Container Collapse and the Information Remix:

Students' Evaluations of Scientific Research Recast in Scholarly vs. Popular Sources

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Introduction

The scientific communication lifecycle relies on recasting information through a variety of genres, from scholarly to popular, as scientific findings are translated for different audiences. In the past several years, this has become increasingly important as scientists recognize the need to broadly communicate their findings in order to demonstrate the broader impacts of their research and gain public trust. When students turn to search engines to locate resources for a science project, this means they often encounter similar information in a variety of containers, formats, and genres. This variety requires them to make nuanced judgments about which resources will help them as they begin their research, which to cite and incorporate into their project, and which are the most credible. Although a significant body of research addresses how scholars communicate with one another and how scientific information becomes news, little research examines how information consumers use and compare different iterations of the same information across the scientific communication lifecycle. This paper compares and contrasts 116 students' point-of-selection judgments of three resources recasting the same scientific content: an original research article, a news piece about the article in a scientific journal, and a news piece about the article in a popular magazine.

Background

The Lifecycle of Scientific Communication

Lievrouw's model of the scientific communication lifecycle incorporated three stages of scientific activity: conceptualization, documentation, and popularization.[1] In this model, conceptualization and documentation encompass scholarly communication, and popularization is the stage in which scientific information enters general public awareness and discourse. Lievrouw pointed out that most academic research tends to focus on either

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the relationship between the conceptualization and documentation stages or on the popularization stage as a separate entity, which seems to hold true today.[2]

Garvey and Griffith's model mapped out the process by which scientific information was communicated from the commencement of a project until it found its way into abstracts and reviews.[3] Given the increasing prominence of digital communication, publication, and storage, Hurd extended the model to scholarly outputs, including citations in the scholarly literature and on websites.[4] Bjork expanded on these models to create an exhaustively detailed model of the activities of seven actors involved in the scientific communication lifecycle: researchers, research funders, publishers, libraries, bibliographic services, readers, and practitioners.[5] Evaluating scholarly impact beyond citation, Lewison acknowledged the popular outputs that evolve from the dissemination of research results, such as newspaper articles, education, patents, clinical guidelines, government policy, and regulations.[6]

Despite the lack of thorough inclusion in scientific communication models, a large body of research has examined the communication of scientific information in the mass media. Particularly with the advent of online communication and new media, increased attention has been placed on methods of communicating scientific information and the quality of scientific information in the news. The news has a long history of misrepresenting science.[7] Often this is a combination of several factors—the process by which scientific work is determined to be newsworthy, the sensationalizing of science in the news, and the translation of science into non-specialist language—that has resulted in uneven coverage of scientific work and the misrepresentation of findings and implications.[8] While concerns about science news accuracy have been around for decades, definitions of accuracy vary, and news values of balance and objectivity are often at odds with scientific definitions of accuracy and consensus within a field.[9]

Numerous studies have indicated that the quality of science news is affected by press releases, which are themselves affected by the quality of article abstracts.[10] Yavchitz found that the main factor associated with distortion in the press release was distortion in the article abstract.[11] Exaggeration or spin in the press release was associated with misrepresentation and inaccuracy in science news.[12] Many press releases failed to include important information about limitations, the role of funding, and potential risks.[13] Brechman, however, found significant discrepancies between the information in press releases and the information reported in subsequent news coverage, suggesting that not all inaccuracy in science news can be attributed to pre-journalistic sources.[14]

Source Selection and Evaluation

Search engines have come to dominate practices for seeking information. Several studies have demonstrated that a resource's ranking in the search results pages influenced both the likelihood that it would be selected and its perceived credibility.[15] Teachers in elementary and secondary education struggled to teach online search as anything other than a practical skill, resulting in a lack of critical instruction about the role that search engines play in filtering and prioritizing available information.[16] Hargittai et al. found that in addition to showing significant trust in search engines, students also relied heavily on known brands to determine the quality of online information.[17] The students also relied heavily on established routines and patterns of information-seeking to find information that they felt they could trust on different topics.[18]

Credibility evaluation online is complex and multifactorial. Despite many students reporting significant evaluation of online resources, evidence suggests that they engage in little to no evaluation behavior and that those who report more evaluation actually engage in less.[19] Metzger, Flanagin, and Medders found that credibility judgments are often made socially, relying on others both online and offline to make such assessments.[20] Additionally, rather than thoroughly assessing the credibility of each resource individually, most people relied on cognitive heuristics that allowed them to make quick judgments about a resource's quality based on reputation, endorsement, consistency, expectancy violation, and persuasive intent.[21] Students also relied on .org, .gov, and .edu domains to help them determine credibility.[22] Those who used newspaper websites reported higher credibility ratings for online information than those who did not,[23] and news websites were rated the most credible.[24]

