

Questioning CRAAP: A Comparison of Source Evaluation Methods with First-Year Undergraduate Students

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Abstract: Librarians and instructors see college students struggle with evaluating information and wonder how to best teach source evaluation in a one-time course integrated library research session to ensure understanding and improve student performance. This research compared multiple sections of first-year students over two semesters taught two evaluation methods: the CRAAP method, and the six journalistic question words. Results indicate that students taught to evaluate information using the six question words produced better end-of-semester papers. Results of the pre-, post-, and end-of-semester quizzes were less conclusive, but do highlight some of the challenges first-year students face when determining credibility. Results have the potential to inform instructional practice.

Keywords: evaluating information, instruction, six journalistic question words, information literacy

Evaluating information is a critical information literacy proficiency that students use not only in college, but after graduation for the rest of their lives (Hart Research Associates, 2015). Instructors and librarians observe students' struggle with evaluating information especially during their first-year (for example, Jankowski et al., 2018). Students have trouble differentiating which information is the best evidence for their purpose and whether the information is credible. A Stanford study found high school students had difficulty differentiating fake from real news sources and college students were swayed into believing sources were credible if they looked polished (Wineburg et al., 2016). Project Information Literacy found that, while students do evaluate the information they find, 77% only look at whether the information is up-to-date, and 61% ask friends and family members when they need help evaluating information (Head, 2010).

The authors of this study have all taught first-year students and reviewed papers and projects containing inappropriate or inadequate sources to support claims. The authors' research question was relatively simple: is there a "better" way to teach source evaluation to first-year students in a one-time course integrated library research session that could lead to student learning and retention of concepts?

For this study, the CRAAP and six question words (6QW) were chosen for comparison for several reasons. The CRAAP checklist is a long-standing (Blakeslee, 2004), ubiquitous evaluation method. CRAAP appears numerous times in a Google search of library research guides on evaluating sources. Online information literacy assignment repositories like CORA (Community of Online

Research Assignments) and the ACRL (Association of College and Research Libraries) Framework for Information Literacy Sandbox both have multiple assignments that specifically mention CRAAP. The checklist is so popular that it has moved beyond libraries and library instruction to other units within higher education (for example, writing centers (Purdue University)). Additionally, while originally developed in a higher education environment (Blakeslee, 2004), it is now used by K-12 (for example, Curtis High School and Santarosa). The six question words, also known as the Five W's or the Journalistic Six (Wikipedia, "Five Ws") were also chosen due to their ubiquity. A Google search of "journalistic question words" brings up hundreds of results.

Anecdotally, the authors have employed checklist methods, such as CRAAP, in the past, but found students were not engaging with the sources as critically as hoped. The authors were all familiar with the six journalist question words (who, what, where, when, why, how) and wondered if it would provide, not a checklist, but rather a framework for evaluating information. In other words, would the structure of the 6QW allow for schema creation (Gerjets et al., 2009) by linking something known (six question words) to new information (critically evaluating sources) more effectively than a mnemonic device (CRAAP) leading to "better" source evaluation? To test this research question, teaching librarians collaborated with a business instructor who coordinates and teaches multiple sections of a business first-year seminar to deliver course embedded library research sessions teaching either the CRAAP method or the six journalistic question words.

Literature Review

The literature is robust with varied source evaluation methods. Relevant to the present study is the extensive presence of checklist approaches. The CRAAP method (Currency, Relevance, Authority, Accuracy, Purpose) (Blakeslee, 2004), the CARS Checklist (Credibility, Accuracy, Reasonableness, Support) (Harris, 2018), and RADAR (Relevance, Authority, Date, Appearance, Reason for Writing) (Mandalios, 2013) are just a few of them. While memorable, checklist methods have come under criticism as not being adequate for the current information landscape (Caulfield, 2017; Crum, 2017; Ostenson, 2014). They require a binary "good" or "bad" mindset without allowing for nuance (Lenker, 2017; Meola, 2004). Additionally, although they have catchy acronyms, they are not easily remembered (Lenker, 2017; Radom & Gammons, 2014). To address these deficiencies, Lenker (2017) proposes combining these methods with a developmentalist approach, so that students learn through the evaluation process, questioning sources and not just looking for sources to support their position. Wichowski and Kohl (2013) refute claims of inadequacy and argue that the CRAAP checklist is useful for students new to research.

