

The Effect of Information Literacy Training on Graduate Students' Ability to Use Library Resources

Shuzhen Zhao, Rong Luo, Christine Sabina, and Karen Pillon

This study assessed the influence of information literacy training on graduate students' self-rated ability to search using academic databases and the internet to find information, as well as their objective information literacy skills through a survey in 2017 at the University of Windsor. After controlling for a comprehensive set of covariates, there was not a statistically significant difference in self-rated searching ability between students with training and those without any training. However, the trained students' average objective assessment scores in the five dimensions of information literacy were significantly higher than those of students without any training at the significant level $\alpha=0.05$.

Introduction

Over the past few decades, the methods and effects of information literacy training have become a primary focus for academic librarians and other educators in the field of information literacy. Information literacy training aims to help students improve their research skills, particularly in the context of library sources and strategies. The focus on information literacy instruction in library literature and practice indicates a growing interest in improving teaching methods so that students can more effectively learn the academic skills they need. In keeping with the trend of information literacy training in academic libraries, the Association of College and Research Libraries (ACRL) released their "Framework for Information Literacy for Higher Education" in 2015,¹ which provides a useful and adaptable guide for librarians developing information literacy training using different methods and in a variety of disciplinary fields.²

Information literacy training can take many different forms depending on the library, the librarian, and the wider educational and institutional environment. Often, information literacy training methods must align with institutional context, faculty members' requests, and students' needs. Primary information literacy training methods include library orientation activities (exhibition booths, library tours, scavenger hunts), library instruction sessions in classrooms

* Shuzhen Zhao is Librarian and Head of the Acquisition and Bibliographic Services Department at The University of Windsor, Canada, email: zhaoszf@uwindsor.ca; Rong Luo is Statistical Consultant and Learning Specialist at The University of Windsor, Canada, email: rluo@uwindsor.ca; Christine Sabina is Public Service Librarian at Windsor Public Library, Canada, email: csabina@windsorpubliclibrary.com; and Karen Pillon is Associate University Librarian at The University of Windsor, Canada, email: karen@uwindsor.ca. ©2023 Shuzhen Zhao, Rong Luo, Christine Sabina, and Karen Pillon, Attribution-NonCommercial (<https://creativecommons.org/licenses/by-nc/4.0/>) CC BY-NC.

(usually providing an introduction to library research, databases, and information literacy concepts), and one-on-one intensive instruction with a librarian (often about a specific assignment or issues like citation and copyright).

However, information literacy instruction efforts are only useful if they are effective. Does information literacy training actually teach students the skills they need? Through assessment, academic librarians can demonstrate how information literacy training contributes to student learning and development. Consequently, the study of training assessment results has been an important concept motivating academic libraries to provide widespread and efficient training to students. To leverage the full power of assessment, librarians need to adopt conceptual frameworks of assessment that will enable them to facilitate learning, increase instructional quality, and answer calls for accountability. One such framework is the 2005 Beile Test of Information Literacy for Education (B-TILED).³ The survey's questions capture demographic information, measure self-rated ability for searching databases and the internet, and assess participants' information literacy skills and knowledge.

While librarians might assume that information literacy training is working, this is not enough. It is important for librarians to more closely investigate the relationship between information literacy training and skills through quantitative research. Understanding the impact of training is essential if librarians and other educators wish to improve their information literacy training methods and help students. The purpose of this study is to explore the relationship between information literacy training and information literacy skill. Using a modified version of the B-TILED questionnaire, this study measured the information literacy skills and self-perceived research ability of graduate students studying in the Faculty of Arts, Humanities, and Social Sciences (FAHSS) at the University of Windsor. The aim of this study is to examine students' self-perception of information literacy skills and objective assessment of information literacy skills and to identify the effect of information literacy training. Given these objectives, our research questions are:

1. How do students perceive their ability to search library databases and the internet to find the information they need?
2. Is there any gap in information literacy skills as assessed through knowledge test questions between students with training and those without training?

The first research question seeks to determine students' subjective assessments of their research skills. The second research question objectively examines five dimensions of information literacy: search strategy skills, knowledge of electronic resources, knowledge of academic databases, citation, and ethical considerations and copyright.

Literature Review

Methods of Information Literacy Training

Information literacy training is present in almost all academic libraries, but the specifics can vary widely. One type of information literacy training common at colleges and universities is library orientation. Library orientation events usually aim to acquaint students (especially new students) with the library and librarians. They are meant to ease library anxiety and familiarize students with information literacy and how the library fits within university life.⁴ Library orientation activities can take a variety of forms. At the University of California, the library orientation section of a first-year class included a brief in-class presentation about research concepts and library services, an online interactive library scavenger hunt given as an

in-class activity, and a homework assignment.⁵ According to Manuwa, Agboola, and Aduku, library orientation is a core activity of academic libraries that “entails educating, enlightening, guiding and helping the users to identify, understand and utilize the library information resources and services effectively.”⁶ Library orientation activities can thus serve as an important introduction to academic library services.

Classroom training, one of the main methods for information literacy training in academic libraries, involves librarians visiting classes on campus to teach students about library resources and research skills. While library orientation is about familiarizing students with librarians, library services, and the library as place, information literacy training in the classroom can go beyond introductory lessons to offer something more. The “service learning” information literacy training model described by Young and Maley “presents opportunities for deeper library engagement in the curriculum and the teaching of critical information literacy.”⁷ Instructional design and pedagogical approach can vary widely. The information literacy training described by librarians at the University of California, Berkeley incorporated a “flipped instruction model” that utilized “pre-class assignments” and “active learning techniques” for students at both the undergraduate and graduate level.⁸ The researchers found this model to be successful in increasing student engagement and allowing more class time for “higher-order learning exercises and discussions.”⁹ The training described by Whitver and Riesen was focused around “reiterative reflection” as a pedagogical approach to library instruction.¹⁰ The librarians at the University of Colorado, Colorado Springs decided to tailor information literacy lesson content to their students’ needs by assessing students’ ability to use ProQuest’s Summon to see if students would need training and altered instruction plans accordingly.¹¹

