

There is no information on the websites to determine if conferences and research journals cater to specific student identity populations among undergraduates. A few conferences encourage upper year students to participate, but they do not exclude junior students from presenting. It can be inferred that research journals are open to all since the websites do not specify who, among undergraduates, can submit. The focus here is on apprenticeships in relation to specific student identity groups. In total, only eight of 128 apprenticeships support particular undergraduate populations (Appendix B). Dalhousie University has the highest number of apprenticeships in this regard – supporting women, Indigenous, and African students. Moreover, these apprenticeships cater only to specific student identity populations in sciences and engineering, with zero supporting students in the arts and humanities. Such apprenticeships may be absent due to the lack of literature on women and racialized populations in UR within the arts and humanities. What is also missing from the study are UROs supporting undergraduates with disabilities.

Implications

Recommendations are outlined in this section to identify ways to better support and enhance UR, as one form of WIL, in Canada. These considerations primarily focus on the issue of access to UROs by undergraduates. Reducing barriers to access is one step to ensuring universities can achieve their institutional goals and provide UR experiences for all.

Information from institutional strategic plans calls for increasing the number of opportunities for students. However, there is no directive on how this is accomplished besides scaling up existing programs. Due to the high-level nature of these documents, they provide generic information and lack specificity. Further direction is needed from senior leadership to provide guidelines around how to increase the number of UROs – including the type of UROs, which undergraduates require additional opportunities, and for what disciplines. Considering WIL and the goal of broadening UR access to all undergraduates, having specific guidelines is important for Faculties, staff, and faculty members. This may be better facilitated by having clear directives from the Vice-President, Research and Innovation portfolio, giving Faculty autonomy while ensuring alignment within an institution. At the same time, there is also a need to promote and increase understanding of WIL (including UR as a form of WIL) to faculty since they are key stakeholders to facilitating UROs within higher education.

Current apprenticeships advantage upper year undergraduates and those who have a strong academic record, which makes these opportunities competitive and inaccessible for certain students. New program offerings (or changes to current eligibility criteria) should be developed, supporting junior

undergraduates and those with lower GPAs. Existing and new UROs should also consider other measures when evaluating apprenticeship applications so it is not solely based on academic merit. Such opportunities can ensure more undergraduates are exposed to research early on in their degree. More UROs should be offered to arts and humanities students, especially when it comes to conferences and apprenticeships. Conferences can provide a platform to recognize students' work which can then be used to promote and encourage UR within the discipline. Allocation of additional funding towards increasing the number of paid arts and humanities apprenticeships is another strategy to address the current gap. A similar funding model like the University of Toronto's UTEA can be used by other Canadian institutions, providing more monetary funding to arts and humanities students compared to those in the sciences and engineering.

Universities should focus on providing additional research opportunities to certain student groups – women, students of color, Indigenous students, and students with disabilities – instead of for the entire undergraduate population. Some of the existing literature have demonstrated benefits to participating in UR for women and racialized students (e.g., Estrada et al., 2018; Fechheimer et al., 2011; Kardash, 2000; Parker, 2018). An alternative is to set quotas among current UROs to ensure such groups are equitably represented.

Future Research

Additional research areas are highlighted here to gain deeper insights around UR in Canadian higher education and to enhance the scholarship of WIL. Given the small sample size in this study, how are other Canadian postsecondary institutions facilitating UR and UROs? Are other institutions using similar or different approaches compared to the findings here? A larger sample size can provide a more holistic picture of the Canadian UR landscape by expanding this study to the other U15 Canadian institutions. Another way to expand the research scope is by including UROs where students receive academic credit. How do credit-based UROs fit with the other types in this study? Participation of UROs would also warrant an interesting research topic. UROs identified in this study are based on what is publicly available online. However, this may not translate in terms of involvement and who obtain these UROs. It would be interesting to determine the student demographics by URO type and whether certain student groups are more likely to acquire these opportunities compared to others.

Considering the context of WIL and future research of UR, it will be beneficial to look into the reflections or learnings of students who participated in an URO through a qualitative study and identify if there are additional career, employability, and/or identity gains beyond the ones already identified in WIL literature. The study can be further analyzed by looking at the extent of these benefits in relation to each URO type. This will allow for a deeper examination between UR, development of relevant workplace skills, and identification of career opportunities in both academia and industry. The findings can help practitioners and institutions prioritize their focus and resources to strengthen students' readiness in the workplace through research experiences. Another area of future research is the identification of key characteristics that foster a positive research-oriented WIL experience. Understanding these attributes will allow practitioners (e.g. faculty, staff, administrators) to create an environment that maximizes students' gains when participating in an URO.