Others have proposed alternatives to these checklists. Results from Radom and Gammons' (2014) study suggest employing the 6QW which may not only allow for more meaningful and nuanced evaluation, but may also be more easily remembered by students than acronyms such as CRAAP. Meola (2004) proposes a contextual approach using three techniques: promoting peer- and editorially-reviewed resources, comparison, and corroboration. Metzger (2007) suggests a dual processing model that involves assessing how the source fits within the larger body of information as well as iterative models of evaluation. Russo et al. (2019) developed an evaluation strategy based on information containers, and cues, questions, to help students evaluate based on the container. Strand and Wishkoski (2020) employ a problem-based learning approach. Introduced in 2017, another relatively new evaluation method is the SIFT (Four Moves) fact-checking method (Caulfield, 2019). The SIFT method (Stop; Investigate the source; Find better coverage; Trace claims, quotes, and media to the original context) draws on methodologies fact checkers use to evaluate information on the web, a method that has been adapted by some librarians (Fielding, 2019).

Beyond discussion of evaluation methods, how have CRAAP and the 6QW been taught to undergraduate, especially first-year, students? There are a few examples in the published literature. Henry et al. (2015) taught a first-year English class to analyze websites using CRAAP. Berg (2017) in a 75-minute library research session, teaches first-year students to evaluate an article from a website using the CRAAP checklist (Berg, 2017; Padgett, 2017). Lewis (2018) used CRAAP as part of a two-part library instruction session in an undergraduate science writing course to evaluate the sources for their assignment. In the session, students evaluate a blog post (Lewis, 2018). As mentioned, Radom and Gammons (2014) used the 6QW in a first-year composition course while Elmwood (2018) used them in a first-year information literacy course.

The bulk of the literature is situated around proposals for evaluation methods and research focuses on the effectiveness of the individual methods. For instructors wondering which is the best method for student learning and retention, the literature becomes a blur of various evaluation methods each with their own findings that state effectiveness. The present study is one of the few that examines evaluation methods in comparison to each other to determine which, if any, is most effective.

Method

The authors targeted multiple sections of a business first-year seminar course. One business instructor coordinates all sections of the business first-year seminar and teaches multiple sections of the course. The business librarian teaches a one-time library research session in all sections of the course. This ensured a similar experience between sections.

In Spring 2018, the authors piloted the methodology in two sections of the course. The authors created a pre- and post-library instruction quiz, as well as an end-of-semester quiz (see Appendixes 1, 2, and 3), which were integrated into Canvas course sites. The authors also developed a rubric for end-of-semester papers to assess depth of source evaluation (see Table 1). Students were asked to complete the pre-quiz prior to the library research session. The post-quiz opened two weeks after the library session. The end-of-semester quiz opened two weeks before the end of the semester. To encourage higher response rates, the business instructor gave participation credit to students for completing the quizzes. The business librarian exported quiz results and end-of-semester papers from Canvas course sites into a secure Box folder only available to the authors. The authors replaced student names with random numbers. The project was deemed exempt by University IRB.

At the end of the semester, the quizzes and end-of-semester papers were reviewed. Students misinterpreted some quiz questions, so the authors rephrased those questions for clarity in subsequent semesters. The authors tested and modified the paper rubric. Additionally, the authors read sample student papers in pairs and normed the rubric to ensure interrater reliability.

The course relies on a course-specific research guide embedded into Canvas course sites using the SpringShare LibApps LTI (SpringShare). The course research guide was identical between sections except for the evaluation page. One section displayed CRAAP, the other the 6QW. The course lesson plan was also the same for both sections except for the source evaluation section. The business librarian taught one section to evaluate sources using CRAAP, the other the 6QW each semester (Fall 2018, Spring 2019).

Table 1. Rubric for final student papers.