Information literacy training can also take the form of one-on-one instruction with a librarian. One survey of academic librarians found that one-on-one instruction was the most common method for information literacy training.¹² Individual information literacy training has unique benefits not shared by the other methods of instruction. In group information literacy training, for example, academic librarians have reported challenges in trying to motivate and engage all students.¹³ Koelling and Townsend found that one-on-one information literacy training at the University of Mexico was successful, with “students and librarians reporting high levels of satisfaction.”¹⁴

Students' Attendance at Information Literacy Training

Students cannot benefit from information literacy training if they do not attend. A survey of PhD students found that attendance at library training sessions was high but that among students who did not attend, there was “the perception of not needing further training, an unawareness of library-facilitated training and reliance on their supervisor’s help.”¹⁵ Zhang, Goodman, and Xie found that attendance of first-year engineering students at in-person information literacy training sessions was low.¹⁶ Low attendance could be attributed to timing issues as well as students’ unfamiliarity with the sessions and lack of awareness of their value.¹⁷ Attending information literacy training can have benefits beyond improving research skills; Blake et al. found that attendance at library training sessions was associated with student retention.¹⁸

Assessment of Information Literacy

Assessing information literacy has increasingly become an area of focus in academic librarianship, both in the literature and in practice. Assessment of information literacy training provides

insight into students' skills and the impact of instruction that is valuable to both students and instructors; assessment also provides evidence of the value of information literacy training to the institution and other stakeholders.¹⁹ Assessment can take a variety of forms. Erlinger's systematic review of assessment in information literacy instruction found that assessment could fall into one of seven categories: "surveys, focus groups, objective tests (locally developed), classroom assessment techniques (CATs)/performance measures, authentic assessment, rubrics, and standardized tests."²⁰ Assessment methods might be standardized or developed by the researchers, and their results might be objectively or subjectively determined.

Self-assessment of information literacy skills is a subjective method of assessment that seeks to determine students' perceptions of their abilities. However, studies have shown that students are not always accurate in assessing their research skills. Geffert and Christensen examined the information literacy skills of incoming college students and found "no significant correlation ...between students' test scores and their levels of self-confidence, comfort in libraries, or self-assessment of library skills."²¹ The results of Maughan's survey at the University of California, Berkeley library show "that students think they know more about accessing information and conducting library research than they are able to demonstrate when put to the test."²² Similarly, Gross and Latham found that "students who score as below proficient in information literacy (IL) skills have a miscalibrated self-view of their ability."²³

Since, as these studies suggest, self-assessments of information literacy skills are not always accurate, it is important for information literacy skills to be assessed objectively. One common method of assessing information literacy is using "pre-tests" and "post-tests." Librarians and researchers using this method will administer one test before and one test after information literacy training; often, the test is identical. Pre-tests and post-tests are usually designed by the researchers (that is, not standardized) and are often used to determine the effect of information literacy training or to prove its value. This method can be used for "one-shot" library instruction or for longer information literacy programs. Studies using the pre-test and post-test method appear frequently in the literature. Zhang, Goodman, and Xie designed and used a pre-test and post-test method to assess the information literacy skills of first-year engineering students at the University of Western Ontario.²⁴ McClurg et al. used a pre-test and post-test to assess the effects of information literacy training in an undergraduate medical education program at the University of Calgary.²⁵ The University of Rhode Island Libraries have used a pre-test and post-test method of assessing information literacy skills for years.²⁶ Numerous other studies describe pre-tests and post-tests used to assess information literacy instruction.²⁷

There can be other types of objective information literacy assessment beyond the pre-test and post-test model. Erlinger found that the most common type of information literacy assessment was "CATs [classroom assessment techniques]/performance measures,"²⁸ a type of in-class assessment that allows for instant evaluation and feedback²⁹ and commonly uses in-class worksheets.³⁰ Spievak and Hayes-Bonahan used "psychological decision-making theory and research design" in their assessment of undergraduates' information literacy skills by asking volunteer study participants to evaluate web pages and Google searches.³¹ Standardized testing is another method for objective assessment that uses an already-developed instrument instead of newly designing an evaluation tool. The Standardized Assessment of Information Literacy Skills (SAILS) assesses information literacy skills based on the ACRL Information Literacy Competency Standards for Higher Education.³² The Information Literacy Test (ILT) is another standardized test for assessing information literacy that is also based on the ACRL

Information Literacy Competency Standards for Higher Education.³³ This study uses a modified version of the Beile Test of Information Literacy for Education (B-TILED), an instrument originally designed for evaluating the information literacy skills of education students,³⁴ as a means of objectively assessing participants' information literacy skills.

Effectiveness of Information Literacy Training

The literature indicates that academic libraries put a lot of effort into developing and providing information literacy training, but is this training effective in improving students' skills? In general, the findings of most studies indicate support for the effectiveness of training in improving information literacy and library skills. However, different studies report varying levels of efficacy depending on factors such as training method, instructional design, lesson content, and student population. Burkhardt examined the information literacy skills of over 1,000 undergraduate students who took an information literacy credit course, analyzed students' pre-course and post-course test scores, and found that their scores improved "significantly" in the post-test.³⁵ Similarly, McClurg et al. found that students' information literacy skills improved after multiple short, small group library instruction sessions that were integrated into an undergraduate medical course,³⁶ and Beile also found that students' library skills improved after information literacy training that was integrated with a course.³⁷ Zhang, Goodman, and Xie studied the effects of online and in-person information literacy training on the skills of undergraduate students and found that the training improved information literacy levels.³⁸ Walker and Pearce found an improvement in students' information literacy skills after they had received both user-centered and traditional library instruction,³⁹ even though both types were of the "one-shot" variety. Spievak and Hayes-Bonahan also found "one-shot" library instruction to be effective in improving students' information literacy skills and library use.⁴⁰ Even online information literacy training has been shown to be effective.⁴¹ While the literature differs on the effectiveness of different training methods, overall, information literacy training in some form helps improve students' skills.

