

## **Lasting Impacts of Credited Information Literacy Library Instruction for Graduate Engineering Students**

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# **Lasting Impacts of Credited Information Literacy Library Instruction for Graduate Engineering Students**

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## **Abstract**

**Background:** For over 20 years, librarians at Polytechnique Montréal, a francophone engineering university in Canada, have been delivering a credited workshop mandatory to research master's and PhD students. CAP7005, a bilingual workshop, is recommended to be taken at the beginning of the student's program, with the goal of developing their information literacy (IL) skills. In 2020, the librarians conducted a study based on course assessments, which revealed satisfaction rates of over 90% in terms of achieving this workshop's learning objectives. To build on these results, the team wanted to assess what students remembered from the workshop and still used a few months after completing it. This article also seeks to foster discussion regarding the lasting impact of library-based IL skills training.

**Purpose/Hypothesis:** More specifically, the question this program evaluation activity attempts to elucidate is: What are the impacts of CAP7005 on students' information literacy skills in terms of learning and putting them into practice, as well as on their awareness and use of library services, three to twelve months after completing it? Additionally, this article assesses students' general appreciation of the workshop.

**Methodology:** In spring 2024, an online survey was sent to 380 students who took CAP7005 in 2023 (during the winter, summer and fall terms) and who were still studying at Polytechnique Montréal. These students also had the opportunity to participate in a focus group meant to provide a qualitative insight to the survey.

**Results:** The response rate was 23%, with 89 complete survey responses and 10 students for the focus groups. Between 89% and 98% of the respondents reported that CAP7005 has helped them master at least partially the IL skills taught, and that 67% to 97% used them sometimes or often. These skills include finding appropriate documents for their information needs, creating advanced search strategies to query bibliographic databases, understanding plagiarism and copyright, and evaluating a scientific article. Also, 91% of respondents indicated that CAP7005 has made them more aware of library services and resources, and 69% used them more as a result. In addition, 64% of the participants would recommend the

workshop to their colleagues if it were not compulsory (21% would not recommend it, 15% were neutral), attesting to their general appreciation of the workshop.

Conclusions: Even if the long-term aspect was limited to students who were still enrolled at Polytechnique Montréal, the survey showed that three to twelve months after completing it, students stated the workshop improved their IL skills and usage of library services. As they continue to use these skills in their research activities, some could become habits and thus benefit them in their future.

Students in the focus group mentioned it made a real difference that the workshop was given by librarians. Combined with the survey results, this shows that the librarians' expertise made an important contribution to graduate students' research habits, ethics, and critical reading.

## **Introduction**

Polytechnique Montréal, a francophone engineering university, offers over 120 programs in various fields of engineering and applied sciences at different levels (certificate, bachelor's, master's and PhD). Over 10,000 students were enrolled in 2023, 29% of whom were women. The same percentage are international students. Approximately a quarter of the student population is enrolled in graduate programs, with international enrollment at 59% for master's programs and 71% for doctoral programs [1], [2], [3].

Polytechnique Montréal offers several mandatory and optional one-credit courses called CAP workshops to students in research master's and PhD programs.

Since 2002, the Polytechnique Montréal Library has been collaborating with the Graduate Studies Office on a mandatory and credited workshop designed to provide students with the information literacy (IL) skills they need to complete their theses and dissertations. Although the workshop title has changed over the years, the pedagogical objectives remain largely the same [4].

Since 2011, the Library has been coordinating a mandatory one-credit workshop entitled CAP7005. This workshop was created and updated according to the Association of College & Research Libraries (ACRL) standards [5], [6], and part of its pedagogical content was developed in collaboration with a professor from the Engineering Physics Department, who oversaw the workshop until summer 2019. Starting in September 2020, the Library became responsible for both the pedagogical content and the evaluation of the workshop [4].

The main objectives of the workshop are:

- Identify reliable information sources;
- Recognize and comply with the ethical and legal requirements related to the use of information;
- Define an information need related to a field or a research project;

- Structure and optimize a search strategy by using research methods;
- Apply basic criteria for evaluating the quality and relevance of information sources;
- Recognize the main benefits of using bibliographic management software;
- Identify collaborators and competitors in the scientific community;
- Identify current awareness tools and activities to keep up to date;
- Apply basic principles for analyzing the contributions and the limitations of a scientific article.

This workshop is delivered in four 2h 30 min. sessions and includes a series of readings and tutorials available online. Graded evaluations to determine the students' understanding of the course content include:

- a self-diagnostic test to establish students' IL skills at the beginning of the workshop;
- a first assignment, in which students create an optimized search strategy related to their project and perform it in a bibliographic database;
- three quizzes to encourage active learning, for which students need to watch videos and do prior readings;
- a second assignment, whose objective is to critically analyze a scientific article related to the students' projects.

During the COVID-19 pandemic, the team of librarians quickly modified the workshop materials so that it could be given online and still foster active learning. Before the pandemic, the workshop was given only in person. Since then, the workshop is offered both online and in person, so the students have a choice. To encourage active learning, three quizzes have been added to help students prepare before the sessions. To complete them successfully, students should watch tutorials and study annotated prior readings.

Since the workshop's creation, surveys have consistently shown a satisfaction rate of almost 90% among students, who particularly appreciate learning how to create and execute a complex search strategy in a bibliographic database, as well as discovering new resources and learning more about plagiarism and copyright. The fact that the assignments are linked to the students' own research projects is a positive aspect to them [4]. As far as the teaching community is concerned, a survey carried out in 2021 showed that a large majority of teachers who answered the survey indicated that CAP7005 had enabled their students to produce better literature reviews [7].

In 2023, the team of librarians was particularly interested in validating what the students had retained a few months after participating in the workshop, i.e., after a period of three to twelve months. More specifically, this article aims to present some of the lasting impacts observed by the students, in terms of IL skills acquisition as well as in their awareness and use of Library services.

## **Literature Review**

The Framework for Information Literacy for Higher Education [6] has shaped the way IL has been taught for almost a decade. In this influential document for library instruction, the ACRL defines IL as “the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning” [6, p. 3]. While the Framework offers insight as to which aspects of IL should be considered and integrated within instruction programs, it does not address directly the specific needs of undergraduate and graduate students or how they may vary. Despite this, some studies have explored the fact that IL training can increase knowledge and the use of library resources and services among graduate [8] and undergraduate students [9], [10]. The short-term and lasting impacts of IL instruction among these two groups will be explored in further detail in this section.