	Highly Developed (4)	Developed (3)	Emerging (2)	Initial (1)
<i>Sources used in the context they were intended (purpose, why) (relevance, what)</i>	Always distinguishes between types of sources (e.g., scholarly v. popular, fact v. opinion)	Usually distinguishes between types of sources (e.g., scholarly v. popular, fact v. opinion)	Does not consistently distinguish between types of sources (e.g., primary v. secondary, scholarly v. popular, fact v. opinion)	No distinction between types of sources (e.g., scholarly v. popular, fact v. opinion)
<i>Sources are appropriate (relevance, what)</i>	Does not over- or under-rely on the ideas of others or the work of a single author. Sources are always used in a way that provides evidence toward the argument.	May over- or under-rely on the ideas of others or the work of a single author. Most sources are used in a way that provides evidence for the argument.	Relies on too few or largely inappropriate sources	When included, sources are too few or badly inappropriate
<i>Sources are authoritative (authority, accuracy, who, where)</i>	Uses a variety of authoritative sources	Sources are used support claim(s) but may not be the most authoritative source to make claim	Many unsupported claims and clearly selected sources out of convenience	Does not explore outside sources or present evidence when called for
<i>Sources are timely for the research question (currency, when)</i>	Student utilizes current sources and/or data on the issue	Most information used is current, however some may be outdated	Most information used is outdated with no discussion of relevance in the paper	The student does not appear to have considered currency in selecting sources and/or data

Results

Pre-, Post-, and End-of-Semester Quizzes

A total of $N = 85$ students completed either the pre-quiz, post-quiz, or end-of-semester (EOS) quiz. Of the total, $n = 39$ took all three quizzes, $n = 58$ took the pre- and post-quizzes, $n = 42$ took the pre- and EOS quizzes, $n = 44$ took the post- and EOS quizzes (see Table 2).

Table 2. Percentage of pre-, post-, end-of-semester (EOS) responses for students introduced to source evaluation via CRAAP or six question words (6QW).

	CRAAP	6QW
Responded to Pre-Quiz (n = 71)	44%	56%
Responded to Post-Quiz (n = 74)	53%	47%
Responded to EOS Quiz (n = 48)	40%	60%
Responded to All Quizzes (n = 39)	36%	64%
Pre & Post Only (n = 58)	47%	53%
Pre & EOS Only (n = 42)	33%	67%
Post & EOS Only (n = 44)	41%	59%

The pre-quiz asked several background questions to ascertain student understanding of source evaluation and experience with library instruction (see Table 3). Prior to the business first-year seminar course: 87% of students in CRAAP sessions and 70% of students in 6QW sessions had not had a library session; and, 84% of CRAAP and 75% of 6QW students either had not used a library research guide, were not sure if they had, or did not understand the question.

Table 3. Pre-quiz background questions.

Have you had a library research session in your time at the university?	CRAAP (n = 31)	6QW (n = 40)
No	87%	70%
Yes	13%	30%
You indicated you have had a library research session. How many have you had?	CRAAP (n = 4)	6QW (n = 12)
1	75%	75%
2	25%	17%
3	0%	8%
Have you ever used a library research guide?	CRAAP (n = 31)	6QW (n = 40)
I don't know what you mean	6%	10%
I'm not sure	26%	20%

No	52%	45%
Yes (once or twice)	16%	20%
Yes (many times)	0%	5%

Question 4 of the pre-quiz asked students to identify the characteristics of a peer-reviewed article. Of five choices, three were correct. Each correct answer selected gained 1 point and deselection of incorrect answers gained 1 point for a maximum score of 5. Overall scores averaged above 3 (see Table 4). CRAAP students scored an average of 3.23 while 6QW students scored 3.33 on average. When broken out by those who indicated they had not had a prior library research session, averages were similar to the overall average (3.33 for CRAAP, 3.29 for 6QW). CRAAP students who indicated they had a prior library session scored much lower (2.5) than the average while 6QW students with a prior library session scored higher (3.42).

Table 4. Pre-quiz question of what a peer reviewed article means.

		Had a prior library session?								
		All Respondents			No			Yes		
Score		CRAAP	6QW	All	CRAAP	6QW	All	CRAAP	6QW	All
0		100%	0%	n = 2	50%	0%	50%	50%	0%	50%
1		33%	67%	n = 6	100%	50%	67%	0%	50%	33%
2		63%	38%	n = 8	100%	100%	100%	0%	0%	0%
3		35%	65%	n = 26	78%	76%	77%	22%	24%	23%
4		33%	67%	n = 12	75%	63%	67%	25%	38%	33%
5		53%	47%	n = 17	100%	63%	82%	0%	38%	18%
Average Score		3.23	3.33	3.28	3.33	3.29	3.31	2.50	3.42	3.19

In order to determine students' pre-existing knowledge on source evaluation, as well as determine the depth of schema creation, a question on the pre-, post-, and EOS quizzes asked students to list 3 to 6 criteria for evaluating resources. The answers were coded for alignment with criteria as listed in CRAAP and the 6QW for all respondents no matter which evaluation source they were taught (see Table 5). There was no marked difference between student responses and the evaluation method they were taught. The number of student responses referring specifically to either CRAAP or 6QW vocabulary in several areas dipped from the post- to the EOS quiz.