Current developments in the literature have emphasized the important role of information literacy training and assessment of information literacy outcomes. This study will contribute to the literature in these areas through an examination of the effect of information literacy training on the information literacy skills of graduate students studying in the areas of arts, humanities, and social sciences. While there are many studies about information literacy training effectiveness and assessment, this study is particularly valuable for its use of quantitative data analysis to confirm the influence of training on information literacy skills and for its examination of the unique relationship between objective information literacy skills, self-assessed information literacy skills, and information literacy training. The use of a standardized instrument (the B-TILED questionnaire) for assessing information literacy skills is also notable.

Methodology

Survey Instrument

Participants' information literacy skills were assessed using an online survey that was developed from the Beile Test of Information Literacy for Education (B-TILED),⁴² a survey instrument that was developed by Beile O'Neil and is used to assess information literacy skills.⁴³ The B-TILED survey has been applied by Robertson and Felicilda-Reynaldo,⁴⁴ Magliaro and Munro,⁴⁵ and

Soltani and Nikou⁴⁶ in their information literacy studies. While the original B-TILED instrument was used for undergraduate students, Magliaro (2011),⁴⁷ Magliaro and Munro,⁴⁸ and Soltani and Nikou⁴⁹ have used a modified version in assessing the information literacy skills of graduate students, demonstrating the success and applicability of the B-TILED for a graduate student population. Since the original B-TILED questionnaire was intended for education students, the modified version used in this study was customized to better align with the academic disciplines of the participants. For instance, the name of the database ERIC (a popular database for education research) was changed to JSTOR (a database for research in arts, humanities, and social sciences). Another way in which the B-TILED questionnaire used in this study differed from the original instrument was the reflection of a Canadian rather than American context. In addition to demographic information questions, survey questions 11 and 12 were used for subjective assessment by asking students to rate their own research abilities, and questions 13 to 36 objectively assessed students' information literacy skills using the modified B-TILED questionnaire.

Data Collection

All University of Windsor graduate students studying in the Faculty of Arts, Humanities, and Social Sciences (FAHSS) were sent an invitation to complete the survey via email. The next day, student responses started arriving. A week after the initial email, a second reminder email was sent out to all students. At this point, there were only 46 responses out of a potential 626 responses (7.8%). In an effort to increase response rate, the researcher visited classrooms, arranged for more departmental emails to be sent out, and asked instructors to encourage participation. The survey opened for eight weeks (from January 19 to March 16, 2017), allowing enough time for students to access the survey. After these efforts, the response rate increased to 23.18%,⁵⁰ or 137 participants.⁵¹ The researcher also offered a prize incentive to encourage study participation by entering participants' names in a draw to win a bookstore gift card.

Participants spent an average of thirty to forty minutes answering the survey questions. Survey responses were labelled as either "complete" or "incomplete." In both categories, some of the responses were weighted as lower scores. If, for instance, a student answered fewer than ten survey questions and spent fewer than six minutes completing the survey, the response was counted as valid but weighted lower. There were fourteen blank surveys in the "incomplete" category that were deemed invalid. Out of all 137 responses, eighty five were "complete" (which included one empty response), fifty two were "incomplete" (which included fourteen empty responses), and nine were weighted lower. There were 122 valid responses in total. Since the total number of registered FAHSS graduate students in the University was 591, the response rate was 23.18%, which is reasonable based on previous studies.⁵²

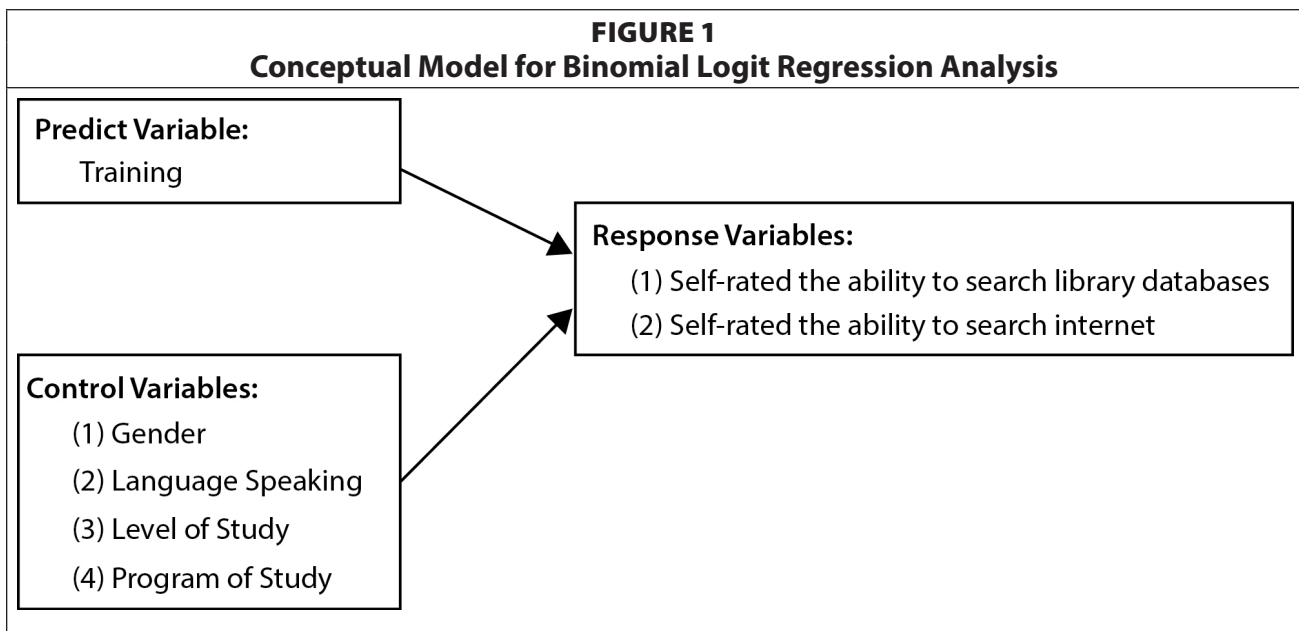
Statistical Analysis

Predictors

The main area of interest in this study is the effect of information literacy training on information literacy skills. The survey included three questions about respondents' training information: "Have you attended an orientation of the library?" "Have you attended a library instruction session held in your classroom?" and "Have you had one-on-one intensive organized instruction with a librarian?" The responses for these questions were in binary form (Yes=1; No=0). Based on these, we created a binomial variable of training that equalled 1 if respondents reported they received either kind of training.