Research into the effects of integrating IL instruction in graduate programs has a long history. Much of the literature on IL instruction provided by academic libraries focuses on undergraduate students [9], [11], [12], [13], [14], [15] and is often integrated in early degree courses in communications, English, or history [16], [17]. This tendency also permeates engineering university programs [8], [18], [19], [20]. However, interest among librarians in IL instruction for graduate students began in the 1950s in North America and has increased steadily over the ensuing decades [21]. In a 50-year span, individual consultations, one-shot workshops, and credit-based courses emerged as the preferred methods among librarians for teaching research skills and IL to graduate students [21]. While the perceived efficiency of one-on-one consultations remained high throughout these decades, the advent of the internet in the 1990s and early 2000s prompted a need for more workshops focused on bibliographical database training [21].

IL-focused instruction gained importance with the publication of the American Library Association’s (ALA) 1989 report which “linked information literacy to personal empowerment, lifelong learning, and active citizenship” [21, p. 21]. There was also a rise in librarian-faculty collaboration and in course-integrated IL instruction programs at graduate levels [21]. Ince et al. [22] stressed the necessity of providing doctoral students with IL and digital literacy instruction that is tailored to their evolving needs as contemporary researchers. The importance of including discipline-specific material has also been emphasized by graduate students themselves within engineering and health sciences [23], [24]. Since 2000, there has been an explosion of research into the formal assessment of education outcomes [20].

There have also been attempts to study the impact of IL instruction on graduate students, specifically in STEM. In Canada, Liu [8] studied the short-term impact of one IL lecture included in a compulsory course for international master’s students in engineering at the University of Windsor. Liu found that even after a single lesson, there was an improvement in the students’ IL skills and comprehension of IL concepts (for example, searching and retrieving information). Liu also recommended that international engineering graduate students be provided with further instruction and assistance. Critically, she stressed the need

for a more longitudinal approach to measuring the impact of IL instruction on students since “post-tests conducted immediately after the lecture might reflect just their short-term memory rather than what students comprehended and retained” [8, p. 6].

Research into the impacts of IL instruction on graduate students is more abundant in academic domains outside of engineering. One example is Shaffer’s [25] comparison of the impact of online library instruction and in-person one-shot sessions on the research skills of 59 education graduate students at the State University of New York at Oswego. By comparing pre- and post-training test scores and using citation analysis, Shaffer demonstrated the positive impact of IL instruction on students’ information retrieval and article selection skills.

Less abundant is research looking into the lasting impacts of IL instruction on graduate students, that is, the enduring influence of these instructional sessions on students in the weeks, months and even years after IL training. Talim et al. [26] sent a survey to graduate students in healthcare before and 4-5 months after completing a 15-hour workshop with their librarian. The authors saw improved confidence among students in their information searching abilities. Other studies have shown similar results, although Han & Schuurmans-Stekhoven [27] note that graduate students also feel that these benefits are diminished if they lack effective composition and communication skills, especially among those who speak English as a second language.

The lasting impact of IL instruction on undergraduate students in various academic domains has also been demonstrated in the literature, particularly in the North American context [9], [16], [28]. One of the earliest examinations is Hardesty et al.’s [29] three-year study of Depauw University’s undergraduate population. Walters et al. [20] conducted a five-year yearly assessment of an IL program at Manhattan College, a university specializing in engineering and business. The study demonstrates how continuous program assessments have been used to enhance and adjust the library IL program to better meet the needs of its students.

Lasting impacts were also demonstrated in Wong et al.’s [30] study at the Hong Kong University of Science and Technology. A survey was sent to students four to eight weeks after the library sessions ended. They received responses from mostly undergraduates, nearly half being engineering students. In general, responses were more positive if the participant was more advanced in their studies (graduate students and up) and if they had attended a voluntary workshop, rather than an obligatory one. The researchers also found that class size had a negative effect on the outcomes, namely student satisfaction and skill retention, suggesting library instruction should be carried out in smaller classes.

According to the present literature review, the novel aspect of the program evaluation activities presented in this paper is the combination of the studied population (engineering graduate students) and course format (credited IL instruction taught by librarians) with the timing of the survey administered, which focuses on the lasting impacts of the IL instruction.

This specific combination seems unique, as no article on that specific topic was found, even after a thorough search of the literature conducted by the authors. Moreover, the timespan required for the acquisition of knowledge or skills to be considered lasting is unclear in the literature.

## **Methodology**

The main data collection tool was an anonymous online bilingual survey, whose aim was to reach as many 2023 CAP7005 students as possible. To gather qualitative data and to complement the survey, one focus group in English and one in French were held. The answers were transcribed and recorded. These offered participants the opportunity to further express their opinions regarding CAP7005. The survey results were analyzed with Excel. No formal analysis was carried out on the focus groups' answers, as they were meant to only complement the survey. The survey and the focus group questions are available in the appendix.

At the end of CAP7005 sessions, students are encouraged to complete a course evaluation. These evaluations were the basis for a previous article [4], which investigated the benefits of this workshop for students. These two elements, the course evaluation questionnaire and the article [4], were the starting point for the authors' reflections on this new survey. This time, these elements were to be examined from a long-term perspective rather than a one-off view.

The choice of the platform was straightforward, since Polytechnique Montréal has its own survey tool on LimeSurvey. The librarians in charge of CAP7005 tested the survey by answering the questions.

Once the questionnaire had been finalized, various methods to reach the target students were considered. It soon became apparent that to contact the appropriate population, they needed to be active students in the school's records, and thus still enrolled at Polytechnique Montréal.

In collaboration with the CAP workshops registration coordinator, former CAP7005 students who were still active at Polytechnique Montréal were identified as the target of the survey, so that they could be easily contacted via their academic e-mail address. This approach had the advantage of facilitating the communication process, but the disadvantage of limiting the study to students who had taken CAP7005 during the last year (in this case, 2023). In fact, a large proportion of the population concerned were master's students who, a year and a half later, have usually finished their studies. A large proportion of them would have been therefore ineligible to participate in the study.

The survey was sent in March 2024 to 380 students out of 390, that is, 97.4% of the students who took the workshop in 2023. They had three weeks to fill in the survey and two reminders were sent out during those weeks. To encourage participation, students who filled out the survey had the chance to win a \$50 gift.



Regarding the ethics approval, the program evaluation activities detailed in this article were examined by the Polytechnique Montréal Office of Research Ethics and Integrity (ORIE). According to this evaluation, the project falls under the exemption detailed in article 2.5 “Activities not requiring research ethics board review” of the Canadian Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans [31]. The initial project was to report on the quantitative data collected via the survey, as a supplement to what is done continuously as part of program quality assurance. Qualitative data from focus groups was purely illustrative. According to this description, the activities mentioned do not constitute research for the purposes of the policy.