The evaluation criteria coded most often referenced authority, specifically who wrote something or where it was published. The top three criteria coded based on the CRAAP evaluation

model were authority, accuracy, and currency. The top three for the 6QW were who, where, and when. Students were less likely to mention reasons that could be coded as relevance, purpose, what, and why. Many students commented on looking for spelling, grammar, or appearance which falls under accuracy (CRAAP) and what (tone of document, 6QW).

Table 5. List 3 to 6 criteria for evaluating sources.

Criteria	CRAAP			QW			ALL		
	Pre	Post	EOS	Pre	Post	EOS	Pre	Post	EOS
Currency	43%	53%	50%	57%	47%	50%	n = 37	n = 45	n = 34
Relevance	0%	78%	40%	100%	22%	60%	n = 2	n = 9	n = 5
Authority	43%	52%	38%	57%	48%	62%	n = 67	n = 67	n = 47
Accuracy	43%	56%	28%	57%	44%	72%	n = 44	n = 43	n = 25
Purpose	63%	50%	50%	38%	50%	50%	n = 8	n = 18	n = 2
Who	42%	50%	53%	58%	50%	47%	n = 57	n = 54	n = 32
What	33%	48%	52%	67%	52%	48%	n = 15	n = 23	n = 33
Where	44%	57%	44%	56%	43%	56%	n = 48	n = 46	n = 34
When	43%	52%	47%	57%	48%	53%	n = 37	n = 42	n = 34
How	47%	51%	29%	53%	49%	71%	n = 34	n = 35	n = 21
Why	63%	80%	100%	38%	20%	0%	n = 8	n = 10	n = 1

All three quizzes presented students with a source and asked if they would use the source for their course research paper about current issues on that topic. The three sources were: pre-quiz, scholarly article from 1984 on drug addiction; post-quiz, web-based reference article on privacy published in 2013; EOS quiz, scholarly article on business ethics of privatized prisons published in 2017.

Overall 44% chose correctly in the pre-quiz, 52% in the post-quiz and 100% in the EOS quiz (see Table 6). Students who learned the CRAAP method performed better on the post-quiz, 76% chose correctly, versus 42% of the students who learned the 6QW.

Table 6. Would you use [source] for a research paper on the topic?

	Percentage of Respondents (shaded cell = best answer)	
CRAAP	Y	N
Pre-Quiz (n = 31)	58%	42%
Post-Quiz (n = 21)	24%	76%
EOS-Quiz (n = 19)	100%	0%
6QW	Y	N
Pre-Quiz (n = 40)	55%	45%
Post-Quiz (n = 52)	58%	42%
EOS Quiz (n = 29)	100%	0%
ALL	Y	N
Pre-Quiz (n = 71)	56%	44%
Post-Quiz (n = 73)	48%	52%
EOS-Quiz (n = 48)	100%	0%

Responses detailing the reasons why students would or would not use the source were coded using the following scheme (see Table 7):

- Incorrect use of criteria: 1
- Used criteria correctly & incorrectly, mostly incorrectly or missed a significant piece of criteria: 2
- Used correct or incorrect criteria, mostly correct: 3
- Used correct criteria: 4

The differences between students who learned CRAAP versus the 6QW and the evaluation methods used were not statistically significant for either average scores or change in scores (see Table 8). In other words, the higher performance by CRAAP students in the post-quiz who chose correctly to *not* use the source was not based on using evaluation criteria correctly.

Table 7. Average score of evaluation criteria for deciding a resource is suitable for a research paper (shaded cell = correct answer).