Outcomes

Inasmuch as this study seeks to answer the two specific research questions in the introductory section, we studied several distinctive outcome variables. The first research question is about the effect of training on perceived ability to search library databases and the internet to find information. The survey included the questions "Overall, how would you rate your ability to search library databases to find information?" and "Overall, how would you rate your ability to search the internet to find information?" to collect students' self-perceptive information literacy abilities. The answers to this question were "1. Poor; 2. Below average; 3. Average; 4. Above average; 5. Excellent." For these two self-rated searching abilities, we created two corresponding binomial variables that equalled one if respondents reported they were above average or excellent separately. We estimated binomial logit regression in which we regressed probability of being above average or excellent on training and a comprehensive set of covariates that may potentially explain the perceived searching ability, namely, individuals' gender, native language, level of study, or program of study. The estimation was conducted separately for the ability to search library databases and the internet. Figure 1 illustrates the conceptual model of this information.



The second research question concerns the effect of training on an objective assessment of five dimensions of information literacy skills: (1) search strategy skills, (2) knowledge of electronic resources; (3) knowledge of academic databases; (4) citation; and (5) ethical considerations and copyright. These five information literacy dimension scores have been rescaled between zero and one as the number of questions correctly answered divided by the total number of questions in each area after evaluating based on the students' responses to knowledge questions in the survey (questions 13 to 36). We estimated linear regression, in which we regressed scores on training as well as demographic variables. Figure 2 illustrates the conceptual model of this information. Sample statistics for predictors, outcomes, and covariates can be found in Table 1.

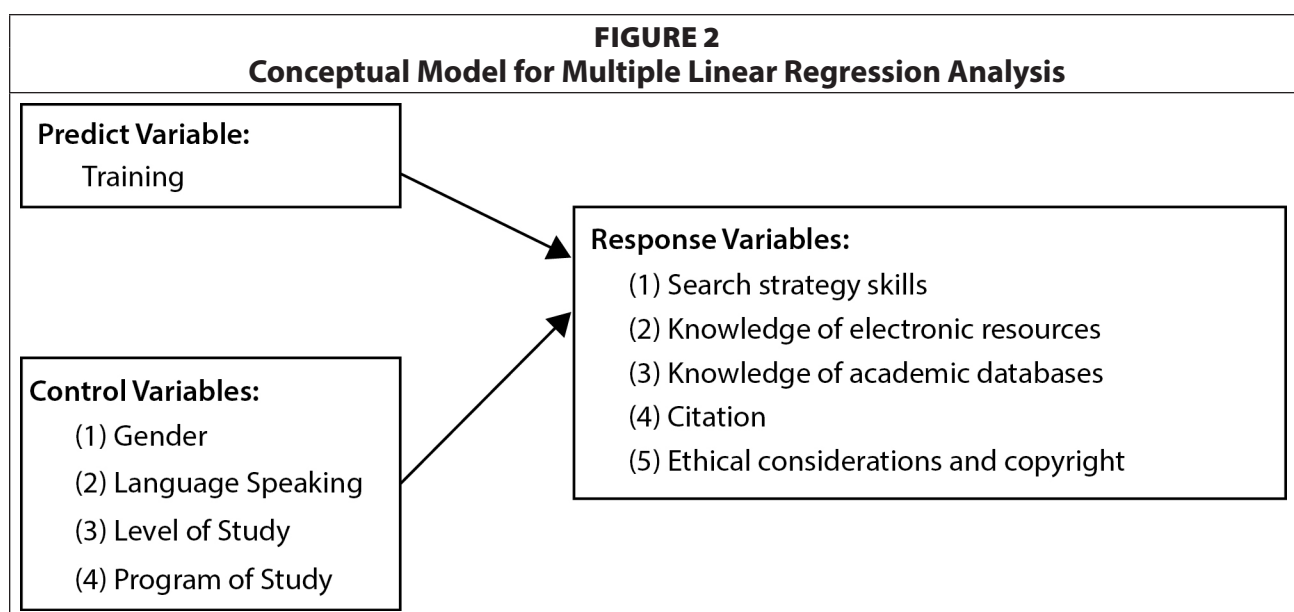


Table 1 shows that 69.67% respondents accepted information training. Approximately three fourth (74.59%) of respondents self-identified as female, 67.21% respondents reported they are native English speakers, and 78.69% of respondents are master's students. These FAHSS graduate students were from various departments, including Communication, Media & Film, Creative Arts, English Language & Literature, History, Philosophy, Political Science, Social Work, and Sociology & Anthropology. Among the respondents, 54.92% assessed their database-searching abilities as above average or excellent, and 68.03% assessed their internet-searching abilities as above average or excellent.

Variable	Description	Mean/ Percentage	SD
Outcome Variable			
Self-Rated Ability in Searching Databases	=1 if respondent reported they were above average or excellent	54.92	
Self-Rated Ability in Searching Internet	=1 if respondent reported they were above average or excellent	68.03	
Search Strategy	Score assessed by responses to survey questions	0.55	0.21
Knowledge of Electronic Resources	Score assessed by responses to survey questions	0.82	0.23
Knowledge of Academic Databases	Score assessed by responses to survey questions	0.5	0.22
Citation	Score assessed by responses to survey questions	0.74	0.24
Ethical Considerations and Copyright	Score assessed by responses to survey questions	0.63	0.26
Predictors			
Training	=1 if respondents reported they attended orientation or in class instruction or one-on-one instruction	69.67	

TABLE 1
Descriptive Statistics

Variable	Description	Mean/ Percentage	SD
Covariates			
Female	=0 male, =1 female	74.59	
Native Language	=1 if respondent's native language is English	67.21	
Level of Study	=0 Master, =1 Doctorate	78.69	
Program of Study			
Communication, Media & Film	=1 if respondent from Communication, Media & Film	5.74	
Creative Arts	=1 if respondent from Creative Arts	4.92	
English Language & Literature	=1 if respondent from English Language & Literature	7.38	
History	=1 if respondent from History	7.38	
Philosophy	=1 if respondent from Philosophy	5.74	
Political Science	=1 if respondent from Political Science	5.74	
Psychology	=1 if respondent from Psychology	26.23	
Social Work	=1 if respondent from Social Work	27.87	
Sociology & Anthropology	=1 if respondent from Sociology & Anthropology	9.02	

Results

Self-Rated Searching Ability

The results of binomial logit regression for the probability of students' self-rated ability being above average or excellent in searching library databases and the internet to find information are reported in table 2. The results are presented in the form of marginal effects. As shown, the effect of training is not significant in all models, which means there is not a statistically significant difference in self-rated searching ability between students with training and those without any training at the significant level $\alpha=0.05$.