The online survey also invited students to sign up for a focus group. To recruit participants, focus group attendees had the chance to win a \$50 gift.

The focus group questions were elaborated with two main objectives: first, to gather additional information to complement the survey results, and second, to allow plenty of room for free, spontaneous exchange, through a semi-structured interview format. The questions were therefore deliberately general and open-ended. Some were adapted directly from the survey results to obtain more qualitative feedback on specific points.

Questions that targeted the workshop’s content and structure were also asked to gather concrete feedback and thus help improve the workshop. The testimonials gathered in these focus groups should not be generalized to all respondents, let alone to the entire target population. What is more, there may be a bias, as those willing to allocate such time to the Library are likely individuals who already have a favorable opinion of CAP7005. For these reasons, the students’ statements from the focus groups are incorporated in the results section when it seemed relevant, as illustrations or avenues of interpretation of the quantitative data.

The final questionnaire sent to all study participants contained five categories of questions:

1. Questions 1 to 7 are demographic elements that made it possible to paint a portrait of the respondents and check whether the sample is representative of the population. These could have had an impact on the results (field of engineering, workshop language, level of study, etc.).

The next four categories correspond to the article’s subquestions:

2. What learning outcomes (information literacy skills) remain a few months after completing CAP7005? (Q8 and 10)  
Aim: To assess students’ lasting impression of the knowledge they acquired or deepened during the CAP7005 workshop.
3. Are students still using what they have learned (IL skills) in CAP7005? (Q9 and 11)  
Aim: To assess students’ lasting impression of the concrete impact of this workshop on their practices.

4. Following CAP7005, are students more aware of library services and resources, and what do they use most? (Q12, 13, 14, 15 and 16)

Aim: To assess the impact the workshop had on students' relationship with the library.

5. What aspects of CAP7005 do students still value after a few months? (Q15, 16, 17, 18 and 20)

Aim: To assess lasting impressions and appreciations left by their recollection of the workshop contents, as well as suggested avenues for improvement.

## **Results**

It should be noted that for brevity's sake, even though all five categories of questions are discussed here, some individual question results are omitted. Exclusion choices were made solely when the answers did not provide further insight in evaluating the workshop. As such, Q10, 11, 14 and 16 are not discussed.

### **1. Profile of respondents (Q1 to 7)**

There was a response rate of 23.4% (89 surveys completed). Surveys that were only partially completed were discarded from the analysis of results. As for the focus groups participants, there were seven in French and three in English.

Of the students who responded to the survey, 68.5% attended the workshop in French and 31.5% in English, which is close to the distribution of students who were sent the questionnaire, with 62.6% who attended the workshop in French and 37.4% in English.

In terms of respondents' program, 65.2% were at the master's level and 34.8% at the doctoral level. Overall, 55.8% of the students who took the workshop in 2023 were at the master's level and 41.9% at the doctoral level.

Students who took the workshop in French are therefore slightly over-represented among survey respondents. The same applies to master's students.

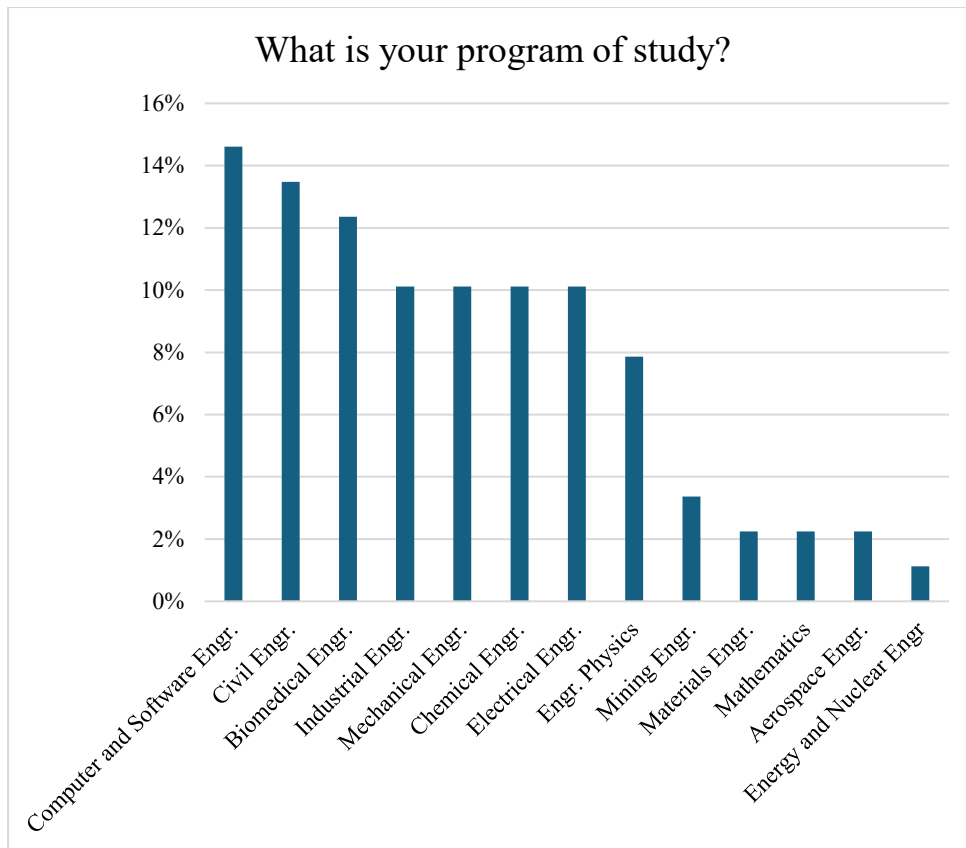


Figure 1: Program of study of the respondents (Q1)

It should be noted that in this workshop, the proportion of master's and PhD students is reversed according to the language of the groups. In the workshops in English, 27.7% of students were at the master's level and 68.9% at the doctoral level, whereas in the workshops in French, 73.1% were at the master's level and 25.2% at the doctoral level.

The location of the most recent diploma obtained was used as a proxy for the origin of the students. The breakdown is as follows: 50.6% of respondents obtained their degree outside Canada, 40.5% at Polytechnique Montréal, and 9% elsewhere in Canada.

In addition, 58.4% of respondents said they had never received information literacy training before. Of the remaining responses, 12.4% had taken one at master's level, 20.2% at bachelor's level, and 9% before starting university.

These demographic elements were cross-referenced with other survey questions to assess their potential influence, but these preliminary calculations proved inconclusive; thus, they are not presented in this article.

2. What learning outcomes do students feel remain a few months after completing CAP7005? (Q8)

This first set of questions was designed to assess how students felt about the knowledge they had acquired or developed during the CAP7005 workshop, at the time of the survey (i.e., three to twelve months after attending CAP7005).

