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## Changes in First-Year Students' Use of Research Resources: Impacts of an Interdisciplinary Seminar Program on Research and Literacy Learning Outcomes

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# Changes in First-Year Students' Use of Research Resources: Impacts of an Interdisciplinary Seminar Program on Research and Literacy Learning Outcomes

## **Abstract**

The Internet, which has made information ubiquitous and seemingly infinite, has transformed education. Universities are challenged to educate students to navigate and evaluate critically the undifferentiated information of the Internet so that students gain the ability to transform it into knowledge. To better understand the effects of taking a First-Year Seminar we examined the types of research resources students consulted before and after taking an interdisciplinary graded for-credit First-Year Seminar at a midsize comprehensive public university in Canada. We analyzed 2,576 anonymous questionnaires collected across 102 first-year seminars. After completing a first-year seminar, students consulted more reliable and scholarly resources, irrespective of the semester of enrollment. Generally, there were some improvements noted between first and second semester students. However, comparisons between students who had just completed a seminar in semester one with students who were about to begin a seminar in semester two, reveal that the improved results are not solely attributable to the normal transition and maturation process experienced by students in their first semester of university.

L'Internet, qui a rendu l'information omniprésente et apparemment inépuisable, a transformé l'éducation. Les universités sont mises au défi d'enseigner aux étudiants comment naviguer et évaluer de façon critique les informations non différenciées trouvées sur Internet afin que les étudiants puissent apprendre à transformer ces informations en connaissances. Pour mieux comprendre les effets sur les étudiants qui suivent un séminaire de première année, nous avons examiné les divers types de ressources de recherche que les étudiants ont consultées avant et après avoir suivi un séminaire interdisciplinaire noté et menant à l'obtention d'un crédit, dans une université canadienne publique de taille moyenne. Nous avons analysé 2 576 questionnaires anonymes obtenus de 102 séminaires de première année. Après avoir suivi un séminaire de première année, les étudiants ont consulté des ressources plus fiables et plus savantes, indifféremment du semestre dans lequel ils se trouvaient à ce moment-là. En général, on a noté quelques améliorations entre les étudiants de premier semestre et ceux de deuxième semestre. Toutefois, les comparaisons entre les étudiants qui venaient de terminer un séminaire au cours de leur premier semestre et les étudiants qui étaient sur le point de commencer un séminaire au cours de leur deuxième semestre ont révélé que les meilleurs résultats ne sont pas exclusivement attribuables à la transition normale et au processus de maturation dont les étudiants font l'expérience au cours de leur premier semestre.

## **Keywords**

first-year seminars, interdisciplinary, active learning, learning outcomes, research skills

## **Cover Page Footnote**

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“The volume of information . . . means no one will ever be ‘educated’ for long – we will have to continually educate ourselves, searching, retrieving, and synthesizing information”

(Lorenzo & Dziuban, 2006, p. 2)

The twenty-first century has experienced a paradigm shift in terms of information and communication. The ubiquitous, infinite, and uninflected knowledge available through the Internet has challenged our education systems (Bates, 2010). University students are faced with more information than ever before and require an education that supplements research skills with the ability to assess, critique, and synthesize information (Lorenzo & Dziuban, 2006). Universities have been tasked with the responsibility to help students gain the skills necessary to navigate the Internet. Moreover, universities also need to ensure that students develop the ability to engage in disciplined enquiry, think critically, and analyze in order to transform information into knowledge and to be able to apply that knowledge (Candy, 2000). Consequently, educators not only need to create pedagogies that empower students to manage the information universe, but also actively to engage in assessment strategies to ascertain how effectively students are in fact being prepared for this information age.

Today’s students have known the Internet all their lives, but they do not necessarily understand how to use it most effectively. Many do not appreciate the difference between effective research strategies and grabbing information from Google (Arvanitakis & Hornsby, 2016; Candy, 2000; Gulliver, 2014). Their familiarity provides them with the technical skills, which allow them to navigate the virtual world effortlessly with skills such as the ability to download files with ease. However, students do not always have experience with critical thinking and close reading that is necessary to analyze and synthesize information and transform it into knowledge and wisdom (Bates, 2010; Graham & Metaxas, 2003; Heil, 2005; Lorenzo & Dziuban, 2006).