Would you use the article	CRAAP			6QW			Either		
	Yes	No	All	Yes	No	All	Yes	No	All
Pre-Quiz	2.13	3.50	2.77	2.16	3.57	2.90	2.14	3.54	2.84
Post-Quiz	1.75	1.75	2.04	2.04	2.20	1.97	2.09	1.75	2.00
EOS Quiz	3.06	NA	3.07	3.10	NA	3.07	3.09	NA	3.07

Table 8. Change in score on evaluation criteria for deciding a resource is suitable for a research paper.

Change in Score*	CRAAP	6QW	ALL
Pre-Quiz vs Post-Quiz	(0.68)	(1.00)	(0.85)
Pre-Quiz vs EOS Quiz	0.40	0.18	0.26

*T-Tests do not show a significant difference in Average Score or Change in Score between CRAAP vs 6QW.

When analyzing student responses to pre-, post-, and EOS quizzes as to how they evaluate sources, several themes emerged. Many students stated that website domain is a good indicator of credibility; they value .org and .edu as more credible than a .com website (see Table 9). Responses indicate that a number of students decided a source was valid to use if the citation format looked correct (Post-quiz 15% CRAAP, 35% of 6QW; EOS quiz 11% CRAAP, 10% 6QW). The quiz data also revealed that respondents judged credibility based on a source coming from a “safe database” like ProQuest (9% respondents, 12% CRAAP, 7% 6QW) or from the library website (9%, 12% CRAAP; 7% 6QW); 12% of respondents listed either ProQuest or the library website (21% CRAAP; 14% 6QW).

Table 9. Student responses mentioning domain name as a tool to evaluate credibility.

Domain Name	Pre-Quiz (n = 17)	Post-Quiz (n = 30)	EOS Quiz (n = 15)
CRAAP	26%	44%	32%
6QW	23%	37%	31%

Finally, responses indicate that students had a difficult time evaluating web resources. Evaluation scores lowered with the post-quiz, indicating that students had difficulty evaluating the non-scholarly resource, as opposed to the scholarly articles listed in the pre- and EOS quizzes. They failed to understand that the web resource in the post-quiz was a reference article. In fact, only one student recognized that the article was a reference source that should only be used if needed for providing a definition.

End-of-Semester Papers

The authors collected a total of $N = 88$ papers for analysis. For Fall 2018, $n = 26$ CRAAP and $n = 16$ 6QW papers were received. For Spring 2019, $n = 24$ CRAAP and $n = 22$ 6QW papers were received. Overall, papers written by students in the sections taught the 6QW outperformed students in the CRAAP on the rubric (2.81 versus 2.28 out of 4) (see Figure 1). The authors assessed the differences between CRAAP and 6 question word sections using one-way ANOVA (see Table 10). Results indicate that students taught the 6QW scored significantly higher on the rubric than students taught the CRAAP method ($F(1, 354) = 40.89$) (see Table 9) and that the difference was statistically significant at $p < 0.005$. Cohen’s $d = 0.10$ indicating a large effect size.

