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**Author(s):** Kiili, Carita; Brante, Eva W.; Räikkönen, Eija; Coiro, Julie

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## **Citing as a Sourcing Practice: Students' Citing Self-Selected Online Sources in Their Essays**

Carita Kiili<sup>ab</sup>, Eva W. Brante<sup>c</sup>, Eija Räikkönen<sup>d</sup> and Julie Coiro<sup>e</sup>

<sup>a</sup>*University of Oslo*; <sup>b</sup>*Tampere University*; <sup>c</sup>*Malmö University* <sup>d</sup>*University of Jyväskylä*;  
<sup>e</sup>*University of Rhode Island*

**Abstract:** This study examined upper secondary school students' citations of self-selected online sources in their essays. Students ( $N = 140$ ) conducted online inquiry about either effects of social media on people's quality of life (SM), or allowance of genetic manipulation of organisms (GMO). Students, working either individually or in pairs, explored online sources with the help of a graphic organizer after which they composed their essays. To capture the quality of citations identified in the essays, they were evaluated in terms of accuracy and richness of source features. Further, regression analysis was used to examine the effect of topic, grade level, and work mode on the number and quality of citations. Results showed that students seldom cited sources in their essays, and when they did, citations were mostly accurate but less often rich in source features. When writing about SM, students most frequently cited media sources, while sources with ideological, political or religious motives were frequently cited in GMO essays. Students' grade and work mode predicted the number of citations and number of accurate citations.

**Keywords:** Sourcing, Online reading, Citing, Collaboration

As the Internet has become one of the most important venues for acquiring and sharing knowledge, today's educators are required to "teach students to be confident but cautious users of the Internet" (Harrison, 2018, p. 461). Consequently, much effort has been expended on assessing students' critical evaluation of online sources (Coiro, Coscarelli, Maykel, & Forzani, 2015; Mason, Scrimin, Tornatora, Suitner, & Moè, 2018) and on teaching critical evaluation of online sources (e.g., Perez et al. 2018; Walraven, Brand-Gruwel, & Boshuizen, 2013).

To become active citizens of the 21st century, students need to be educated to not only be responsible consumers of online information but also active creators of new knowledge (OECD, 2014). Thus, it is equally important to support students in becoming confident and cautious *communicators* of knowledge that they draw from the Internet. In other words, when sharing the results of their online inquiries, students should not only

communicate ideas that they have found but also indicate whose voice is behind those ideas. Consequently, this study sought to understand what kinds of online sources students cited and how they cited them in the essays that they composed either individually or in pairs. In addition, the study examined whether self-selected topic, grade level, and work mode were associated with the number and quality of citations.

### **Sourcing in Multiple Document Reading**

Sourcing practices refer to representing, evaluating, and using available or accessible information about the type of document or the sources of documents, such as publisher, authors' expertise, and motives (Bråten et al., 2018; Perfetti, Rouet, & Britt, 1999). The concept 'sourcing' can be traced back to Wineburg's (1991) study during which expert historians and high school students read a set of historical texts. Wineburg observed that high school students scarcely noticed source features, while experts interpreted the texts in light of source features when striving to corroborate information from multiple documents.

Building on the findings from research on reading in history, a group of reading researchers developed the Documents Model Framework (DMF) to highlight the importance of sourcing, in particular when seeking understanding of an issue from more than one document (Perfetti, Rouet, & Britt, 1999). The role of sourcing is based on the idea that texts are more than linguistic constructions; they are also social entities written by authors with specific backgrounds and intentions, and published in certain contexts, cultures, and points in time (Britt & Rouet, 2012). All these features contribute to the interpretation of the text and its trustworthiness (Bråten, Stadtler, & Salmerón, 2018; Wineburg, 1991).

Further, to build a coherent representation of an issue across multiple documents, skilled readers form a document model by integrating information from several documents while also attending to the sources of these documents (Perfetti et al., 1999). Paying attention to who was presenting a particular idea and whether other sources support or contradict that

idea helps readers to organize ideas into a coherent whole (Britt, Rouet, & Braasch, 2013). Often, a readers' representation of multiple documents is realized in a written product such as an essay, blog, or any other type of written text (Barzilai, Zohar, & Mor-Hagani, 2018). When composing these products, it is pivotal that writers cite their sources and also share relevant source information to facilitate an audience's interpretation of a newly composed text. Citations are, thus, affordances for "the next reader" to engage in sourcing. Conversely, if writers cite ideas encountered in their research without including important contextual affordances about those citations, these omissions make it increasingly difficult for readers to determine the underlying motives of the original author (see Ostenson, 2013). This study is significant in that it aims to tackle this issue head on to better understand the extent to which students include (or omit) critical details about author agendas and/or credibility in their sourcing practices.