Sadly, the development of these important skills is being neglected, as first-year university students are too frequently confronted by traditional courses which are often large, anonymous, and intimidating lectures, focused on content-delivery, memorization, and objective testing (Bligh, 1998; Hansen & Stephens, 2000; Summerlee, 2013). Although many universities are making concerted attempts to enhance and innovate large lectures (Hornsby, 2013), economies of scale and lack of funding frequently result in the continued reliance on traditional teaching methods such as lectures and objective assessment (Falvo, 2012). The situation is further complicated by postsecondary participation rates that have resulted in increasing numbers of undergraduates who are differently-prepared (Hansen & Stephens, 2000; Reed, 2016). The Canadian University Survey Consortium 2016 tracks increases in the numbers of first-year students who self-report being members of a visible minority or having a disability (Canadian University Survey Consortium, 2016; Higher Education Strategy Associates, 2016). As Joy Mighty (2008) has observed: “Differences in age, learning styles, gender, levels of preparedness, pre-existing skills, ability, language, socio-economic status, race, ethnicity, family make up, sexual orientation, and other dimensions of social identity present significant pedagogical challenges.” As a consequence of many contemporary stresses, many innovations are challenging traditional pedagogies and seeking to engage students in their learning.

While universities attempt to address the changes to teaching and learning occasioned by the Internet, there is also considerable external pressure from parents, the private sector, and

politicians for universities to ensure that their graduates have developed the skills of information literacy. Thus, opportunities for students to develop the critical skills necessary to assess the quality and reliability of information are essential to their success in the “knowledge-based economy” (Doyle & Hammond, 2005). These are skills deemed to be transferable to the workplace, particularly the knowledge-based economy (Bates, 2010; Bennett, Dunne, & Carré, 1999). There is a growing concern about how to prepare students for a globalized world, a concern that has been identified in higher education internationally (Arvanitakis & Hornsby, 2016; Côté, 2007). Moreover, the skills that are identified for internet literacy and the ones equally necessary for students to analyze any source of information irrespective of format, be it conventional print or electronic, are one and the same. There is, then, a new urgency to focus on these traditional skills, which continue to be critical to students’ future in a globalized, knowledge-based economy.

Many universities are addressing this challenge through the implementation of innovative pedagogies and high impact educational practices. Five types of first-year seminars have been identified: extended orientation (often referred to generically as Univ 101) and similar transition-focused seminars; academic seminars with uniform content; academic seminars with various themes and topics; pre-professional or disciplinary seminars; and seminars that focus on basic study skills (Mamrick, 2005). In the United States, a number of institutions have implemented first-year seminars to serve a smaller, focused, skills-based courses to ease the high school to university transition, to remediate poorly prepared students, and to enhance socialization, all with the goal of reducing attrition rates (Jessup-Anger, 2011; Mamrick, 2005; Stassen, 2000). In Canada, there are also a variety of types of first-year seminars. For example, seminars might be offered to majors in a specific discipline (University of British Columbia, 2016) or a knowledge area such as the social sciences (McMaster University, 2016). Seminars can focus on developing specific skills not well addressed in the traditional first-year curriculum (Brent, 2005). First-year seminars tend to stand outside the formal curricular structures, even while they contribute to the overall learning, often having an impact on student learning that exceeds their small class size and anomalous position in institutions (Bass, 2012).

In the University of Guelph’s First-Year Seminars (FYS), students engage in learning in context, deploying theoretical and applied knowledge, which reinforce each other to promote deep learning (Murray & Summerlee, 2007). The goals and structure of the FYS program provides students with the opportunity to work both in and across disciplines, and in the process, students encounter diverse inter- and multidisciplinary information. There is a focus on cultivation of higher order, transferable skills that enhance students’ ability to communicate in multiple fora and media, foster intellectual autonomy, develop creative problem-solving, and analyze sources from multiple fields of knowledge (Lattuca, Voigt, & Fath, 2004). These skills are gained through participating in a multidisciplinary, high participation, and discussion based atmosphere. Consequently, teaching and learning does not privilege the acquisition of specific or generic skills, or content because they are fundamentally integrated (Bennett, Dunne, & Carré, 1999).