In question 8, six fundamental competencies from the workshop syllabus were listed. For each one, students were asked to determine whether they felt CAP7005 had helped them master those skills, the possible answers being “Yes”, “No” or “Partially”.

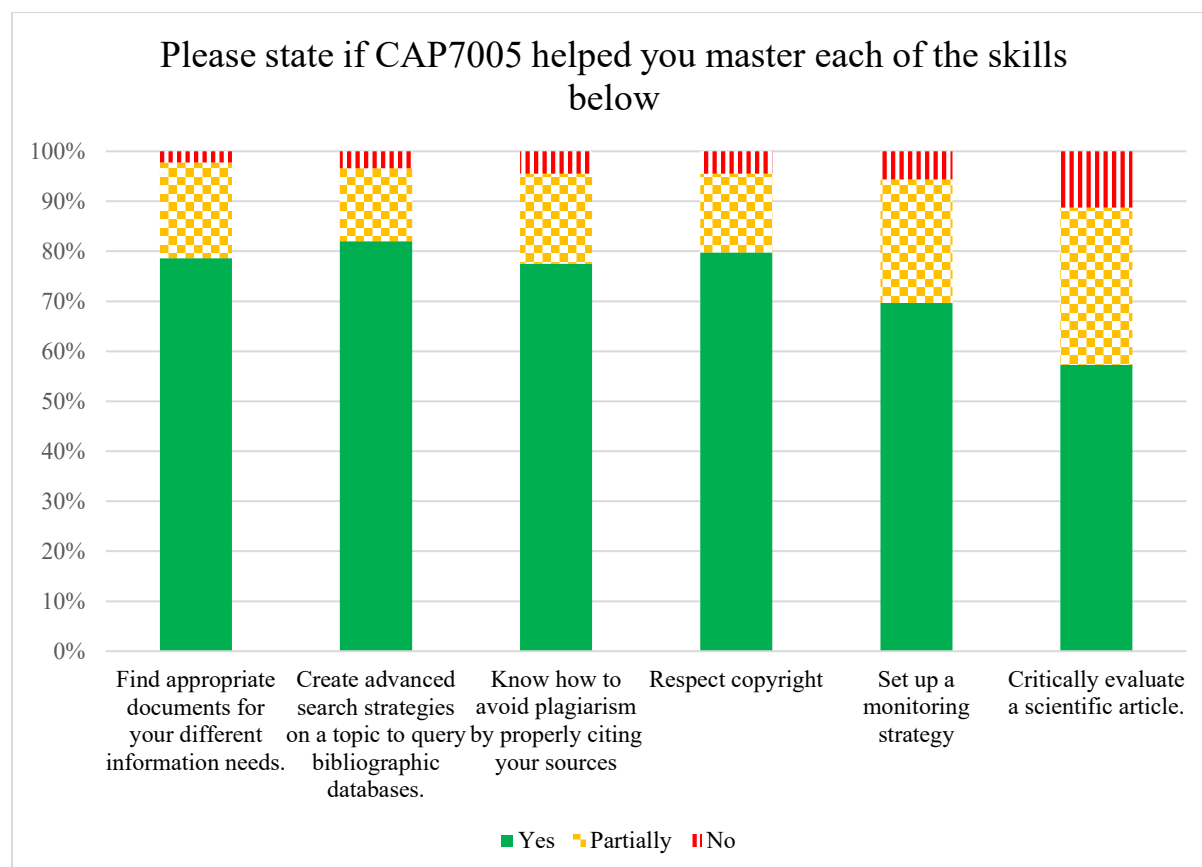


Figure 2: Level of agreement with the acquisition of fundamental IL skills through CAP7005 (Q8)

This largely seems to be the case, with a “Yes” response rate of around 80% for the first four competencies.

These positive figures are backed up by numerous accounts collected during the focus groups, for example:

*“Thanks to CAP7005, I know now what I need to do to set up a successful search strategy. I didn’t know about patents and anything to do with plagiarism. I really think this workshop helped me.”* [translated from French]

These students’ comments show that CAP7005 has succeeded in fulfilling its ambition of equipping these students with IL skills, helping them gain confidence and autonomy.

The lower “Yes” rates for the questions on notification services and critical evaluation of a scientific article are not surprising, as they can probably be explained as follows.

As far as notification services are concerned, most of the information on the subject in CAP7005 is provided in a reading. Moreover, the workshop does not include any exercises or assignments on the subject. Thus, it is hardly surprising that students feel like they have less mastery of the topic after following the workshop.

Even so, some focus group remarks support the idea that this is a very valuable skill for students, and one that would benefit from further development during CAP7005:

*“I’ve also made a lot of use of the weekly notifications via Compendex, I think, (...) the alerts. I find it really interesting, to have this kind of passive technological watch.”* [translated from French]

When it comes to evaluating an article, the possible factors explaining the responses are manifold. To start, as the librarians mention in the workshop, critically analyzing a scientific article is not as straightforward as information search or copyright compliance, but a skill that develops in the long term, through practice and experience. Comments from focus group participants also suggest that students feel less comfortable (or “legitimate” in their words) critiquing a scientific article, regardless of their actual skills.

### 3. Are students still using what they have learned (IL skills) in CAP7005? (Q9)

In this set of questions, the intent was to assess students’ perceptions of the lasting impact of this workshop in practice.

It is interesting not only to assess the extent to which students feel they have retained something from CAP7005, but also to evaluate the extent to which the skills acquired are useful to them. Consequently, the students were asked how often they use the skills taught in the workshop (Q9).

According to the responses, the skills used most often were “Find appropriate documents for your different information needs,” “Know how to avoid plagiarism by properly citing your sources” and “Critically evaluate a scientific article.”

Conversely, students create search strategies less frequently and set up automatic search updates even less.