Both information skills and domain expertise affect these strategies for assessing credibility.[25] Those with domain expertise tended to focus more on content-level assessments, while those without domain expertise relied on more superficial indicators.[26] Individuals with better information skills used more surface features, but they were also more sensitive to the differences in low- versus high-quality articles.[27] Expertise also affects the evaluation of scientific information.[28] Undergraduate science students struggled to understand scientific journal articles and tended to avoid using them unless required.[29] When encountering scientific information, lay people have to rely on the expertise of others and must assess the credibility of the source providing that information.[30] In cases of conflicting information, they considered a variety of source characteristics to help assess the credibility not only of the sources but also of the information itself.[31]

Methods

The data for our paper were gathered as part of Researching Students' Information Choices: Determining Identity and Judging Credibility in Digital Spaces (RSIC), a four-year Institute of Museum and Libraries Services (IMLS)-funded research project. RSIC examines students' point-of-selection behavior (i.e., the moment a user determines a piece of information potentially meets a research need) when just beginning work on a science inquiry assignment about Burmese pythons in the Everglades. Six groups of students from fourth grade through graduate school participated in the study. Community college, undergraduate, and graduate students were Science, Technology, Engineering, & Mathematics (STEM) majors.

Our team created a search engine simulation to capture participants' decisions and used a think-aloud protocol to gather participants' thought processes as they progressed through a task-based research session. Participants in each student group were presented with a controlled set of search results and asked to determine the helpfulness, citability, credibility, and container of the resources. A short video demonstration of the simulation session can be viewed at: http://ufdc.ufl.edu/IR00010570/00001/video?search=rsic.

To complement the students' simulation data, we gathered pre-screen survey and interview data such as students' demographics, educational experiences, and information-seeking behaviors. The RSIC advisory panel, composed of STEM instructors and librarians, also assessed the citability, credibility, and container of all the resources for their respective education levels to provide an additional point of comparison.