The current research examines the extent to which students who take a single first-year seminar develop the critical capacity to disentangle undifferentiated information and access reliable research resources. Do seminars help students to become more selective in their research, better able to seek out and assess more suitable, relevant, and authoritative sources? In effect, do students who complete a first-year seminar partake in an academic experience that enhances their research abilities and provides the opportunity to develop the critical acumen to

navigate the seemingly endless information that confronts them? According to the American Library Association (2000), these are the fundamental characteristics of information literacy. The current project, then, compares the research resources students report using at the beginning of the semester with those they use at the end, to examine how their research activities change over the duration of a single, one-semester seminar course.

### **First-Year Seminar Program at University of Guelph**

The First-Year Seminar program was developed to provide a balance to the large first-year courses found across the institution. The program was implemented at the university level in 2004 with the deliberate goal of providing students from across campus with access to a small, intensive, multidisciplinary experience. Seminars are capped at 18 students without exception and a total of approximately 40-45 seminars are offered annually in each of the fall and winter semesters. By design, seminars do not articulate with any degree program or discipline. They are not prerequisites for advanced study but rather serve as electives for every program. Seminars earn the same 0.5 credit as every other first-year course. In short, any student is eligible to enrol in any seminar that captures his or her interest. Registration is first-come, first-served with staggered opening of spaces across the registration period to ensure equitable access. There is a less than 3% attrition rate for the First-Year Seminar Program, from which it is possible to construe that there is considerable student satisfaction and the program meets their expectations and learning goals. Indeed, first-year seminars would appear to address the disjunction that separates first-year students' experience and the perceptions of their instructors (Mancuso, Desmarais, Parkinson, & Pettigrew, 2010).

Seminars are taught primarily by full-time faculty members, with the addition of the occasional faculty librarian (as instructor not consultant), members of the senior administration, and academic professional staff with doctoral degrees. Annually, two doctoral candidates receive a special fellowship to offer a seminar. An advisory committee assesses all seminar proposals to ensure every course meets the program's goals of being interdisciplinary, relevant, and intriguing. There is tremendous flexibility and breadth in the specific topics as well as in a seminar's structure and pedagogy. Seminars have included community-engaged learning, problem-based, or project-based learning. They have included field trips or field work. Students have designed public events, engaged with various communities from at risk youth to high school students to social service agencies. Some seminars rarely use their classroom, while others have their focus centred on a seminar table or computer screen. There is no requirement except that students have the opportunity to develop critical thinking and analysis, some form(s) of research skills (from observing animal behaviour to interviews to more traditional scholarly research, and presentation skills (which have included making electronic presentations, designing public displays, or producing radio documentaries). Instructors who are not familiar with nontraditional pedagogies have the opportunity to brainstorm with a mentor. For all the individual autonomy that instructors enjoy, and for all the incredible diversity of seminar topics and perspectives, there is a unity and coherence to the program that is recognized and appreciated by faculty and students alike. It can, however, prove unsettling to outside observers given there are no unifying themes, pedagogies, or learning objectives.

## **Method**

This study was approved by the university's Research Ethics Board and conducted over three academic years: 2011-2012, 2012-2013, and 2013-2014. Each academic year is comprised of a Fall (September to December) and Winter (January to April) semester. Consequently, this research is based on data from six distinct semesters or "student cohorts" of the FYS program. Seminars deliberately do not articulate with disciplines or degree programs. There are no prerequisites, academic exclusions, or other gate keeping criteria, such as grades upon admission to the university. In the first class meeting, prior to any instruction or introductions, instructors requested that students complete a questionnaire. All questionnaires used a paper and pen format and were submitted anonymously. An identical questionnaire was administered on the last class day of the semester in the same manner. All sets of questionnaires were unavailable to the instructors and were stored in sealed envelopes until the end of the academic year.

The questionnaire focused on "research resources," comprising 13 diverse sources of information (see the Appendix). These items were developed to parallel items from a previous FYS study (Summerlee & Murray, 2010). The different types of research resources investigated could be grouped into human sources, scholarly sources, printed sources, and electronic sources. In each category, there were resources of greater and lesser authority. The different types of sources appeared randomly on the survey rather than being grouped together. Students were asked to indicate how frequently they consulted each resource on a 5-point Likert scale, which ranged from "Always (a resource you consult whenever you need to do research, perhaps as the starting point)" to "Never (a resource which you have never consulted and perhaps do not know)." Completed questionnaires were collected and data were manually entered and verified by a research assistant. Any blank or indeterminate responses were coded as missing.