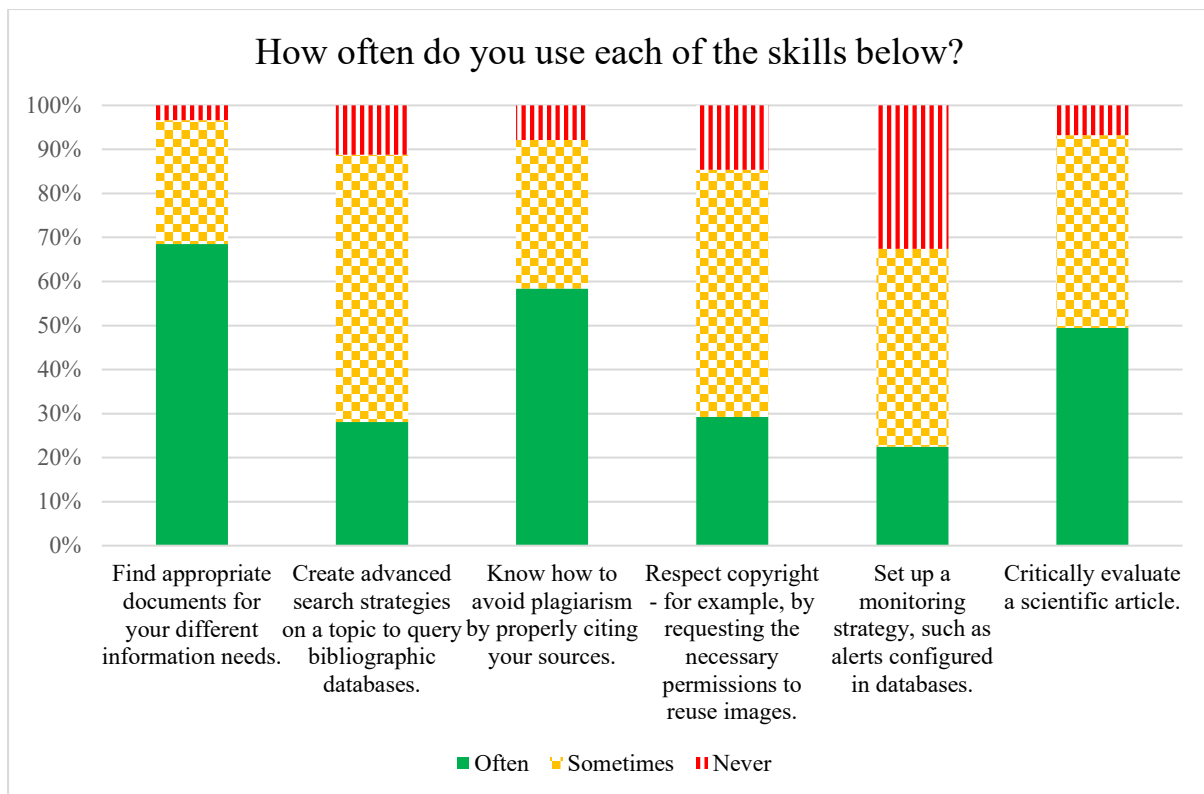


Figure 3: Estimated level of use of the IL skills taught in CAP7005 (Q9)

Various hypotheses could explain these results. Developing an elaborate search strategy and setting up automatic search updates (monitoring strategies) are not activities that are carried out on a regular basis.

The development of a search strategy is most relevant to the literature review. As for setting up automatic search updates, it is something that, if done well, should only need doing once per topic. Given that students are less proficient in this skill (as indicated by their previous responses), it is logical that fewer of them would put it into practice.

It is hardly surprising that the “Often” rates are higher for statements “Find appropriate documents for your different information needs”, “Know how to avoid plagiarism by properly citing your sources”, and “Critically evaluate a scientific article.” These activities are regularly carried out by master’s and doctoral students.

Regarding copyright compliance, the wording of the question may have introduced a bias, negatively impacting the responses. It is possible that students commonly practice this skill, but their answers were influenced by the specific example given in the question to illustrate this activity: requesting permission for the reuse of figures. This is an activity that is indeed not performed very often. Copyright compliance involves taking, but also refraining from, certain actions, such as ensuring not to share copyrighted materials unlawfully. Was the skill performed if no action was taken?

Based on the frequency of their use, and bearing in mind certain interpretations of the results, it is possible to say that the information skills taught in CAP7005 are considered useful by students. Several focus group participants even stated that they saw the usefulness of the workshop “every day”.

4. Following CAP7005, are students more aware of library services and resources, and what do they use most? (Q12, 13, and 15)

The next set of questions concerns the relationship between the students and the library.

The first step was to determine whether students felt better informed about the services and resources offered by the library than they did prior to their participation in CAP7005. Moreover, it seemed relevant to explore their actual practices. Question Q15 asked students about their level of agreement with various statements, on a scale from 1 to 5 (1 representing “I strongly disagree” and 5 “I strongly agree”).

Concerning the statement “CAP7005 made me more aware of the services offered by the Library”, 91% agreed (55% strongly agree; 36% somewhat agree). For the remaining 9% (3.4% somewhat disagree, 3.4% strongly disagree and 2.2% were undecided), it is very likely that these were students who felt that their knowledge of the Library services and resources preceded their participation in CAP7005.

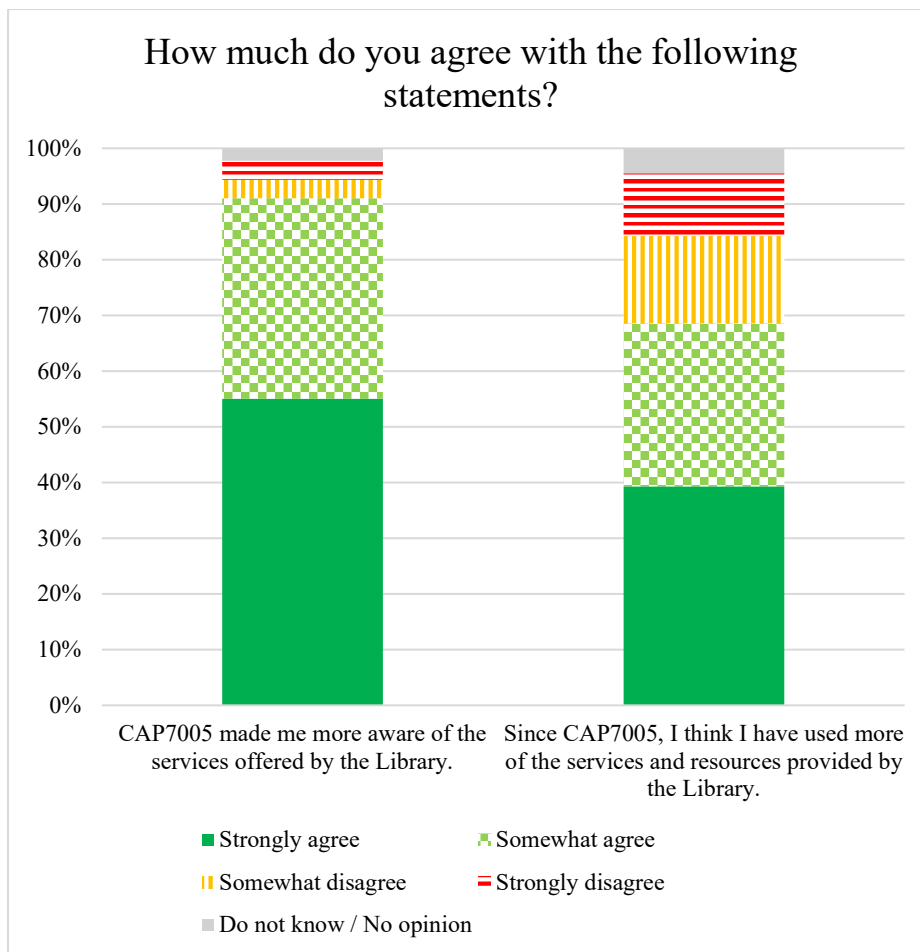


Figure 4: Levels of knowledge and use of the library resources and services (Q15)

As the presentation of library services and resources is an integral part of the curriculum, this result was expected. Thus, it was interesting to go a step further and ask students about their practices and actual use of these services and resources.