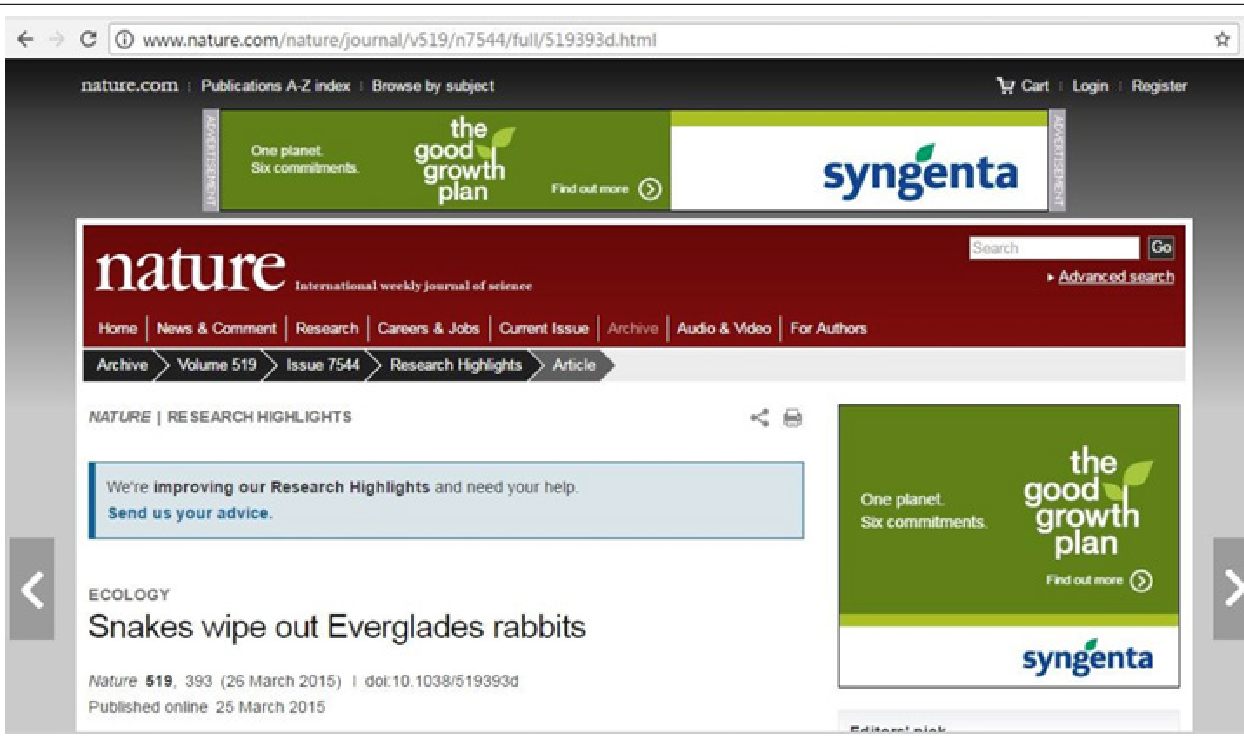
Data Collection and Analysis

For this paper, we selected three resources that demonstrate the transition of research from scholarly article to popular press. Only four student groups had all three resources in their search results, so we use data collected from the 116 participants in those groups: 26 high school, 30 community college, 30 undergraduate, and 30 graduate students. The three resources are:

1. "Marsh rabbit mortalities tie pythons to the precipitous decline of mammals in the Everglades"
   Proceedings of the Royal Society B: Biological Sciences (RSPB)
   This is the full-length original research article referenced in the two subsequent resources (figure 1). It was included in the simulation because it was relevant to the topic and came from a scholarly journal. In addition, it was authored by experts with backgrounds in the subject area and affiliations to academic institutions and government agencies. It displayed as search result 20 for adult student groups and 9 for high school.

FIGURE 1
Screen Capture of Proceedings of the Royal Society B: Biological Sciences (RSPB) Resource

FIGURE 2
Screen Capture of Nature Resource



2. "Snakes wipe out Everglades rabbits"
   Nature
   This resource was included because it was relevant to the topic and came from a recognized, scholarly journal (figure 2). However, this resource was part of the "Research Highlights" section of *Nature* and presents what could be considered a press release for the *RSPB* article. In addition, there is no author listed. It displayed as search result 32 for adult student groups and 18 for high school.

3. "Burmese Pythons are Taking Over the Everglades"
   TIME (Time)
   This resource was included because it was relevant to the topic and came from a widely recognized magazine (figure 3). It is authored by a *Time* contributing author with no background in the subject and offers a short report on the *RSPB* article using language geared towards a general audience. It displayed as search result 5 for adult student groups and 13 for high school.

FIGURE 3
Screen Capture of Time Resource

We analyzed data gathered during three of the simulation tasks. In the Helpful Task, the four student groups were given 40 resources across four search engine results pages and asked to select a prescribed number that they found most helpful. The high school students were asked to select 10 resources and all adult student groups were asked to select 20 resources. Those selections were then carried forward to the Cite Task, where the students were asked to determine whether or not they would cite the resources they selected as helpful. Resources that were not selected as helpful were automatically scored as "Not Citable". In the Credible Task, students were asked to rate the credibility of each of their helpful resources on a scale of 1 (Not Credible) to 5 (Highly Credible). Students' decisions during these tasks were recorded, along with their click behavior and the time they spent on each task. Demographic and research experience data collected during the pre-screen survey and simulation interview were also used. Cross-tabulations, logistic regression, and ordered logistic regression were performed using SPSS and R.

Results

Of the 116 participants, almost all students attended classes in person (93.10%). All but two high school students had access to libraries, librarians, and library websites at their school. Fifty three percent of the students were female, 44% male, 1% genderqueer, and 1% transgender. The remaining preferred not to answer. Fifty percent of the students were White/Caucasian, 20% Asian, 12% Latino/Hispanic, 9% Black/African American, 6% Mixed Race, and 1% Native American. The remaining preferred not to answer.

Comparison of Resources Within Groups

For each student group, table 1 reports the percentage of students who chose each resource as helpful. Each student who thought a resource was helpful was then asked to decide whether it was citable and to rate the credibility of the resource (table 1). The paragraphs that follow provide a summary of these results for each resource by student group.