## **Data Analysis**

The data were imported into and analyzed with StataSE version 13.1 software. Descriptive statistics (count, frequency, mean, and median) were prepared for four time-points within a first-year experience: (1) September (start of the first semester of study, pre-seminar questionnaires); (2) December (end of the first semester of study, post-seminar questionnaires); (3) January (start of the second semester of study, pre-seminar questionnaires); and (4) April (end of second semester of study, post-seminar questionnaire). Since questionnaires were anonymous data could not be individually linked across survey time-points. Therefore, we used multilevel mixed-effects linear regression analysis, controlling for academic year, with seminar included as a grouping variable to account for the relationship between students within a seminar group (Dohoo, Martin, & Stryhn, 2012). A p-value of less than 0.05 was considered statistically significant.

Four sets of comparisons were made: (1) differences between Semester 1 pre- and post-questionnaires, (2) differences between Semester 2 pre- and post-questionnaires, (3) differences between pre-seminar questionnaires for Semester 1 and Semester 2, and (4) differences between Semester 1 post-questionnaire and Semester 2 pre-questionnaire. The first and second set of comparisons provides an indication of how research resource use changed within a given semester while participating in a first-year seminar. The third set of comparisons, which examine pre-seminar questionnaires exclusively, and thus does not reflect the completion of a first-year seminar itself, provides a background understanding of the change in research resource use for

first-year students upon entry into the university system (September), and after the completion of a single semester of study (January). The final set of comparisons examines students' research resource use after one semester of first-year studies, comparing those students who have completed a first-year seminar (December post-Semester 1 questionnaires) with another group of students who have enrolled in, but have not yet started, their First-Year Seminar (January pre-Semester 2 questionnaires). This comparison provides stronger evidence pertaining to the effect of participation in a first-year seminar on students' use of research resources compared with group 1 and 2 comparisons, which examine differences within the context of first-year transitions.

## Results

A total of 2,576 questionnaires were collected from students in one of 102 first-year seminars offered over three academic years (six semesters of unique student cohorts). The number of questionnaires completed in each academic year, semester, and time of survey are presented in Table 1. There was no significant difference in the response rate by semester and time.

Table 1

*Number of Participants by Academic Year, Semester, and Time of Survey.*

	Semester 1 (Fall)				Semester 2 (Winter)			
	Pre-Seminar		Post-Seminar		Pre-Seminar		Post-Seminar	
	n	%	n	%	n	%	n	%
Year 1	220	36.0	190	36.0	213	29.6	254	35.4
Year 2	220	36.0	186	35.2	246	34.2	210	29.3
Year 3	171	28.0	152	28.8	260	36.2	254	35.4
Total	611	100.0	528	100.0	719	100.0	718	100.0

Note. % indicates the proportion of responses within a semester and time of survey across multiple academic years.

Students self-rated their frequency of use from one (never) to five (always) for thirteen different types of research resources. Students' average rankings at the start and end of each semester are presented in Table 2. The students' average ratings across all resources consulted increased within each semester (2.85 to 3.04 for fall and 2.93 to 3.11 for winter). There was also an increase in the pre-semester results from semester 1 to semester 2 (2.85 to 2.93) indicating some increase as a result of the natural maturation process of first-year. Table 2 presents the statistical results assessing changes within each semester (comparison set 1 and 2 as per methods). After completing a first-year seminar, regardless of semester, students reported significant decline in the use of Internet search engines and significant increase in the frequency of use of library search engines, journal articles, government statistics, databases, specialized encyclopedias, and research institute websites. Regardless of semester, there was no significant change in the frequency students used general encyclopedias or a reference librarian.