Question 15 also asked students how much they agreed with the statement “Since CAP7005, I think I have used more of the services and resources provided by the Library” (using the same 1 to 5 scale). A total of 68% said they were using the library services and resources more, although this does not rule out the idea that they were already using them before.

For example, some resources presented in CAP7005 are specialized databases useful to engineering research, such as Compendex, Inspec, and Web of Science. Question 12 asked about these resources, and only 10% said they did not use them.

Keeping in mind that the answers to this question are not mutually exclusive, 63% continue to use Compendex, 62% Web of Science and 19% Inspec, and/or 2% use databases not presented in CAP7005.



The focus group participants provided additional context on these data, with one of them stating, for example, *“Personally, I can say I only knew of Google Scholar before CAP7005.”* [translated from French]

CAP7005 is also an opportunity to promote the use of bibliographic reference management software, tools considered indispensable in a research project. Two, EndNote and Zotero are presented during the workshop, and others are also the subject of independent workshops, offered free of charge by the library.

The question of whether CAP7005 encouraged students to adopt and use such tools seemed pertinent, since it represents a further indication of the concrete impact of CAP7005 in students' current and enduring practice. Thus, to the question, “Has CAP7005 prompted you to use a bibliographic management software?” (Q13), only 7% answered “No”, 66% answered “Yes” (naming a particular tool), and 33% said they were already using one. Some 4% of the students were using another bibliographic reference management software than given in the choices.

According to the focus group's statements, the link between the students and the library strengthened. Also, the fact that librarians are responsible for this workshop is seen as a real asset:

*“It's fun because the library gives the course on how to use the resources. It's the right people giving the right course!”* [translated from French]

5. What aspects of CAP7005 do students still value after a few months? (Q15, 17, 18, and 20)

Finally, the survey contained questions on the general appreciation of CAP7005. Students were first asked whether they agreed with the statements detailed in figure 5 (Q15).

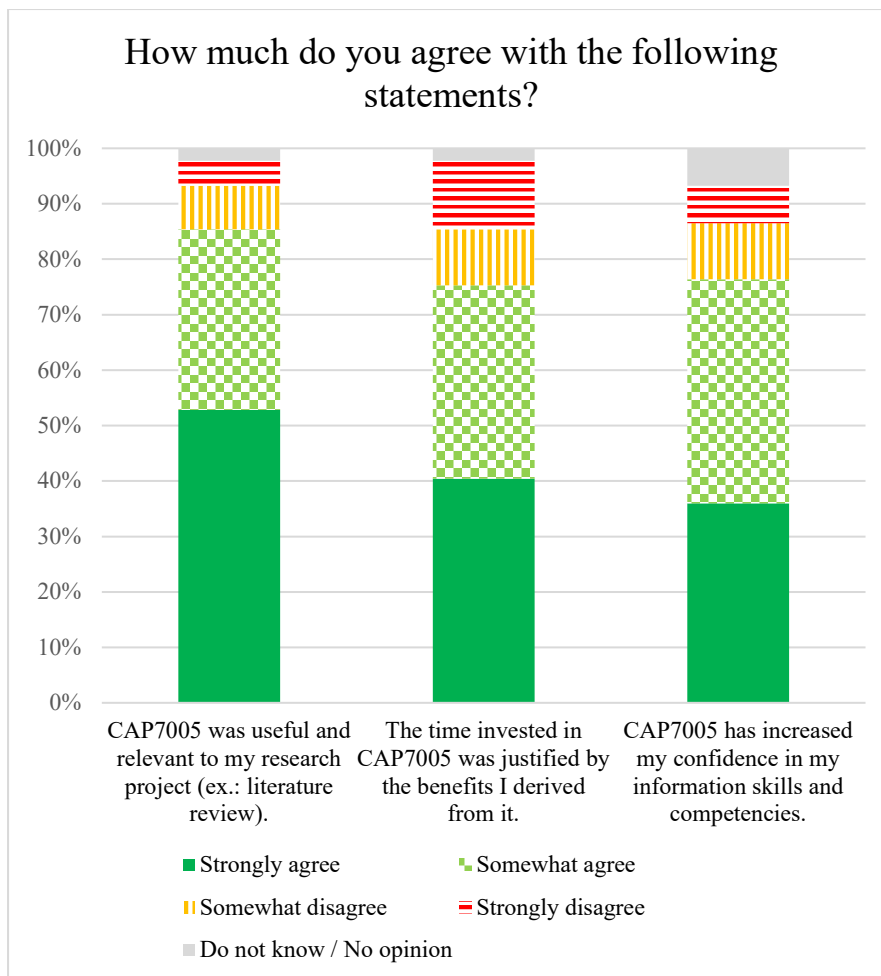


Figure 5: Level of agreement on the overall usefulness and relevance of CAP7005 (Q15)

Given the previous answers regarding acquired skills and frequency of use, the high rate of respondents who partially or strongly agree with the first statement of this graph is not surprising.

One might wonder why the positive responses to the question on information skills and competencies are lower. A possible explanation is that the notion of information literacy is not obvious to students, since this question has the highest “do not know/no opinion” rate, at 7%. The question about the return on time invested in CAP7005 has the highest combined rate of “somewhat disagree” and “strongly disagree” (22%), but also the highest percentage of “strongly disagree” (12%). The feedback that the workshop is too lengthy or requires excessive reading is formulated somewhat regularly, but by a minority of students.

To assess the overall satisfaction with CAP7005, Q17 was asked: “Would you recommend CAP7005 to your colleagues if it were not mandatory?” (1 being “I do not recommend it at all” and 5, “I highly recommend it”). Responses to this question were slightly less positive than expected. Participants answered 5 or 4 64% of the time, while 21% answered 1 or 2, and 15% answered 3. In fact, satisfaction in end-of-workshop evaluations was generally higher. The answers to several questions presented above (86% who stated that CAP7005 was

partially or very useful for their research project) are better aligned with the results of end-of-workshop assessments. Some students might find CAP7005 useful, but not to the extent that it should be compulsory. In any case, this is a reminder that the workshop, despite its strengths, can still be improved.