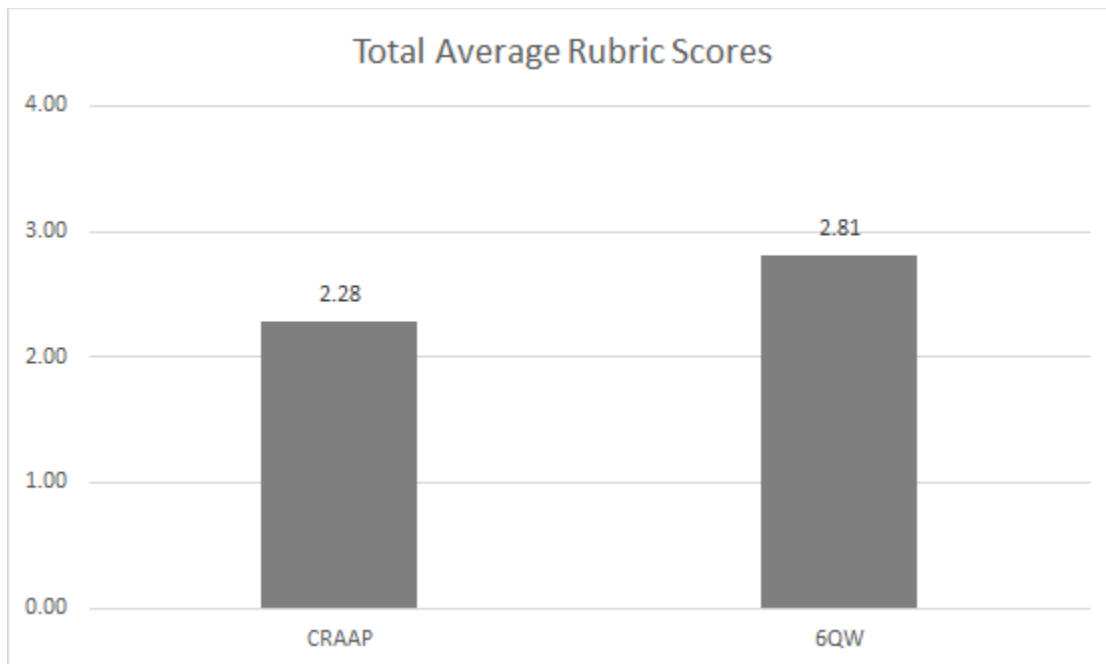


Figure 1. Total average rubric scores.

Table 10. ANOVA results for CRAAP and 6 question word overall rubric scores.

	SS	Df	Mean Square	F
Between	24.55	1	24.55	40.89*
Within	212.58	354	0.60	
Total	237.14	355		

* Statistically significant at $p < 0.005$.

The 6QW outperformed CRAAP in all four rubric criteria (see Figure 2). In three of the criteria, “Sources are authoritative” ($F(1, 85) = 23.45$; $d = 0.21$), “Sources used in the context they were intended” ($F(1, 85) = 20.29$; $d = 0.19$), and “Sources are appropriate” ($F(1, 85) = 15.03$; $d = 0.15$) the differences were statistically significant at $p < 0.005$. Cohen’s d for all three criteria was above 0.1 indicating a large effect size. Only the difference in the criterion “Sources are timely for the

research question” ($F(1, 85) = 1.78$; $d = 0.02$) was not statistically significant ($p = 0.18$) and Cohen’s d indicates a small to medium effect size.

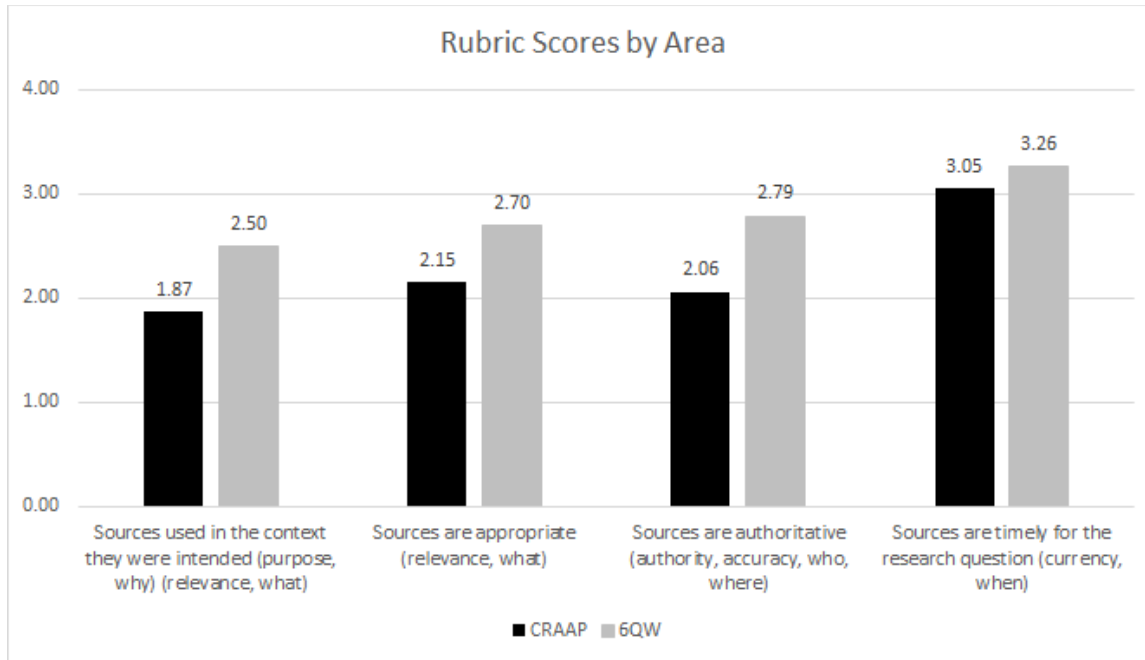


Figure 2. Rubric scores CRAAP versus 6 question words.