TABLE 1
Cross Tabulations and Means by Student Group, Resource, and Task

	High School		
	Selected as helpful (%)	**Chose to cite (%)**	**Mean credibility rating**
RSPB	69	89	4.61
Nature	31	88	4.38
Time	65	82	3.94
	Community College		
	Selected as helpful (%)	**Chose to cite (%)**	**Mean credibility rating**
RSPB	73	77	4.50
Nature	43	46	3.69
Time	70	57	3.67
	Undergraduate		
	Selected as helpful (%)	**Chose to cite (%)**	**Mean credibility rating**
RSPB	87	96	4.62
Nature	43	77	4.08
Time	67	50	3.45
	Graduate		
	Selected as helpful (%)	**Chose to cite (%)**	**Mean credibility rating**
RSPB	83	100	4.64
Nature	53	88	4.63
Time	67	35	3.65

Note: Given the RSIC study design, the sample size varies across student groups, simulation tasks, and resources for the cross tabulations. For high school students, the sample size is n=26 for all resources in the Helpful Task. For the Cite Task and Credible Task, the sample size varies across resources: *RSPB* (n=18), *Time* (n=17), *Nature* (n=8). For the community college students, the sample size is n=30 for all resources in the Helpful Task. For the Cite Task and Credible Task, the sample size varies across resources: *RSPB* (n=22), *Time* (n=21), *Nature* (n=13). For undergraduate students, the sample size is n=30 for all resources in the Helpful Task. For the Cite Task and Credible Task, the sample size varies across resources: *RSPB* (n=26), *Time* (n=20), *Nature* (n=13). For the graduate students, the sample size is n=30 for all resources in the Helpful Task. For the Cite Task and Credible Task, the sample size varies across resources: *RSPB* (n=25), *Time* (n=20), *Nature* (n=16).

Approximately two-thirds of the high school students thought the *RSPB* (69%) and *Time* (65%) resources were helpful, in contrast to about one-third who thought the *Nature* resource was helpful (31%). Large majorities of the high school students who thought the resources were helpful also thought they were citable – 89% (*RSPB*), 88% (*Nature*), and 82% (*Time*). On a scale of 1-5, the average credibility ratings from students who thought they were helpful were 4.61 (*RSPB*), 4.38 (*Nature*), and 3.94 (*Time*).

Almost three-fourths of community college students thought the *RSPB* (73%) and *Time* (70%) resources were helpful, while only 43% thought the *Nature* resource was helpful. Seventy-seven percent of community college students who thought the *RSPB* resource was helpful also were willing to cite it. Only 57% of the students who thought the *Time* resource was helpful also thought it was citable, and less than half of the students (46%) who thought the *Nature* resource was helpful were willing to cite it. The average credibility ratings for the resources from the students who thought they were helpful were 4.50 (*RSPB*), 3.69 (*Nature*), and 3.67 (*Time*).

Eighty-seven percent of undergraduate students thought the *RSPB* resource was helpful, followed by the *Time* (67%) and *Nature* (43%) resources. Almost all undergraduates who thought the *RSPB* resource was helpful were willing to cite it (96%). A little more than three-fourths who thought the *Nature* resource was helpful would cite it (77%) and half of the students who chose the *Time* resource as helpful were willing to cite it (50%). Undergraduate students who thought the three resources were helpful gave the following average credibility ratings: 4.62 (*RSPB*), 4.08 (*Nature*), and 3.45 (*Time*).

Eighty-three percent of graduate students thought the *RSPB* resource was helpful. The *Time* (67%) and *Nature* (53%) resources followed. All the graduate students who thought the *RSPB* resource was helpful also thought it was citable. Although more graduate students rated the *Time* resource as helpful than the *Nature* resource, 88% of graduate students who thought the *Nature* resource was helpful were willing to cite it, while only 35% of those who thought the *Time* resource was helpful thought it was citable. The average credibility ratings for the three resources among those who found them helpful were 4.64 (*RSPB*), 4.63 (*Nature*), and 3.65 (*Time*).

Student results were compared with data collected from six of the members of the RSIC advisory panel representing high school, community college, and university instructors, and community college and university librarians. All advisory panel members agreed that the *RSPB* resource can be cited. The average credibility rating for the *RSPB* resource among the advisory panel was 5, compared to 4.59 across all student groups. The advisory panel disagreed about whether the *Nature* resource could be cited, with half deeming it citable. The average credibility rating for the *Nature* resource from advisory panel members was 4.67, compared to 4.19 across the students groups. Only one advisory board member, a high school instructor, thought the *Time* resource could be cited. The remaining advisory panel members, all affiliated with community colleges and universities, did not think it could be cited. For the *Time* resource, the average credibility ratings were approximately the same between the two groups: 3.67 for the advisory panel and 3.68 across the student groups.