Table 2 also indicates that gender, language speaking, and level of study had no significant effect on any students' self-rated searching ability. Only students from the program of Political Science reported better self-rated searching ability than from those from the program of English Language & Literature. There was no significant difference in self-rated searching ability among other programs.

Objective Information Literacy Skills

The results of the effect of information literacy training on search strategy skills, knowledge of electronic resources, ethical consideration and copyright, and overall information literacy skills scores are presented in table 3. Effects of training are significant in all estimations after controlling for a comprehensive set of covariates. The average score of trained students was 0.147 ($p < 0.001$) higher in search strategy skills, 0.171 ($p < 0.001$) higher in knowledge of electronic resources, 0.150 ($p < 0.001$) higher in knowledge of academic database, 0.120 ($p < 0.01$) higher in citation skills, and 0.180 ($p < 0.001$) higher in ethical consideration and copyright than those of students without training at the significant level $\alpha=0.05$.

TABLE 2
Probability to Be Above Average or Excellent (Marginal Effects of Binomial Logit)

	Model 1	Model 2
Variables	Searching Database	Searching Internet
Training Situation		
Without Training (ref.)		
With Training	0.127	0.064
	(0.109)	(0.110)
Gender		
Male (ref.)		
Female	0.027	-0.039
	(0.115)	(0.108)
Language Speaking		
Native English (ref.)		
Non-native English	-0.127	-0.034
	(0.103)	(0.102)
Level of Study		
Master (ref.)		
Doctor	-0.118	-0.074
	(0.131)	(0.123)
Program of Study		
English Language & Literature (ref.)		
Communication, Media & Film	0.228	0.001
	(0.392)	(0.010)
Creative Arts	0.437	0.070
	(0.231)	(0.226)
History	0.364	0.065
	(0.229)	(0.220)
Philosophy	0.001	0.002
	(0.159)	(0.212)
Political Science	0.511*	0.128
	(0.229)	(0.231)
Psychology	0.206	-0.026
	(0.240)	(0.225)
Social Work	0.075	-0.073
	(0.208)	(0.197)
Sociology & Anthropology	0.329	-0.057
	(0.235)	(0.230)
N	120	118

Notes: Robust standard errors are in parentheses.
 Significance *<0.05; **<0.01; ***<0.001
 ref.: Reference category
 N: Total number of observations in the model

As shown in table 3, gender had no significant effect on any students' information literacy skills. Compared with non-native English speakers, native English speakers presented better skills in search strategy, knowledge of electronic resources, knowledge of academic databases, citation, and ethical consideration and copyright capabilities. Doctoral students had better performance in all five dimensions of information literacy skills compared with master's students. Students from different programs had similar levels in information literacy skills.

TABLE 3					
Training Effects on Objective Information Literacy Scores					
(Regression Coefficients Reported)					
Variables	Model 3	Model 4	Model 5	Model 6	Model 7
	Search Strategy Skills	Knowledge of Electronic Resources	Knowledge of Academic Database	Citation Skills	Ethical Consideration and Copyright
Training Situation					
Without Training (ref.)					
With Training	0.147***	0.171***	0.150***	0.120***	0.180 ***
	(0.036)	(0.047)	(0.010)	(0.031)	(0.015)
Gender					
Male (ref.)					
Female	-0.058	-0.090	-0.117	0.142	-0.026
	(0.112)	(0.082)	(0.118)	(0.108)	(0.120)
Language Speaking					
Native English (ref.)					
Non-native English	-0.302**	-0.159*	-0.084*	-0.082*	-0.249*
	(0.101)	(0.074)	(0.042)	(0.043)	(0.102)
Level of Study					
Master (ref.)					
Doctor	0.083*	0.078*	0.074*	0.089*	0.077*
	(0.048)	(0.033)	(0.032)	(0.036)	(0.035)
Program of Study					
English Language & Literature(ref.)					
Communication, Media & Film	-0.052	0.189	0.309	-0.480	0.038
	(0.372)	(0.268)	(0.360)	(0.322)	(0.349)
Creative Arts	0.406	0.240	-0.216	0.280	0.173
	(0.246)	(0.177)	(0.271)	(0.225)	(0.252)
History	0.127	0.236	-0.192	0.406	0.103
	(0.248)	(0.184)	(0.285)	(0.228)	(0.247)
Philosophy	0.484	0.346	-0.497	0.699	0.169
	(0.482)	(0.347)	(0.459)	(0.415)	(0.450)
Political Science	0.082	-0.242	0.078	-0.068	-0.109
	(0.275)	(0.210)	(0.295)	(0.251)	(0.272)
Psychology	0.392	0.229	0.213	0.261	-0.012
	(0.239)	(0.173)	(0.292)	(0.209)	(0.227)

TABLE 3
Training Effects on Objective Information Literacy Scores
(Regression Coefficients Reported)

	Model 3	Model 4	Model 5	Model 6	Model 7
Variables	Search Strategy Skills	Knowledge of Electronic Resources	Knowledge of Academic Database	Citation Skills	Ethical Consideration and Copyright
Social Work	0.267	0.243	-0.038	0.282	0.069
	(0.216)	(0.156)	(0.251)	(0.189)	(0.206)
Sociology & Anthropology	0.177	0.221	-0.152	-0.044	-0.205
	(0.243)	(0.175)	(0.270)	(0.216)	(0.238)
N	109	102	86	93	92
Notes: Regression results reported: coefficients and standard errors in parentheses. Significance *<0.05; **<0.01; ***<0.001 ref.: Reference category N: Total number of observations in the model					