The third set of comparisons investigated the difference in students' use of research resources at the start of each semester, prior to any first-year seminar instruction. This provides some evidence of the natural transition and maturation process experienced by first-year students. Compared with September, in January students reported less frequent use of internet search engines, general encyclopedias, a professor or teaching assistant, a reference librarian and

research institute websites, and reported more frequent use of library search engines, journal articles, subject or course guides, and specialized encyclopedias. There were no differences in the frequency of use of friends and fellow students, government statistics and documents, databases, or Wikipedia.

The final set of comparisons was between students who just completed a first-year seminar (post-semester 1 in December) and those who were just about to begin their first-year seminar (pre-semester 2 in January). Figure 1 shows the significantly lower use of lower quality sources and significantly higher use of higher quality sources for students who completed a first-year seminar. Compared with those students who had not yet completed a first-year seminar, those who had completed a first-year seminar reported less frequent use of internet search engines, Wikipedia, and subject or course guides, but reported more frequent use of all other types of research resources with the exception of general encyclopedias and friends and fellow students, for which there was no statistically significant difference. Combining the results from the third and fourth comparison sets, we note the additional benefits provided by completion of a first-year seminar above and beyond the changes observed as part of the natural maturation process of first-year.

### **Discussion**

An examination of over 2,500 questionnaires, from students enrolled in one of over 100 first-year seminars over the course of three academic years at this university shows that students, irrespective of semester of enrollment, report improved and enhanced use of research resources. Indeed, students, irrespective of semester of enrollment, reported using both a greater diversity and higher number of resources in their research. This trend aligned with a temporal change inherent in the first-year transition into university education when examining students at the start of semester one and two prior to any first-year seminar experience. However, most notable was the demonstration that further academic development can be achieved by completion of a first-year seminar above and beyond the natural transition and maturation process experienced in first semester.

When considering intended learning outcomes, at both the institutional and system level (Bass, 2012), first-year seminars provide enhanced learning outcomes in a variety of domains, including components of information literacy and critical thinking. Notably, the shift in resource use relates to the students' initial more exclusive or heavier reliance on Internet search engines such as Google or Yahoo. At the beginning of the academic year, and indeed subsequently, internet search engines are used ubiquitously and almost exclusively. Students who completed a first-year seminar decreased the frequency with which they used internet search engines, and reported a corresponding increase in the use of more scholarly sources such as journal articles, government reports and statistics, databases, and specialized encyclopedias. It should be noted that, despite shifts in the use of research resources, Internet search engines remained the most popular resource at each step of data collection. We would not necessarily expect students to decrease or abandon this modality because they may be a natural starting point to commence research. They also provide access to unique information sources such as blogs, testimonials, and videos. It was an increasingly complex mix of resources used over time, and as a result of first-year seminar experience, that was most encouraging. Judd and Kennedy (2011) demonstrate the downstream implications of not intervening at an early stage. They examined the information literacy skills of medical students, who were shown to be highly reliant upon, and sub-optimally used, Google and Wikipedia, despite awareness that these are in fact poor sources. Moreover,

Table 2

*Students' Mean Self-Rated Frequency of Using Different Research Resources by Semester and Time of Survey, Including Changes within Semester.*

	Semester 1 (Fall)				Semester 2 (Winter)				Pre-Semester 1 vs. Pre-Semester 2		Post-Semester 1 vs. Pre-Semester 2	
	Pre-	Post-	p	<sup>1</sup>	Pre-	Post-	p	<sup>1</sup>	p	<sup>2</sup>	p	<sup>2</sup>
Internet search engines	4.61	4.12	***	-	4.39	4.24	*	-	***	-	***	-
General encyclopedias	2.81	2.76		=	2.64	2.75		=	**	-		=
Professor or teaching assistant	3.22	3.22		=	2.93	3.18	***	+	***	-	***	+
Library search engine	1.35	2.35	***	+	2.00	2.64	***	+	***	+	**	+
Journal articles	2.79	3.89	***	+	3.69	4.16	***	+	***	+	*	+
Subject or course guides	3.36	3.54	**	+	3.78	3.83		=	***	+	**	-
Government statistics and reports	2.93	3.25	***	+	2.93	3.38	***	+		=	***	+
Friends and fellow students	3.32	3.18	*	-	3.22	3.19	*	+		=		=
Specialized encyclopedia	2.28	2.65	***	+	2.41	2.76	***	+	*	+	**	+
Databases	1.81	2.36	***	+	1.82	2.27	***	+		=	***	+
Wikipedia	2.99	2.57	***	-	2.84	2.78		=		+	**	-
Reference librarian	2.51	2.41		=	2.23	2.28		=	***	-	*	+
Research institute websites	3.11	3.26	*	+	2.91	3.03	***	+	**	-	***	+
<i>Average overall rating</i>	<i>2.85</i>	<i>3.04</i>			<i>2.93</i>	<i>3.11</i>				-		