Discussion

Returning to our research question: is there a “better” way to teach source evaluation to first-year students in a one-time course integrated library research session that would lead to improved student learning and retention of concepts? The authentic assessment of student research papers indicates that sources chosen by students taught the 6QW were more appropriate than those chosen by students taught the CRAAP method, showing a significant difference when judging authority, context, and appropriateness. The easiest criterion to judge, timeliness, was the only one without a significant difference. It is not clear, however, if the difference in performance was related to the present instruction or the slightly higher percentage of 6QW students who had received prior library research sessions, as indicated in the pre-quiz, or other unknown factors.

The pre-, post-, and end-of-semester quiz results did not provide conclusive data as to which evaluation method was better for student learning and developing their evaluation skills. Both CRAAP and 6QW students scored about equally on the pre- and EOS quizzes. CRAAP students did score higher than 6QW students on the post-quiz, but analysis of students' answers for why they chose, or did not choose, the source revealed flawed logic, so the higher percentage of correct responses may be attributed to guessing.

Returning to schema creation and retention of evaluation method, as addressed in the literature review, acronyms and checklists have come under scrutiny as being difficult to remember. The present study found that students in the post- and EOS quizzes used the actual language of CRAAP and 6QW indicating there was some retention of concepts. Declines in language usage from the post- to EOS quizzes, however, indicate that concepts were not retained long-term. Specific mention of the words in the CRAAP acronym was higher than the specific 6QW possibly due to evaluation techniques learned in high school. Results add evidence to the criticism in the literature of acronyms and checklists

as inadequate in helping students develop deeper, more nuanced, critical thinking skills. In the present study, demonstrated retention of terminology did not necessarily translate into students providing a correct rationale for evaluating sources. Findings corroborated by others (for example, Kim & Sin, 2011; List & Alexander, 2018).

The results do provide insights that can inform professional practice and future directions of research. Students hold the belief that website domain is a good indicator of credibility; they value .org and .edu as more credible than a .com website. A tendency noted by other researchers (for example, Silva et al., 2018; Taylor & Dalal, 2014). Quiz data also revealed that a number of students decided that a source was acceptable to use if the citation format looked correct. This could mean students misunderstood the question or that students use accurate citations as a short-cut for source evaluation, not understanding that a correct citation has nothing to do with the credibility of a source. Something for the authors to consider is whether their teaching reinforces these beliefs as the percentage of students who refer to domain and citations increased from the pre-quiz to the post- and EOS quizzes.

Students who deem a source coming from a “safe database” like ProQuest or from the library website as credible is likely connected to students' reliance on domain as a short-cut proxy for credibility. This points to the need to explain to students that databases and the library provide a wide range of resources that offer differing levels of authority and that they must dive deeper into other aspects to determine credibility such as the author and the purpose of the writing.

Another concerning finding is that students had a difficult time evaluating less traditional resources (i.e., non-scholarly web resources) as demonstrated in the lowered evaluation post-quiz scores. Students failed to recognize that the web resource in the post-quiz was a reference article, which is acceptable to use for definition purposes but generally not appropriate as a source for college-level research papers, a point made during the instruction sessions. These findings add more evidence to the literature on students' struggle to identify and differentiate types of sources (for example, Evanson & Sponsel, 2019; Fleming-May et al., 2015; Radom & Gammons, 2014).

Conclusion

This study began with a relatively simple research question: which evaluation method (CRAAP versus the 6 journalistic question words) is most effective for student learning in a one-time course integrated library research session? Authentic assessment of students' end of semester research papers found that students taught the 6QW used more appropriate sources to support their arguments than students taught the CRAAP method. However, pre-, post-, and EOS quiz results found no difference between students' evaluation sophistication and thought processes.

As with any research, there were limitations to this study. Although the researchers made every effort to teach all sections the same, slight natural variations in content may have occurred. As mentioned, a slightly higher percentage of students in 6QW than CRAAP sections had previously had a library research session which may impact students' rubric scores. Additionally, lower quiz completion rates for some sections, and thus lower Ns, means some data may not be representative across all students.