There were a few qualitative questions in the survey. Respondents were asked if they would like to add, remove or modify any material in CAP7005 (Q18), and if they had any other comments on the workshop (Q20). 88% of students answered No - that there were no elements that should be added, removed or modified in the workshop. Eleven people (12%) answered “Yes”, and 22 respondents (25%) left comments. The comments and the suggestions for additions and deletions were quite varied. They were combined and compiled.

Three respondents mentioned that more time during the workshop should be devoted to article analysis. This is consistent with the answers to Q8. Otherwise, two respondents stated that the workshop was too long, that it should be given in person and that workshop groups should have only students of the same department together, to encourage discipline-specific examples and discussions in class.

## **Discussion**

### *Challenges in assessing lasting impacts*

The results presented here have some important limitations that should be mentioned. The survey’s main objective was to estimate the lasting impacts of an information literacy workshop given by a team of librarians. However, the students surveyed had only completed the workshop between 3 and 12 months earlier, and it should be noted that it is not known exactly how long ago each student completed the workshop. Had the time frame been lengthened, the sample would have overrepresented doctoral students, introducing a new limitation to the results. Moreover, in the literature review, many articles had considered lasting impacts starting at a couple of months after the end of the intervention [15], [26], [30], although some went longer, between one and four years [9], [14], [16], [28], [29]. It can be argued that the length of time when a positive impact becomes “lasting” varies across studies.

Another potential limitation lies in the wording of question 8 “Please state if CAP7005 helped you master each of the skills below”. One of the purposes of this question was to estimate the extent of knowledge acquisition a few months after the end of CAP7005. This aim was formulated in the introductory text of the questionnaire (see appendix), but it is possible that the students did not interpret the question in this way, and instead answered what they thought they had learned at the time of the workshop, without questioning whether or not this learning would be maintained over time.

An additional limit to this study is that it is based on students’ perceptions. Several studies have shown that students tend to overestimate their informational skills [20], yet it is possible to imagine that they also approximate the contribution of a workshop.

One way of getting around the limitations of the short duration and the students' perceptions would have been to conduct assessments of IL skills before and several months after. However, this type of study design would be much more complex to carry out. It is also not certain that it would produce much more robust results. These issues were clearly demonstrated by Lohmann et al. [17]. Indeed, it would be very difficult to isolate the contribution of a workshop taken a year earlier in improving a student's information skills. Many other factors could have also had an impact on those results.

It is worth noting that some students in the focus groups stated their preference for the in-person format. As this question was not included in the survey, it is not possible to assess at this time if students retained more when taking the workshop in person or online, though it would have been an interesting variable to consider.

In any case, the survey results shed a slightly different light on the workshop, providing insights that can help improve it further. Despite its limitations, the feedback is useful for further improving the workshop.

### *Findings*

The results from the survey and the focus groups show students generally state CAP7005 improved their IL skills, and that they continue to use them. Students still active at Polytechnique Montréal were targeted in this study, so the improved skills are still used in the context of their studies several months after the workshop took place. Some may become habits, as students continue to use, practice and appreciate them. As shown, they acknowledge these skills are useful to them. Of course, while students are at Polytechnique Montréal, they have access to the databases and software shown in the workshop, which might not be the case after their career takes them elsewhere. An academic institution would still probably have access to some databases, but they might differ, while the access to information sources in businesses varies wildly. Some habits could be lost in this transfer, but one can hope that the skills developed and practiced to avoid plagiarism, respect copyright, critically analyze scientific literature and find varied documentation from different information sources would remain and continue to benefit them in their careers.

### *Workshop importance for knowledge and use of library resources*

Although this was not the primary objective of CAP7005, the survey results clearly show the value of this type of workshop in raising awareness of library resources and services. As indicated in the results section above, most respondents stated they were more familiar with library services, and a majority said they used them more.

The library team uses a variety of methods to promote its services, but nothing can be as successful as making something mandatory. This is not an isolated situation; O'Malley and Delwiche [24] recount various (somewhat unsuccessful) efforts to promote a series of library workshops. The mandatory nature of CAP7005 forces students to engage with library resources, resulting in most students adopting them, to a certain extent. This approach is

regarded by the authors as potentially the most effective way of encouraging students to modify their search habits on such a large scale.

### *Workshop satisfaction*

Finally, the survey results seem to broadly confirm the conclusions drawn from the evaluation surveys administered at the end of each CAP7005, on which the authors' previous article is based [4]. These surveys show that students are overall very satisfied with the workshop, which is consistent with the positive responses to questions about the contribution of CAP7005 to students' IL skills and their frequency of use. Similarly, in both the end-of-session surveys and the one on which this article is based, developing a search strategy appears to be the most useful for students, while the critical analysis of an article may be the section that needs more improvement.

The above observations can also be explained by the period when CAP7005 is given, that is at the start of the program. It is very relevant and useful for students to learn how to develop a search strategy during their first year of research, when they are still inexperienced in the critical analysis of articles. Nevertheless, many focus group participants felt that CAP7005 was given at an opportune moment in their research careers.

Several students remarked that the workshop was very relevant and that the undergraduate students could also benefit from it and acquire IL skills earlier, if this workshop were also mandatory at undergraduate level.

### *Improvements made in light of the findings*

As previously stated, one of the primary motivations for the survey was to gather feedback to verify the appropriateness of the workshop content in relation to the graduate students' needs, and, if necessary, to improve the course content. Certain quantitative results and student testimonials were considered, leading to modifications made for the Fall 2024 semester. Among them, the most important was a reorganization of the teaching materials to achieve two objectives: to lighten the workload associated with the workshop, and to avoid redundancy between the prior readings and the content presented in class. The flipped classroom approach is thus reinforced.

In the focus group in French, participants unanimously advocated for a return to in-person teaching for all groups, which they felt would optimize concentration, increase interactivity and "*really make you aware that it's the library*" [translated from French] that is in charge of the workshop. The proportion of groups taking the course in person has indeed been increased for Fall 2024, but to accommodate as many students as possible, there are still some online groups.

Assessing the impact of these changes on overall student satisfaction would provide valuable insights for the future.

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## Appendix

### Survey questions

Dear students,

CAP7005 was designed to help master's and PhD students with their research projects. To this end, specific objectives were set, and at the end of the workshop you were invited to assess whether these objectives had been achieved.