*Note.* "Pre-" indicates pre-seminar questionnaires; "post-" indicates post-seminar questionnaires;

<sup>1</sup> Direction of change: "-" indicates decrease, "=" indicates no change, "+" indicates increase;

<sup>2</sup> Direction of change: "-" indicates less, "=" indicates no difference, "+" indicates more;

\* = p<0.05, \*\* = p<0.01, \*\*\* = p<0.001

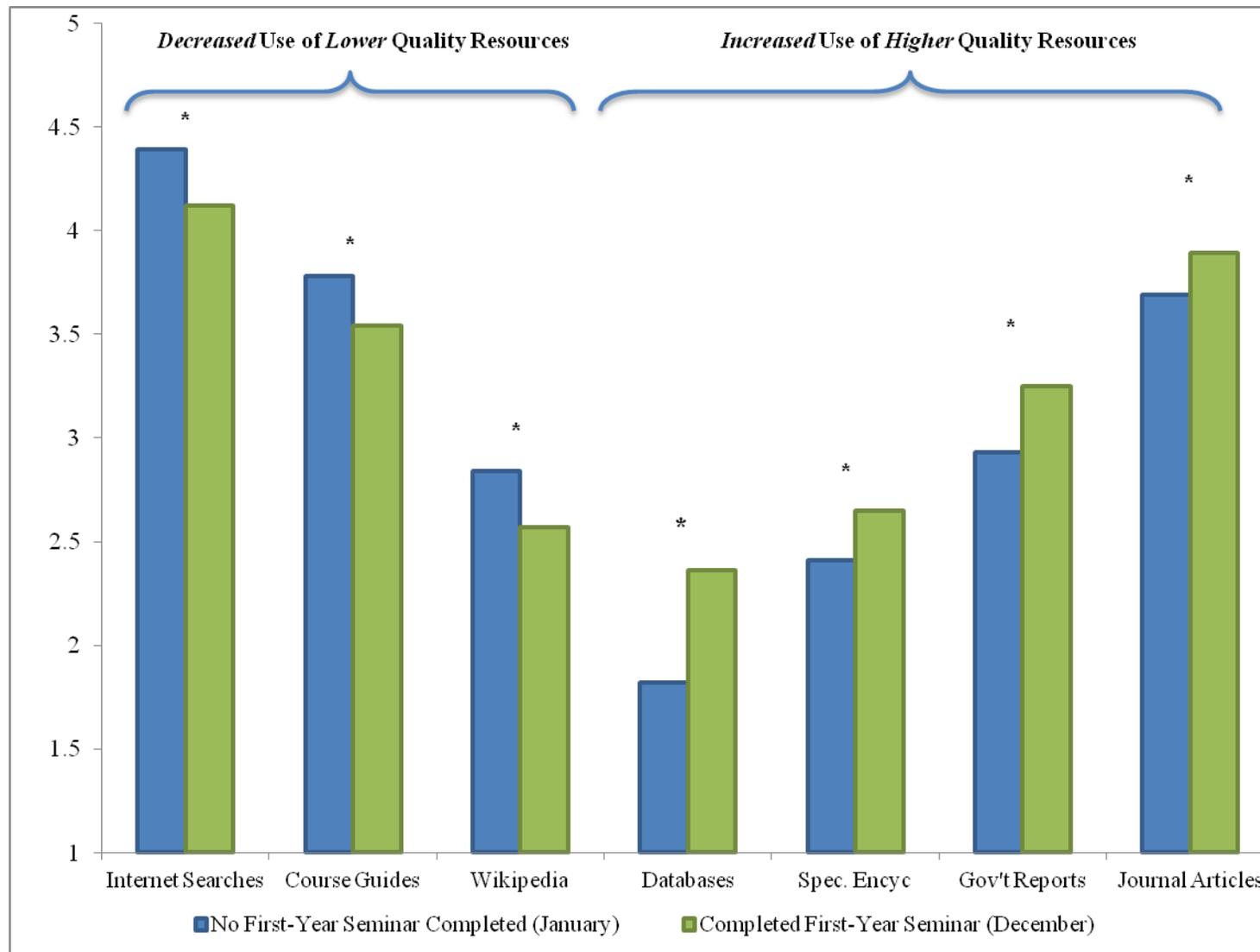


Figure 1. Differences between students' use of lower and higher quality research resources after completion of a first-year seminar (\* indicates statistically significant difference of  $p < 0.05$ ).

medical students also relied on library search engines infrequently; a situation which Judd and Kennedy (2011) explain to be the result of the absence of requisite information-seeking skills. These authors recommend greater emphasis on information literacy training. Perhaps, however, they would be better to take into account the level of research skills, including, for example, the capacity to use Medline, which are developed in first-year seminars at this university.

The University of Guelph's First-Year Seminar program was implemented in order to maximize student motivation to learn. Thus, all seminars focus on topics that are interdisciplinary and engaging and employ active learning pedagogies. As a result, these findings that reveal positive changes in research and the selection of resources, arguably emanate from this forethought and planning. Jessup-Anger (2011) identified three key barriers to students' motivation to learn, each of which is addressed by this university's approach to first-year seminars. First, structural barriers can de-motivate students (e.g., low credit weighting or pass/fail grading); these were explicitly avoided in the University of Guelph's first-year seminars which have credit weighting equal to other first-year courses and final grades similarly reported as a percentage. Second, by offering interdisciplinary, current, intriguing topics, students are able to select a first-year seminar to which they have a personal connection or interest. There are no requirements or prerequisites to take a first-year seminar. Third, all first-year seminars use various active learning pedagogies to ensure that students are motivated and enthusiastic about the opportunity to learn; thus, the pedagogical approach is important. This paper extends the research of Summerlee and Murray (2010) who previously examined enquiry-based learners. Their research demonstrates that participation in any active learning first-year seminar fosters, to varying degrees, more sophisticated use of research resources, compared with students who did not take a first-year seminar. Collectively, first-year seminars can be integrated across the curriculum to break down students' perceived barriers to learning, and, as we have demonstrated, are effective at fostering improved use of higher quality research resources.