Comparison of Resources Across Student Groups

From table 1, findings showed students across groups were in general agreement about the helpfulness of each resource. Across all student groups, the largest percentage of students found the *RSPB* resource helpful, followed by the *Time* resource and then the *Nature* resource. The citability and credibility tasks showed less agreement across the student groups. In general across the groups, the *RSPB* resource was the most citable, followed by the *Nature* resource and then the *Time* resource. Similarly, the average credibility rankings across the groups were highest for the *RSPB* resource, then the *Nature* resource, and then the *Time* resource. However, the magnitude of difference between the resources for both citability and credibility varied considerably.

Six logistic regressions, and three ordered logistic regressions, were run to consider whether education level affected students' decisions for a given task (table 2). Logistic regressions were used for the Helpful Task and Cite Task data because those two variables are dichotomous (helpful vs. not helpful and citable vs. not citable). Since participants were asked to measure credibility on a five-point ordinal scale, ordered logistic regression was employed for each of the three resources in the Credible Task. The results are shown in table 2. The regression coefficients, which are used to determine the direction and magnitude of the relationship, are shown for each variable. The standard errors, which are used to determine the statistical significance, are shown in parentheses under each coefficient.

TABLE 2
Logistic Regressions for the Helpful, Cite, and Credible Tasks

	Helpful [L]			Cite [L]			Credible [O]		
	RSPB	Nature	Time	RSPB	Nature	Time	RSPB	Nature	Time
Cohort	0.34 (0.33)	0.48* (0.21)	–0.15 (0.22)	0.75* (0.26)	0.58* (0.24)	–0.50* (0.21)	0.15 (0.23)	0.32 (0.31)	–0.25 (0.22)
Source Click	4.25* (0.91)	1.58* (0.53)	1.84* (0.52)	2.93* (0.75)	3.84* (0.92)	1.46* (0.54)	1.20* (0.51)	–0.26 (0.60)	–0.03 (0.52)
Librarian Help	–1.56* (0.72)	–0.57 (0.45)	0.41 (0.46)	–0.61 (0.51)	–0.68 (0.54)	0.37 (0.46)	0.62 (0.52)	0.20 (0.64)	–0.24 (0.46)
# of Projects	0.40 (0.28)	0.15 (0.18)	0.03 (0.19)	–0.05 (0.22)	–0.42 (0.24)	0.10 (0.19)	0.02 (0.22)	–0.10 (0.25)	–0.02 (0.20)
Open Web	–0.20 (0.63)	–0.01 (0.43)	–0.59 (0.45)	–0.54 (0.50)	0.65 (0.52)	–1.20* (0.46)	0.12 (0.47)	–0.03 (0.61)	–1.09* (0.45)
Confidence	0.29 (0.36)	0.22 (0.26)	–0.34 (0.28)	0.01 (0.26)	0.02 (0.29)	–0.13 (0.26)	0.45 (0.25)	0.43 (0.37)	0.38 (0.28)
Time on Task	–0.01 (0.02)	–0.06* (0.02)	–0.01 (0.01)	–0.08 (0.05)	–0.31* (0.09)	–0.12* (0.06)	0.03 (0.06)	0.08 (0.09)	–0.08 (0.05)
Intercept	–2.90	–2.40	2.27	–2.04	–1.30	2.96	–2.86	–3.53	–0.46
p(chi-sq)	0.00	0.00	0.01	0.00	0.00	0.00	0.05	0.64	0.10
N	116	116	116	116	116	116	91	50	78