Now, a few months after you finished the workshop, the librarians in charge would like to know if you are still reaping the benefits and if the workshop's objectives have been achieved in a sustainable and transferable way.

This anonymous survey consists of 20 questions and should not take you more than 15 minutes to complete. Your answers will help us to evaluate and improve our teaching, for the benefit of our entire community.

Your feedback is essential. We therefore invite you to complete this survey before April 5, 2024 at 8:00.

You can opt out of this survey at any time. However, once you have submitted your answers, you will not be able to delete or modify them.

What's more, by completing this survey, you can enter a draw for two \$50 gifts. The link to enter the draw can be found at the end of this survey.

If you have any questions or encounter technical difficulties, please contact Polytechnique Montréal Technical Support at email A.

If you have any questions about the content of the survey or other comments about the ABC workshops, please email B.

Thank you for your participation and good luck!

INFORMATION ON RESPONDENTS
----------------------------

1. What is your program of study?
  - Aerospace engineering
  - Biomedical Engineering
  - Chemical Engineering
  - Civil Engineering
  - Materials engineering
  - Electrical Engineering
  - Energy and nuclear engineering
  - Industrial Engineering
  - Computer and Software Engineering
  - Mechanical Engineering
  - Mining Engineering
  - Engineering Physics
  - Mathematics
  - Other

2. Which of the two workshops did you take?  
CAP7005 (in French)  
CAP7005e (in English)
3. When did you take CAP7005?  
During my research master's  
During my Ph.D.  
Other
4. Before beginning your graduate studies at Polytechnique Montréal, you obtained your last diploma:  
At Polytechnique Montréal  
Elsewhere in Canada  
Outside Canada
5. Before beginning your graduate studies at Polytechnique Montréal, you obtained your last diploma:  
Mainly in French  
Mainly in English  
Mainly in another language
6. How many trimesters of study have you completed in your current program (do not count the current term)?  
1-2 trimesters  
3-4 trimesters  
5 trimesters and more

LONG-TERM ACQUISITION OF INFORMATION SKILLS
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7. Did you participate in any specific information skills training prior to CAP7005?  
No, never / Not that I remember  
Yes, before University  
Yes, during my Bachelor's  
Yes, during my Master's  
Other

8. One of the objectives of CAP7005 was to help you develop and master practical skills that will be useful throughout your university studies and beyond. Please state if CAP7005 helped you master each of the skills below.

	Yes	Partially	No
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Find appropriate documents for your different information needs.			
Create advanced search strategies on a topic (Boolean operators, truncation, exact expressions, etc.) to query bibliographic databases.			
Know how to avoid plagiarism by properly citing your sources.			
Respect copyright - for example, by requesting the necessary permissions to reuse images.			
Set up a monitoring strategy, such as alerts configured in databases, subscriptions to journals tables of contents, etc.			
Critically evaluate a scientific article.			

9. How often do you use each of the skills below? Choose the most appropriate answer for each item:

	Never	Sometimes	Often
Find appropriate documents for your different information needs.			
Create advanced search strategies on a topic (Boolean operators, truncation, exact expressions, etc.) to query bibliographic databases.			
Know how to avoid plagiarism by properly citing your sources.			
Respect copyright - for example, by requesting the necessary permissions to reuse images.			
Set up a monitoring strategy, such as alerts configured in databases, subscriptions to journals tables of contents, etc.			
Critically evaluate a scientific article.			

10. After participating in CAP7005, how would you rate your level of knowledge regarding open access publishing? (Where 1 is “I know nothing about the subject” and 5 is “I know the subject very well”)

11. Have you put into practice the skills presented in CAP7005? If not, why not?

Yes, I put them into practice

No, but I plan to

No, I have not had time

No, I have not felt the need

No, I took the workshop too late in my studies

Other

12. Which specialized databases presented in CAP7005 do you still use?

None

Compendex  
Inspec  
Web of Science  
Other

13. Has CAP7005 prompted you to use bibliographic management software?

No, I was already using bibliographic management software before the workshop

No, I do not use any bibliographic management software

Yes, EndNote

Yes, Zotero

Yes, BibTeX

Other

14. Since taking CAP7005, have you ...

Choose the appropriate answer for each item.

	Yes	No
Consulted the guides on the Library website?		
Used the databases provided by the Library?		

#### OVERALL PERCEIVED IMPACT OF CAP7005

15. How much do you agree with the following statements? Choose the appropriate answer for each item.

	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	Do not know / No opinion
CAP7005 was useful and relevant to my research project (ex.: literature review).					
The time invested in CAP7005 was justified by the benefits I derived from it.					
CAP7005 has increased my confidence in my information skills and competencies.					
CAP7005 made me more aware of the services offered by the Library.					
Since CAP7005, I think I have used more of the services and resources provided by the Library.					

16. Name a Library service or resource that CAP7005 has introduced you to and that you particularly appreciate.

17. Would you recommend CAP7005 to your colleagues if it were not mandatory? (Where 1 represents “I do not recommend it at all” and 5 represents, “I highly recommend it”)

18. Are there any elements that you would have liked to add, remove or modify in the CAP7005 content?

Yes

No

19. Which ones ?

20. Do you have any other comments or suggestions about CAP7005 and its capacity to contribute to your academic and professional development?

### **Focus group questionnaire**

#### **Priority 1:**

1. Did CAP7005 help you with your research project? If so, how? If not, why not?
2. What did you retain / what do you remember from CAP7005?
3. Do you have any suggestions for improving the workshop?
4. How can we better help students develop their skills in evaluating scientific articles?

#### **Workload**

5. Think about the other workshops you’ve taken. Do you find that the overall workload (class hours, readings, assignments) for CAP7005 is comparable to other courses? If not, please explain.
6. Did you do the prior readings? Did you find them useful? Should some of this content be taught in class instead of a prior reading?

#### **Priority 2:**

7. Did CAP7005 help you prepare for meeting with your supervisor to talk about the progress of your research project?
8. Following CAP7005, do you feel more comfortable contacting the Library? Using our specialized services? If not, why?

#### **Interaction**

9. What do you think of classroom interaction? (Quick questions in class, discussion / exchange time...)

#### **Free comment period**

**Priority 3:**

Is there anything else you'd like to tell us?

**Supplementary questions:**

1. Did the open access content presented in CAP7005 motivate you to publish in open access or motivated you to think about publishing in open access in the future? Have you talked to your supervisor about that?
2. In CAP7005, we presented several Library guides. Do you use these guides? Do you have any comments on them? Which guides did you use?
3. How do you keep informed about new developments in your field? Do you use any of the techniques presented in the workshop? Which ones do you use?