Another key finding of our research is that there was a differential in terms of learning for first-year students, based on whether a first-year seminar was taken in the first semester or not. Students who took a seminar in the first semester reported using higher quality research resources than students who had completed first semester, but had not yet taken a first-year seminar. Consequently, improvement for first-year students at the end of semester one attributable to the normal maturation process did not explain the unique improvements experienced by those students who completed a first-year seminar as part of semester one. This is demonstrated by the significant differences seen among FYS students post-seminar in the first semester compared with semester two FYS students pre-seminar (see Figure 2). Overall, students who had completed a FYS in semester one reported more frequent use of a variety of research resources, particularly among higher quality research resources, when compared with those students who had completed their first semester without a first-year seminar. Kolb, Jenest, and Jensen (2013) documented a related pattern in the benefit to higher-order writing skills among first-semester college students who participated in a first-year seminar. At the University of British Columbia, a first-year science seminar was able to increase students' writing and argumentation skills (Birol, Han, Welsh, & Fox, 2013).

Much of the literature that argues for the value of first-year seminars in higher education positions first-year seminars as interventions within universities and colleges, related to outcomes such as student retention and persistence (Porter & Swing, 2006; Schnell & Doetkott, 2003) instead of engaging students with new ways of learning, with multi- or inter-disciplinary ways of knowing, or transferrable research skills. Our research demonstrates the value-added

enrichment effect of participation in a single interdisciplinary first-year seminar. Although all students benefit from first-year seminars, they hold significant potential for students who are differently prepared for university (Hansen & Stephens, 2000). Consequently, they provide students with the opportunity to “catch-up” academically and increase their learning skills over those developed in conventional lectures. This is the clear implication of the findings that enhanced research skills were not the result of the normal maturation process of the first semester. Thus, we can hypothesize that if more students had access to the learning experiences provided by first-year seminars throughout their undergraduate programs or even instead of some large conventional classes, there would be significantly enhanced learning outcomes.