While findings were mixed, and do not clearly identify which source evaluation method, CRAAP or 6QW, is more effective for first-year college students to learn, they do illustrate students' superficial level of evaluation. Quiz respondents showed that students largely use a source's overall appearance and website domain as sufficient criteria upon which to judge credibility, as opposed to utilizing the full evaluation methods taught in class. This finding leads to several concerns about source evaluation instruction to first-year college students:

1. What exposure have students had in evaluating sources in K-12? Are university instructors assuming an understanding that is not present?
2. Do students fully understand the importance of source evaluation and the implications of using less credible sources?
3. Are students relying on appearance and other superficial methods because they are less time-consuming, or because they do not have a clear understanding as to how to evaluate the sources more thoroughly?
4. Should source evaluation even be attempted to be taught in a one-time course embedded library research session, considering the students' clear tendencies to use less rigorous methods of evaluation, or is there a better way that librarians can collaborate with instructors in teaching research and writing to first-year college students?

Even though questions about the effectiveness of the one-time course integrated library research sessions are addressed in the literature (Artman et al., & Monge, 2010; Mery et al., 2012) many institutions (for example, Pierce, 2018) including the authors', still deliver a substantial portion of instruction in this manner. The authors believe that instructors working with first-year students should consider these questions and assess students' knowledge prior to introducing the topic of source evaluation in the classroom. When source evaluation is included as part of a one-time library research session, both the instructor and the librarian, where possible, should provide additional support and follow-up to reinforce concepts and develop deeper critical thinking skills.

Appendix

Appendix 1. Evaluating Information Pre-Quiz.

- 1) Have you had a library research session in your time at the university?
 - a) Yes
 - b) No
- 2) You indicated you have had a library research session in your time at the university. How many have you had?
 - a) 1
 - b) 2
 - c) 3
 - d) 4
 - e) 5 or more
- 3) Have you ever used a library research guide?
 - a) Yes (many times)
 - b) Yes (once or twice)
 - c) No
 - d) I'm not sure
 - e) I don't know what you mean
- 4) If an article is considered to be a peer reviewed article, which of the following would be correct? [check all that apply]
 - a) It is a scholarly journal.
 - b) It provides up to the minute research on current events.
 - c) Experts have reviewed the article prior to publishing to ensure soundness in research design.
 - d) It is written for a wide audience.

- e) It may also be called an academic article.
- 5) List and explain three to six things you evaluate to determine if a source is credible.
- 6) You are writing a paper about current issues in drug addiction. You find the following article: Murray, Glen F. "The Cannabis-Cocaine Connection: A Comparative Study of Use and Users." *Journal of Drug Issues* 14, (Fall, 1984): 665. ProQuest Central.
Would you use this article?
- 7) Please explain your answer to the previous question. Why or why not would you use the article for a paper you are writing about current issues in drug addiction.
Murray, Glen F. "The Cannabis-Cocaine Connection: A Comparative Study of use and Users." *Journal of Drug Issues* 14, (Fall, 1984): 665. ProQuest Central.

Appendix 2. Evaluating Information Post-Quiz.

- 1) List and explain three to six things you evaluate to determine if a source is credible.
- 2) If your class paper was about the topic of privacy, would the following source be appropriate?
Title: Right to Privacy: Constitutional Rights & Privacy Laws
Author: Tim Sharp, Reference Editor
Date: June 12, 2013
URL: <https://www.livescience.com/37398-right-to-privacy.html>
 - a) Yes
 - b) No
- 3) Please explain your answer to the previous question. Why or why not would the source be appropriate for your class project?

Appendix 3. End-of-Semester Quiz.

- 1) List and explain three to six things you evaluate to determine if a source is credible.
- 2) If your class paper was about the topic of privacy, would the following source be appropriate?
Surprenant, Chris W. "Policing and Punishment for Profit." *Journal of Business Ethics* (11, 2017): 1-13. doi:http://dx.doi.org/10.1007/s10551-017-3744-7. [Link to article in ProQuest.]
 - a) Yes
 - b) No
- 3) Please explain your answer to the previous question. Why or why not would the source be appropriate for your class project?

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