Discussion

The results emphasize the impact of information literacy training on information literacy skills. Students who received information literacy training scored higher in all areas of the objective information literacy skills assessment than students who had not received training. The impact of training attendance on information literacy skills that was found in this study is especially significant because librarians do not always get the chance to witness the effects of information literacy training or assess a training session's impact in a meaningful or detailed way, especially with the "one-shot" sessions that commonly occur at library orientation events or in classrooms. While some librarians and educators do collect feedback or administer assessment activities in some way after single information literacy sessions, it can be difficult to gauge the longer-term effects of one-time library training sessions, especially since follow-up assessment in this context can be challenging.⁵³ However, the results indicate that library training does make a difference in teaching students valuable information literacy and research skills, confirming the findings of previous studies.⁵⁴ While this study did not examine the details of the training that students received beyond the broad categories of library orientation, classroom sessions, and one-on-one instruction, it is likely that most of the training that study participants experienced was some form of "one-shot" information literacy training. The students surveyed were graduate students at the University of Windsor, where information literacy training occurs via individual appointments with liaison librarians, classroom sessions on information literacy and library research conducted by liaison librarians, and library tours and other orientation activities that occur as part of an annual program for incoming first-year students. Students who visit the research help desk in the library will also sometimes receive an impromptu one-on-one information literacy lesson, an interaction that could be viewed as a "microteaching opportunity."⁵⁵ As Walker and Pearce note, "one-shot" training is still very common in academic libraries,⁵⁶ and librarians usually have little choice but to make the best of a one-time session.⁵⁷ Notably, though, since most of the training methods included as part of this study were likely "one-shot" sessions experienced by participants, the findings suggest that the correlation between information literacy training experience and stronger information literacy skills can occur even with "one-shot" library instruction. While "one-shot" instruc-

tion is sometimes criticized in the library world, there are studies that suggest that single session instruction can be effective. Spievak and Hayes-Bohanan found that students who had attended a "one-shot" library instruction session demonstrated "a more complex reasoning strategy when evaluating sources"⁵⁸ and were more likely to ask a librarian for help and to use library tools and services.⁵⁹ Walker and Pearce also found that one-time library instruction improved students' information literacy skills.⁶⁰ While previous studies on the effectiveness of one-time instructional sessions are varied, the findings of the present study support the idea that information literacy training in any form, including single instruction sessions, can have a positive, measurable impact on information literacy skills.

Like information literacy training at many other academic libraries, the training provided by the University of Windsor's Leddy Library varies widely. The amount and content of information literacy training received by study respondents could be inconsistent for a number of reasons. Librarians tend to develop their own training sessions, so the content and nature of instruction would depend on the individual librarian who provides the training. Moreover, the nature of instruction also usually depends on the level of study and the subject area. Streatfield, Allen, and Wilson studied information literacy training for postgraduate and postdoctoral researchers in UK universities and found significant variation and inconsistency in the training provided.⁶¹ Inconsistent information literacy instruction could be detrimental to students if they do not receive training in basic information literacy skills and concepts. However, it makes sense for information literacy training to differ depending on discipline and level of study. In this study, discipline did not appear to have a notable impact on objective information literacy skills, as students from different programs had similar information literacy scores. However, all respondents were studying in the Faculty of Arts, Humanities, and Social Sciences. Assessing and comparing the information literacy levels of students across different faculties and studying in vastly different disciplines may have yielded different results. Level of study could also impact the nature of information literacy training and, in turn, affect information literacy skill level. This study focused on graduate students and found that doctoral students demonstrated higher levels of information literacy skills than master's students. Although this study did not examine the nuances in form and content of information literacy training, future studies might consider how such details as training session content, subject area, and level of study impact the effectiveness of training. Overall, the study results indicate the benefits of information literacy training regardless of format or content, and academic libraries would do well to ensure a minimum level of information literacy training for students.

Another significant finding from this study is the necessity of objective information literacy skills assessment. Even though students without training self-assessed their research skills to be similar to the skills of students who had received training, the objective assessment of information literacy revealed otherwise. Students who had received training objectively had stronger research skills. This suggests that students are not particularly accurate in assessing their information literacy skills, a finding that aligns with previous studies.⁶² Assessment of information literacy instruction has increasingly become a point of interest in library research,⁶³ and this study reiterates the necessity of objective assessment in information literacy research and practice. Streatfield, Allen, and Wilson found very little evaluation of information literacy training in an examination of information literacy instruction practices for UK researchers.⁶⁴ According to Julien, Gross, and Latham, incorporating evaluation is one of the main ways for

librarians to improve their information literacy instruction.⁶⁵ In order to provide useful and effective instruction, librarians must know the information literacy levels of their students and how instruction impacts those levels.

Librarians should continue to focus on information literacy training and ensure that as many students as possible receive information literacy instruction, at least at a basic level. Julien, Gross, and Latham found that librarians have the opportunity to improve their instruction in a variety of ways, such as by developing education objectives and assessing outcomes.⁶⁶ Since information literacy sessions are not always well attended, librarians should focus on strategies for increasing participation, such as expanded advertising and promotion, incentives, and instructor involvement.

There are a few limitations to this study that should be noted. The study is not widely generalizable due to the sample size of only 137 responses. Out of the potential 626 student respondents, only 137 responses were collected. However, 137 was an adequate number for this study's data analysis, and in fact the response rate for this study was higher than the response rate of similar studies.⁶⁷ Moreover, the study only focuses on graduate students studying in the areas of arts, humanities, and social sciences. Undergraduate students' information literacy skills and experiences with information literacy training are likely quite different due to their experience and academic level. Additionally, students studying in fields other than arts, humanities, and social sciences might also have a vastly different experience with information literacy training. Zhang, Goodman, and Xie note that students studying science and engineering require an information literacy skillset that allows them to effectively navigate disciplinary fields that are constantly evolving.⁶⁸ Despite these limitations, this study provides valuable insight into the effect of information literacy training and students' perceptions of their research skills. Future studies might expand on the research in this study by increasing sample size and focusing on groups of students at different levels and in different disciplines.