## **Limitations**

Data for this research was collected from students in over one hundred different seminars offered across three academic years. All data were collected from students who self-selected to enroll in a first-year seminar, and may not be generalized to the overall first-year student population, which may include students who purposively avoided these intensive, active learning experiences. However, all first-year students in any program at the university were eligible to participate in the First-Year Seminar Program, and, indeed, were drawn from all degrees and majors. This study relied on students’ self-reported practices. Although this may have impacted the data and survey results, nevertheless, there is considerable research that underscores the reliability of students’ self-reported responses to questionnaires and surveys (Douglass, Thomson, & Zhao, 2012; Pike, 2011). The potential impact of socially desirable reporting was mitigated through the use of anonymous questionnaires. However, this approach precludes any ability to conduct sub-analyses by individual-level factors of potential interest, such as gender, grades, or program of study. Finally, using a paper and pen format directly within the classroom setting also increased student participation.

## **Future Research**

It is important that future research explore the process through which these first-year seminars resulted in more beneficial use of research resources, perhaps using qualitative methodology. Future analyses should investigate the differences in the kinds and magnitude of difference as a consequence of pedagogy, as suggested by Barton and Donahue (2009). It would also be worthwhile to compare these interdisciplinary seminars with discipline-based seminars. The interdisciplinary nature of these first-year seminars permits students the intellectual scope in which to develop an appreciation of multiple perspectives on an issue and to become comfortable with a variety of epistemologies (Murray, 2016). These varied competencies, which are developed in individual seminars, provide enhanced learning opportunities and outcomes that are applicable and transferable to other courses and contexts in a way that might not be replicated in discipline-based seminars. Moreover, there are significant possibilities for identifying personal and social learning outcomes from these seminars: for example, to determine the extent to which students develop enduring social relationships, become engaged in voluntary activities, or seek out opportunities for international experiences, either academic or voluntary. Such research would build upon the earlier longitudinal work of Summerlee and Murray (2010) that demonstrated sustained and improved long-term outcomes, and would help us to better understand the multivalent and enduring effects of participating in a first-year seminar.

## Conclusion

Students' completion of a First-Year Seminar at this university led them to consult a greater diversity and higher quality of research resources. The improved results are not solely attributable to the normal transition and maturation process experienced by all students in their first semester. The results of this research articulate with earlier studies and are supported by both qualitative and quantitative evidence (Murray & Summerlee, 2007; Summerlee & Murray, 2010). Thus, interdisciplinary first-year seminars, which focus on critical thinking and analysis, research, and presentation skills, and which incorporate opportunities for active learning and student engagement, contribute to enhanced student learning. In particular, students themselves develop a self-conscious and reflective approach to their use of research resources, a habit that bodes well for their ongoing need to distinguish and critically analyze sources, especially the uninflected content that continues to dominate the labyrinthine Internet.

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## Appendix

### Survey Tool

Please indicate how frequently you consult the following research materials when you prepare an essay or other type of assignment. The scale ranges from *Always* (a resource you consult whenever you need to do research, perhaps as the starting point), *Frequently* (a resource you usually consult), *Sometimes* (a resource you occasionally find useful), *Rarely*, or *Never* (a resource which you have never consulted and perhaps do not know).

	<i>Mark Only One Box for Each Statement</i>				
	<i>Never</i>	<i>Rarely</i>	<i>Occasionally</i>	<i>Regularly</i>	<i>Always</i>
Internet search engines such as Google, Yahoo, Webcrawler	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
General encyclopedias such as The Encyclopedia Britannica	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Professor, teaching assistant	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Library search engine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Articles in scholarly journals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Subject & course guides	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Collections of statistics & other government documents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Friends, fellow students	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Specialized encyclopedias such as the Encyclopedia of Psychology, Encyclopedia of Environmental Microbiology, Encyclopedia of Religion, Communication and Media	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Databases such as Medline, International Medieval Bibliography, Factiva	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wikipedia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reference librarian	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Specialized websites of research institutes, professional associations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>