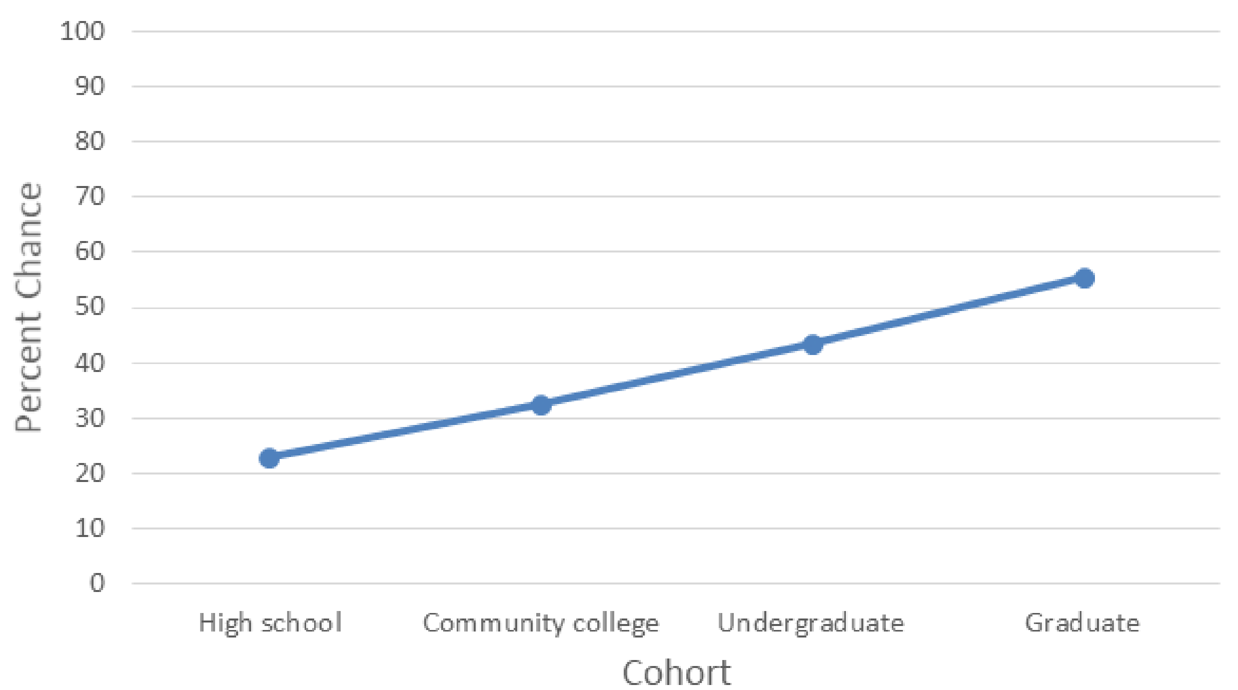
Note: The regressions for the Cite Task include all participants, with those who did not judge the citability of a resource because they did not select the resource as helpful receiving a score of 0 on the Cite variable.
*Significant at the 95% level of confidence
[L]Logistic regression
[O]Ordered logistic regression

These regressions allowed us to determine whether the differences among education levels were statistically significant, make controlled comparisons that account for the impact that other variables might have, and predict the independent impact that education level had on student judgments when these control variables, including task-related variables and research experience variables, are held constant. The task-related variables were whether students clicked on the resource during the task in question (Source Click) and how long they spent on that task (Time on Task). The research experience variables consisted of whether they had asked a librarian for help on a research project (Librarian Help), the number of research projects they completed in the last two years (# of Projects), where they went first to get information for their research projects (Open Web), and how confident they felt selecting online information for research projects (Confidence).

Helpful Task

For the Helpful Task, Cohort had a significant positive relationship with the *Nature* resource only, as shown in figure 4. In other words, students at higher education levels were more likely to select *Nature* as helpful. When all control variables are held at their mean, there is a 23% predicted likelihood that a high schooler would select the *Nature* resource as helpful. For graduate students, on the other hand, the predicted likelihood increased to 55%.

FIGURE 4
Predicted Probability of Finding Nature Resource Helpful by Cohort (N=116)