Conclusion

This study has contributed to the literature in the areas of library training effectiveness and students' self-perceived research skills by offering quantitative evidence on the relationship between training attendance, objective information literacy skills, and students' self-rated search abilities. The main finding of this study is that information literacy training has a positive effect on information literacy skills. Through an objective assessment of information literacy skills, this study found that graduate students who had received information literacy training had stronger information literacy skills in the areas of search strategy, knowledge of electronic resources, knowledge of academic databases, citation, and ethical considerations and copyright. However, this study also found that there was no significant difference between the self-assessed information literacy skill levels of students with training and without training. More than anything else, the findings of this study emphasize the importance of information literacy training for students. By quantitatively demonstrating the effectiveness of information literacy instruction, these findings are useful in confirming the need for a continued focus on information literacy training in academic libraries and across university campuses. Librarians and other information literacy educators can use these findings to inform their teaching practice and keep continuously improving their instruction methods for the benefit of students.

Appendix. Modified Survey Questionnaire Beile Test of Information Literacy for Education (B-TILED)

*The library is gathering information to evaluate the effectiveness of its instruction program.
This questionnaire consists of demographic questions and a library and information skills quiz.*

Demographic Information

1. What is your gender? _____
2. Please indicate which language(s) you normally speak at home: _____
3. Please indicate your level of graduate status
 - a. Master
 - b. Doctorate
4. Please indicate your program of study
 - a. Communication and Social Justice
 - b. Criminology
 - c. Film & Media Arts
 - d. English
 - e. History
 - f. Philosophy
 - g. Political Science
 - h. Psychology
 - i. Social Work
 - j. Sociology
 - k. Visual Arts
5. How long have you been continuously enrolled at University of Windsor as a graduate student?
 - a. One semester or less than 1 year
 - b. 1 to 2 years
 - c. 3 to 4 years
 - d. More than 4 years
6. Have you ever attended another university or college?
 - a. No, I have never attended another university
 - b. Yes, I finished my undergraduate degree at an institution other than the University of Windsor
 - c. Yes, but I transferred to the University of Windsor to finish my undergraduate degree

Knowledge of Library Services

Please indicate whether you have attended any of the following since you began your studies at University of Windsor.

7. Have you attended an orientation of the library?
 - a. Yes
 - b. No
 - c. Not aware of it
8. Have you attended a library instruction session held in your classroom?
 - a. Yes

- b. No
 - c. Not aware of it
9. Have you had one-on-one intensive organized instruction with a librarian?
- a. Yes
 - b. No
 - c. Not aware of it
10. Have you used the troubleshooting system (i.e., elecprod@uwindsor.ca) when you use the library's electronic resources?
- a. Yes
 - b. No
 - c. Not aware of it

Search Strategy

11. Overall, how would you rate your ability to search library databases to find information?
- a. Excellent
 - b. Above average
 - c. Average
 - d. Below average
 - e. Poor
12. Overall, how would you rate your ability to search the internet to find information?
- a. Excellent
 - b. Above average
 - c. Average
 - d. Below average
 - e. Poor
13. Most research and periodical databases have basic and advanced searching interfaces. Which of the following can you do ONLY in advanced searching?
- a. Add Boolean or search connectors between terms
 - b. Enter multiple search terms
 - c. Search by keyword
 - d. Search multiple terms by field
14. Research studies in arts, humanities, and social sciences are generally first communicated through:
- a. Books published by arts, humanities and social sciences associations
 - b. Arts, humanities, and social sciences encyclopedia entries
 - c. Newsletters of arts, humanities, and social sciences associations
 - d. Professional conferences and journal articles
15. You have been assigned to write a short class paper on effective instruction techniques for a Creative Writing Project. Your professor indicated that three recent scholarly sources would be sufficient. Which strategy is best to locate items?
- a. Search a general academic and an arts, humanities and social sciences database for journal articles
 - b. Search an arts, humanities and social sciences database for journal articles
 - c. Search the library catalog for books
 - d. Search the library catalog for encyclopedias
16. Select the set of search terms that best represent the main concepts in the following: What are the health risks associated with the use of drug therapy for hyperactive students?
- a. Drug therapy, health risks, hyperactivity
 - b. Drug therapy, health risks, students
 - c. Drug therapy, hyperactivity, students
 - d. Drugs, hyperactivity, therapy
17. Select the set that best represents synonyms and related terms for the concept "college students."

- a. Colleges, universities, community colleges...
 - b. Gen X, students, undergraduates...
 - c. Graduate students, first years, second years...
 - d. University, adult learners, educational attendees...
18. While researching a paper on *First Nations*, you find that these populations are also sometimes called *Native Americans* or *Indigenous* populations. You decide to look for information on the subject in a research database, and to save time you write a search statement that includes all three terms. Which of the following is the best example to use when you have fairly synonymous terms and it does not matter which of the terms is found in the record?
- a. First Nations and Indigenous and Native Americans
 - b. First Nations or Indigenous or Native Americans
 - c. First Nations, Indigenous, and Native Americans
 - d. First Nations, Indigenous, or Native Americans
19. You are using a research database that uses an asterisk (*) as its truncation symbol. When you type in *read** you would retrieve records that contained which of the following words?
- a. Examine, peruse, reader, reading
 - b. Peruse, read, reader, reading
 - c. Read, reader, reads, readmit
 - d. Read, reader, reading, reapply
20. You have a class assignment to investigate how group work impacts student learning. A keyword search in JSTOR on "group work" has returned over 19,000 items. To narrow your search, which of the following steps would you next perform?
- a. Add "impacts" as a keyword
 - b. Add "student learning" as a keyword
 - c. Limit search results by date
 - d. Limit search results by publication type
21. Your professor has assigned a paper on the whole language movement. You are not familiar with the topic, so you decide to read a brief history and summary about it. Which of the following sources would be best?
- a. A book on the topic, such as *Perspectives on whole language learning: A case study*
 - b. A general encyclopedia, such as *Encyclopedia Britannica*
 - c. An article on the topic, such as "Whole language in the classroom: A student teacher's perspective."
 - d. A subject specific encyclopedia, such as *Encyclopedia of Psychology*