CONCLUSION

This research study set out to gain a holistic view of Canada's landscape in facilitating UROs in higher education. Research questions included the rationale for promoting UROs, identification of the URO types available, and determination of differences across selected postsecondary institutions. Basic

content analysis was used as the methodology for the study. Four Canadian research-intensive universities were selected from U15 and by region: Dalhousie University (Atlantic), University of Alberta (Prairies), University of Toronto (Central Canada), and UBC (West Coast). For this study, UROs were defined as optional research-based activities outside of formal classroom settings and not for academic credit. Thus, apprenticeships, conferences, and research journals were the focus, using written text from public websites as the primary data source.

Universities promote UROs due to perceived student benefits in skill development and enhancement of the overall student experience. One predominant way to enhance UR is to increase the number of opportunities available to students. Further, administration of UROs is facilitated by the Faculties, who determine if UROs should be promoted on their webpages, which lacks consistency within and across institutions.

From the findings, the University of Toronto and the UBC are tied for the highest number of UROs (89), with Dalhousie University having the least number (twenty-nine) of opportunities. Comparing the three types of UROs in this study, apprenticeships (128) are most frequently found online, followed by research journals (64), and then conferences (41). Most apprenticeships advantage undergraduates with a “B” average and who are in year three or four of their studies. Further, apprenticeships tend to favor undergraduates in the sciences/engineering with very few that support specific student identity groups. Conferences are also geared towards science and engineering students. However, most research journals are in the arts and humanities fields.

Overall, different universities provide their own suite of URO offerings to their undergraduates, varying in quantity and type. Though there are general themes and patterns evident from the study, there is no unified approach to facilitating UROs among the selected Canadian postsecondary institutions. Recommendations have also been outlined based on the findings to enhance UR in Canadian higher education. These suggestions are included to address the increase of and access to UROs for all undergraduates. One form of WIL, UR has been an increasingly popular tool in higher education through URO offerings (Bauer & Bennett, 2003) due to the array of benefits for students, faculty, and the institution. However, issues of access to UROs pose significant challenges to enhancing and building a culture of UR. Future research and recommended actions outlined in this paper should be thoughtfully considered to advance UR in Canadian higher education.

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APPENDICES

APPENDIX A: Frequency counts of code categories by URO type and institution.

URO Type	Code Category	Code Names	Dalhousie University	University of Alberta	University of Toronto	UBC
Apprenticeships	Employment Type	Paid	9	22	30	23
		Unpaid	2	1	5	36
	Full-time/Part-time	Full-time (FT)	6	17	30	40
		Part-time (PT)	5	5	3	19
		FT or PT	-	1	2	-
	When URO is offered	Summer	6	16	29	39
		Academic Year	1	2	1	5
		Year Round	4	5	5	15
	Discipline	All Disciplines	1	8	16	21
		Science & Engineering	8	12	19	28
		Arts	2	-	-	9
		Other	-	3	-	1
	Year Level	1	1	3	11	8
		2	2	10	14	11
		3	4	13	18	33
		4	5	13	12	32
		Year – N/A	6	10	15	23
		Minimum Grade Requirement	A	-	-	1
	A-		1	-	-	4
	B+		-	3	9	10
	B		4	8	3	5
	B-		-	1	-	11
	C+		-	1	1	-
C	-		-	1	-	
Location	Canada	11	18	29	38	
	Research Abroad	-	5	6	21	
Conferences	Discipline	All Disciplines	-	2	3	4
		Science & Engineering	8	-	1	5
		Arts	1	2	2	2
		Other	-	1	-	-
Research Journals	Discipline	All Disciplines	-	2	4	4
		Science & Engineering	1-	1	8	2
		Arts	7	4	23	7
		Other	-	-	1	-

APPENDIX B: Frequency count of URO types by academic discipline and student identity populations.

Factors	URO Type	Coding Names	Dalhousie University	University of Alberta	University of Toronto	UBC
Academic Discipline	Apprenticeships	All Disciplines	1	8	16	21
		Science & Engineering	8	12	19	28
		Arts	2	-	-	9
		Other	-	3	-	1
	Conferences	All Disciplines	-	2	3	4
		Science & Engineering	9	-	1	5
		Arts	1	2	2	2
		Other	-	1	-	-
	Research	All Disciplines	-	2	4	4
	Journals	Science & Engineering	1	1	8	2
		Arts	7	4	23	7
		Other	-	-	1	-
Student Identity Population	Apprenticeships	Apprenticeships for Specific Student Identity Populations	5	1	-	2
		Total Apprenticeships (for reference)	11	23	35	59
		Percentage (%)	45.5	4.3	0.0	3.4

Note. Arts includes the following disciplines: arts, humanities, and social sciences.