### **Sourcing During Online Inquiry**

For this study, we conceived sourcing practices—when reading multiple documents in the context of an open web-based environment—as an online inquiry-based problem-solving task. Online inquiry refers to a set of complex processes that occur when individuals use the Internet to explore questions; search for, evaluate, and synthesize information related to those questions; and communicate to others what has been learned through inquiry (Brand-Gruwel, Vopereis, & Vermetten, 2005; Leu, Kinzer, Coiro, Castek, & Henry, 2013). During these processes, skilled readers attend to source features in order to use an appropriate selection of online texts to meet their information needs (Brante & Strømsø, 2018). Source features provide information about (1) the author and his or her characteristics and motives; (2) the setting where the online text was created, the date, and cultural context; and (3) the form of online text, i.e., language style and document type (Bråten et al., 2018; Perfetti et al., 1999).

Sourcing is interwoven throughout the entire online inquiry process. Sourcing practices that students engage in during initial parts of an inquiry are reflected in latter parts of inquiry, such as writing an essay. Table 1 shows how sourcing practices may appear during various online inquiry processes.

---TABLE 1---

In the present study, our focus was on communicating sources to the audience, and more precisely, on citing online sources in an essay. By citing sources, writers justify their statements and give credit to the original source (Strømsø & Bråten, 2014). It is the writer's responsibility to share accurate and sufficiently rich information about sources to ensure audiences can appropriately interpret the quality and diversity of the inquiry results (Strømsø & Bråten, 2014; Wineburg, 1991). This is especially important when citing online texts, where the hosting site's context (ideological, political, commercial) may change how content is interpreted (Castek & Manderino, 2017).

### **Previous Research on Sourcing During Online Inquiry**

Most research on adolescents' sourcing practices during online inquiry has focused on how readers evaluate links provided by search engines or evaluate the online text or both. Previous research suggests that some adolescents use superficial strategies when selecting and evaluating online texts (Coiro et al., 2015; Macedo-Rouet et al., 2019; Rouet et al., 2018). Some think-aloud studies have looked at the entire inquiry process when adolescents use the open Internet as an information resource for written products (e.g., Cho et al., 2017; Kirkpatrick & Klein, 2016). However, these studies focused on analyzing how students represent ideas originating from multiple online texts, while neglecting how ideas are cited in their essays.

In an intervention study (Perez et al., 2018) designed to enhance 9th graders' sourcing skills, students were taught how authors' expertise, motives and media quality can be used to

evaluate the credibility of a source. The intervention improved students' selection of links and evaluation of sources but not their citing of the sources. Citing sources in written conclusion was very rare both before and after the intervention implying that citing needs to be explicitly prompted. Studies of undergraduates suggest that even older students need support in becoming more familiar with citing practices (Britt, Wiemer-Hastings, Larson, & Perfetti, 2004; Knight-Davis & Sung, 2008). Problems in citing are related to using unsourced copied material in essays, mentioning distinct sources only rarely, and not providing explicit citations (Britt et al., 2004).

Collaborative online inquiry, where two or more readers search, evaluate and use multiple online sources to complete a task (see Coiro, Sparks, & Kulikowich, 2018), may also support students' engagement in sourcing during online inquiry. Students can benefit from each other's source knowledge and sourcing strategies in different online inquiry phases. In collaborative learning situations, negotiations about what sources to select, trust, use, and communicate may be especially fruitful (cf. Dillenbourg, 1999). Although computer-supported collaborative learning can be beneficial for students (Chen, Wang, Kirschner, & Tsai, 2018), there is still little evidence about how working together promotes sourcing during online inquiry. In previous work (Kiili, Coiro, & Rääkkönen, 2019), paired students' evaluation of online sources was found to be more active, versatile and advanced compared to students who worked individually. However, these results were true in one context, but not in another, to suggest that pairing students does not automatically enhance students' performance. This study serves to further examine whether collaboration promotes citing of sources, as part of online inquiry.

### **Present Study**

The present study was a part of the larger project designed to develop scaffolds and teaching practices for supporting upper secondary school students' online inquiry. To involve

teachers in the development of these practices, eight Finnish language arts teachers volunteered to participate in a half-day seminar. Teachers were introduced to the study's purpose and design, as well as to scaffolds included to support critical aspects of online inquiry. Then, the seminar continued with mutual planning of practical aspects of the online inquiry assignment that were later incorporated into a language arts course. To participate in the study, teachers selected one of two courses they taught, depending on which was more in line with task assignment objectives and the timing of study sessions. Final participants included first and second year students. First year students participated in a course that, among other goals, aimed to support finding and selecting useful and reliable sources for written or spoken products. The course for second year students aimed at deepening students' skills to analyze, critically evaluate and interpret different types of media texts and their purposes and persuasion.