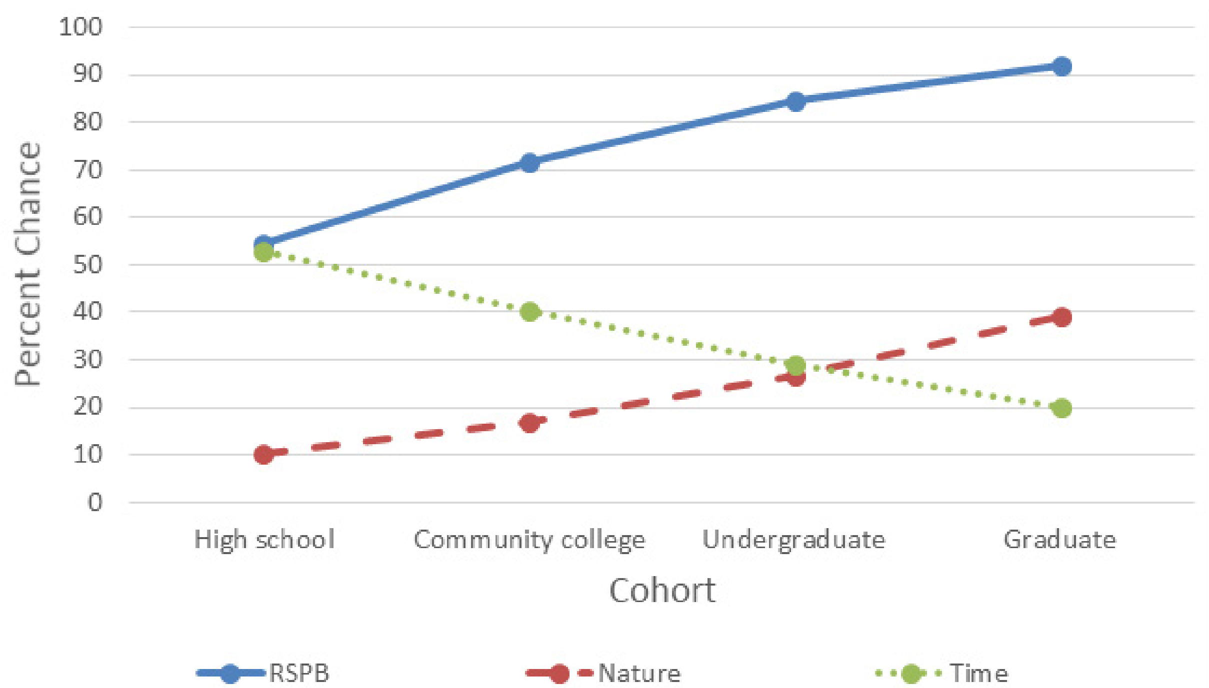
Interestingly, Time on Task had a significant negative relationship with the *Nature* resource. The longer a student spent on the Helpful Task, the less likely they were to select the *Nature* resource as helpful. Source Click had a significant positive relationship with all three resources. Students who clicked on the resource were more likely to select it than those who did not. A significant negative relationship also was found with Librarian Help and the *RSPB* resource; students who reported asking a librarian for help on their research projects were less likely to select *RSPB* as helpful.

Cite Task

For the Cite Task, Cohort had a significant relationship with all three resources. Specifically, students at a higher education level were more likely to cite the *RSPB* and *Nature* resources, but less likely to cite the *Time* resource. Figure 5 shows the predicted probability that students in each cohort would select each resource as citable when all control variables are held at their means.

Source Click again had a significant positive relationship with all three resources. Students who clicked on a resource were more likely to cite that resource. For the Cite Task, Time on Task had a significant negative relationship with the *Nature* and *Time* resources. The more time students spent on the task, the less likely they were to cite these resources. Interestingly, Open Web also had a significant negative relationship with the *Time* resource. This meant students who reported starting their search for information for their research projects on the open web were less likely to cite the *Time* resource.

FIGURE 5
Predicted Probability of Finding All Resources Citable by Cohort (N=116)



Credibility Task

For the Credibility Task, Cohort had no impact on the credibility rating for any of the three resources. The only significant relationships were Source Click and Open Web. Source Click had a significant positive relationship with the *RSPB* resource; students who clicked on the *RSPB* resource during the Credibility Task were more likely to give it a higher credibility rating. In contrast, Open Web had a significant negative relationship with the *Time* resource; students who started their search for information for their research projects on the open web were likely to give the *Time* resource a lower credibility rating.

Discussion

The overall ranking of resources across the three tasks appears to be linked to their characteristics, which are related to where each resource falls in the science communication lifecycle. Recall the *RSPB* resource was an original research article authored by experts in the subject with respected affiliations. The *Nature* resource was a summary of the original research in a reputable journal and provided a link to the article. However, it was the shortest of the three resources in length, amounting to a one-paragraph press release, had no author listed, and is not a widely known source to those outside STEM. The *Time* resource summarized the original article published in *RSPB* and provided a link to the article, but was written for general audiences by an author who was not an expert in the field.

Based on the amount of information in each resource, it is logical that students would select the *RSPB* resource as the most helpful and the *Nature* resource as the least. For the *Nature* resource, students with greater Time on Task were less likely to select it as helpful. This could be attributed to those students exploring the resource's content, which was quite brief, as opposed to more superficial cues (source, title, Google snippet, etc.). Conversely, the positive relationship between Cohort and the *Nature* resource suggests that those students further along in their academic careers experience brand recognition with this resource and may not go beyond the source when judging its helpfulness.

Perhaps unsurprisingly, the *RSPB* resource was also judged to be the most citable and the most credible across all student groups. After that, the trends from the Helpful Task reverse. Although deemed less helpful overall, the *Nature* resource was more citable than the *Time* resource. This again was positively correlated with Cohort, suggesting that older students recognized *Nature* as a respected source and their judgements heavily relied upon that knowledge. Our advisory panel was split on the citability of the *Nature* resource. Those against it pointed out that it was only a summary and wanted students to use the original article. Those for it alluded to *Nature*'s reputation and the fact that it was a peer-reviewed journal without mentioning the content. Our panel's reliance on source characteristics supports the idea that our older students may also be making decisions about the resource based on source characteristics rather than content.