Knowledge of Electronic Resources

22. Which of the following characteristics best indicates scholarly research?
- a. Available in an academic library
 - b. Indexed by JSTOR
 - c. Reviewed by experts for publication
 - d. written by university faculty
23. Research or periodical databases are designed to include items based on which of the following criteria?
- a. Found on the internet
 - b. Not found on the internet

- c. Owned by your library
 - d. Relevant subject matter
24. JSTOR is the most appropriate database to search to locate:
- a. Journals, reviews, and articles relating to the humanities, social sciences, and literature; includes back issues.
 - b. Social sciences publications from 1877 to current
 - c. Full-text articles solely relating to biology
 - d. Entire e-books

Information Literacy Assessment

25. You are writing a paper on the Black Lives Matter movement and your professor asks you to include a current primary source. Which of the following would fulfill these criteria?
- a. *Toronto Sun* article from July 2015 describing one of the protests
 - b. A book written by one of the activists that started the movement
 - c. A WordPress website discussing the Black Lives Matter movement in Toronto
 - d. A referred journal article on racism from the 1960s
26. You are asked to find a work of American Poetry to bring to class next week. Which database would offer access to this information?
- a. Literature Online
 - b. Science Direct
 - c. Project Muse
 - d. Historical Abstracts
27. How can you determine that a book contains relevant information on your topic?
- a. The title includes any of the words from your search
 - b. The table of contents lists a chapter on your topics
 - c. The topic is listed in the index
 - d. The author has written books on your topic before

Citation

28. The following citation is for:
- Massaro, D. (1991). Broadening the domain of the fuzzy logical model of perception. In H. L. Pick, Jr., P. van den Broek, & D. C. Knill (Eds.), *Cognition: Conceptual and methodological issues* (pp. 51-84). Washington, DC: American Psychological Association.
- a. A book
 - b. A chapter in a book
 - c. A journal article
 - d. A website
29. Your professor suggested you read a particular article and gave you the following citation. Which of the following would you type into the Leddy Library's One Stop Search to locate the actual article?
- Morren, & Grinstein. (2016). Explaining environmental behavior across borders: A meta-analysis. *Journal of Environmental Psychology*, 47, 91-106.
- a. Author search: Morren
 - b. Journal title search: Journal of Environment Psychology
 - c. Article title search: Explaining environmental behavior across borders: A meta-

analysis

d. Subject search: environmental behavior

30. The following item was retrieved from ACM Digital Library. What kind of source is it?

Title: Computers and modern art: digital art museum

Author(s): Mike King

Published in: C&C '02 Proceedings of the 4th conference on Creativity & cognition

Publication Year: 2002

Note: Presented at Creativity and Cognition (Loughborough, UK — October 13–16, 2002).

- a. A book
- b. A book chapter
- c. A conference paper
- d. A journal article

31. You are a graduate assistant for an undergraduate political science class. While developing a lesson plan on the U.S. legislative system, you find the following story on the internet:

Congress Launches National Congress-Awareness Week

WASHINGTON, DC—Hoping to counter ignorance of the national legislative body among U.S. citizens, congressional leaders named the first week in August National Congress Awareness Week. "This special week is designed to call attention to America's very important federal lawmaking body," Speaker of the House Dennis Hastert said. The festivities will kick off with a 10-mile Walk for Congress Awareness.

The item is from a newspaper web site, which states it is "America's Finest News Source."

Given this, the following action is in order:

- a. you can use the story as it's obviously from a reputable news source
- b. you decide to investigate the reputation of the publisher by looking at their Web site
- c. you decide to investigate the reputation of the publisher by looking at other Web sites
- d. you should not use the story because web information is not always trustworthy

32. Which of the following sentences must add a reference?

- a. Technology use in the schools is often characterized as a potentially dehumanizing force.
- b. Perhaps the fear that the virtual world may lead to passivity and isolation, at the expense of literal social interaction, is valid.
- c. Certainly, educators must ask which uses of technology result in increased learning and a better quality of life.
- d. To address these issues, Hunter has proposed that students work in groups with the computer peripheral to the group and the teacher acting as facilitator.

Ethical Considerations & Copyright

33. When is it ethical to use the ideas of another person in a research paper?

- a. It is never ethical to use someone else's ideas
- b. Only if you do not use their exact words
- c. Only when you give them credit
- d. Only when you receive their permission

34. You are a graduate assistant preparing a document for class. Browsing the internet, you find a report regarding First Nations populations in Canada, which is an Indigenous and Northern Affairs Canada publication. If you distribute 30 copies of the report to students in the class, which of the following copyright choices is the proper action?

- a. Permission is not needed as the report is openly available from the government agency's website.
 - b. Permission is not needed as the report was found on the internet.
 - c. Permission is not needed as you are only distributing 30 copies.
 - d. Permission to distribute 30 copies of the report must be acquired.
35. You have an assignment that requires you to use course management software to practice setting up a class grade book. Your library has purchased the software and loaded it onto the computers in the computer lab. Due to work conflicts, you have a difficult time getting to the lab. A friend loans you the software and you load it on to your personal computer. Is this legal?
- a. No, because this action constitutes a violation of copyright.
 - b. Yes, because it is already freely available in the lab.
 - c. Yes, because it is educational software and therefore able to be shared.
 - d. Yes, because your friend owns it and can share as they want.
36. Browsing a weekly news magazine, you come across an article that discusses the future of space exploration. As you are teaching this topic you decide to make copies of the article and share it with your class. Which of the following concepts makes it legally permissible to reproduce portions of works for educational purposes without permission?
- a. Copyright
 - b. Fair dealing
 - c. Freedom of information
 - d. Intellectual freedom

Thank you!

Test Key

13. D	21. D	29. C
14. D	22. C	30. C
15. B	23. D	31. C
16. A	24. A	32. D
17. C	25. D	33. C
18. B	26. A	34. A
19. C	27. B	35. A
20. B	28. B	36. B

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