The *Time* resource, despite being found more helpful, was judged both less citable and less credible than the *Nature* resource. The *Time* resource was written for a general audience, potentially making it more easily digestible and therefore more helpful for students seeking to understand a research topic. However, there are indications that the *Time* resource may not be reliable. The title, in particular, misrepresents the findings of the original article. While the title of the *Nature* resource is more sensational than the original article ("Snakes wipe out Everglades rabbits" versus "Marsh rabbit mortalities tie pythons to the precipitous decline of mammals in the Everglades"), it still reflects the original article's focus on rabbit deaths. By contrast, the title of the *Time* resource, "Burmese Pythons are Taking Over the Everglades," is both highly sensational and highly generalized, ignoring the original focus on rabbits to make an exaggerated claim about the ecosystem as a whole.

Advisory panel members had mixed views of the credibility of the *Time* resource. While the advisory panel considered *Time* a reputable source, they expressed concern about the lack of author credentials and the possibility of inaccurate translation from scientific to popular discourse. Additionally, they indicated that it would be better for students to cite the original research article than the *Time* resource. Interestingly, students who reported starting their research on the open web were less likely to find the *Time* resource citable and credible than those who start research with controlled sources. This suggests that these students may be more adept at filtering since they do it more regularly than those who start with more curated information systems (i.e., library databases).

For both the Helpful Task and the Cite Task, students who clicked on any resource were more likely to select it as helpful and citable. While the Helpful Task is more subjective, allowing students to determine what is helpful to them, it is somewhat surprising that students would still select the *Nature* resource despite clicking in and seeing how short it is. This trend for the Cite Task is even more surprising. Given the characteristics and content of the *Nature* and *Time* resources, we would expect that students who clicked into them would have been less likely to find them citable. What this may indicate is that students who click into a resource may not do so with any evaluative intent, but instead to read or otherwise consume information non-critically. It may also be that students are more likely to click on resources that they already view favorably. This suggests that clicking on a resource is not a good indicator of a student's critical engagement with that resource. Time on Task, which was negatively related to the helpfulness of the *Nature* resource and the citability of both the *Nature* and *Time* resources, seems to be a better indicator of the depth of students' evaluation of resources.

Cohort was only found to be significant for all three resources in the Cite Task. Students at higher education levels were more likely to cite the *RSPB* and *Nature* resources, and less likely to cite the *Time* resource, than students at lower education levels. This indicates, as we would expect, that there are different expectations for what types of material should be cited by students at different education levels. This is reinforced by the fact that a much larger percentage of high school students found the *Time* resource citable than any other group, and the only advisory panel member who considered the *Time* resource citable was a high school instructor. Additionally, we found very similar patterns of credibility ranking among our advisory panel members and our students. While this suggests that students are largely conforming to the expectations of their instructors, it also highlights the need to provide instruction that tells students how those expectations change as they progress through education stages, especially during the transition from high school to college.

Conclusion

When students use search engines to locate resources for a science project, they often encounter similar, even duplicative, information recast in a variety of containers, formats, and genres. This paper only begins to explore and compare the judgements of such resources by students at the point of selection. Our future research will use the qualitative data from the RSIC project to provide a more holistic picture of what students are attending to when making judgments. We will be able to analyze not only when students click on a resource, but also what they are thinking while looking at the resource and how that ultimately informs their judgements. These findings will contribute to several priority areas identified in *Academic Library Impact: Improving Practice and Essential Areas to Research* by providing context and clarity to research questions around student discovery and information use and what role library instruction can play in facilitating student transitions.[32]

While students largely conform to the expectations of their instructors, especially in terms of credibility, they demonstrate a lack of deep exploration into resource content. Librarians can consider creating instruction that addresses the movement between looking at a resource in a search results list and clicking a link to engage more fully with the content at the point of selection. If our goal as a profession is to produce information-literate lifelong learners, then it is crucial that information literacy instruction encompass strategies for both curated and non-curated information systems (i.e., library databases as well as search engines). Additionally, librarians can continue to teach students at their given education level techniques to discern which resources best match students' information needs and facilitate students' understanding of "Information Creation as a Process" that often produces several types of resources with similar content.[33]

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