For this study's task assignment, students had some freedom in choosing the inquiry topic. This was done because interest (Schiefele, Schaffner, Möller, & Wigfield, 2012) and topic-relevant prior knowledge (Bråten, Anmarkrud, Brandmo, & Strømsø, 2014; Ozuru, Dempsey, & McNamara, 2009) play a positive role in reading. Further, because many studies suggest that collaboration supports learning (Chen et al., 2018; Lou, Abrami, & d'Apollonia, 2001), we also aimed to explore whether collaboration was beneficial for online inquiry. Within this larger project, the present study focused on examining four issues:

- 1) As students were able to select their topic, we examined *how students' prior knowledge and topic interest informed their selection of the inquiry topic from two available options.*
- 2) Because the study focused on students' citation practices during online inquiry, we investigated *the number of citations and source features across these citations in student essays, and the accuracy of students' citations.*

- 3) Instead of working with pre-selected texts, a common procedure of many studies exploring multiple online text reading (e.g., Bråten, McCrudden, Stang Lund, Brante, & Strømsø, 2018; Macedo-Rouet et al., 2019), students worked with self-selected online texts from the open Internet. Therefore, we explored *what source types were represented in students' citations?*
- 4) Finally, we examined *whether grade level, self-selected topic, and work mode predicted a) number of citations, b) number of source features across these citations, or c) number of accurate citations in the essay.* Grade level was selected as a predictor because second graders have taken two additional language arts courses (providing more experience in the academic practices) compared to first graders who are just beginning to acquire more advanced academic practices. Obviously, we expected second year students to perform better in citing sources. As previous research has shown that topic familiarity matters for students' attention to source features (Bråten et al., 2018; McCrudden, Stenseth, Bråten, & Strømsø, 2016), we also examined whether the self-selected topic from two available options was associated with how students cited sources in their essays. We expected to find some differences in citations across two topics. Based on research showing that collaboration may have potential to support online inquiry (Kiili et al., 2019; Coiro, Sparks, Kiili, & Castek, 2018), we also expected that students working with a partner would show more advanced citing practices than individuals.

## **Methods**

### **Participants and School Context**

Participants were 140 voluntary Finnish students (73 females; 67 males) recruited from seven upper secondary schools. Thirty-six (25.71% of the sample; aged 15–17 years)

were studying in their first year, and 104 (74.29%; aged 16–18 years) were studying in their second year of upper-secondary school.

In the Finnish school system, after nine years of comprehensive school, students can apply to vocational school or to academic, upper-secondary school. The transition from comprehensive to upper secondary school is quite demanding because students are required to take more responsibilities in their studies and the study load is substantially larger. Especially, in the beginning of their first year, students are learning these new required practices. The school year is divided into six periods. In each period, students choose subjects to study from available courses. For example, there are six obligatory and three voluntary courses in language arts (each course consists of 38 class hours). One of the ten overriding objectives is that students are capable to critically evaluate different information resources and their usefulness, motives and credibility as well as to search and select relevant resources.

At the end of each period, students have an exam that can last multiple hours (e.g., 3 hours). Teachers grade each course with the scale from 4 (fail) to 10 (exceptional) by taking into account students' activities during the course and performance on the final exam. In the end of the upper secondary school, students' take national test (matriculation exams), where exams for each subject students take is six hours.

### **Online Inquiry Task Topics**

The task students completed in this study served as a final exam in their language arts courses. The exam session offered enough time for students to complete the complex task that normal classes could not offer (see Procedure section for details). Students were asked to use the Internet to explore one of two controversial topics: a) allowing the genetic modification of organisms (GMO) or b) the effects of social media (SM) on people's quality of life, and write an essay that weighed different perspectives on the topic and included their own, justified view. To increase students' engagement with the task, they were allowed to

choose the topic they preferred; students (individuals or pairs) chose GMO 33 times and SM 55 times.

### **Prior Knowledge, Topic Interest and Language Arts Grade**

To understand the reasons behind students' topic selection, we asked them to rate their prior knowledge level and interest on both available topics. Students were asked to evaluate their prior knowledge with a 3-item measure using a scale from 1 = not at all to 5 = a lot with the following items: 1) I have knowledge about, 2) I have read about, and 3) I have discussed about GMO / SM. From these items, a sum score was calculated. Topic interest was evaluated with one item using a scale ranging from not interesting at all (1) to very interesting (5). Students were also asked to report their previous language arts grade (observed range 5–10).

### **Digital Tool Supporting Online Inquiry**

The Online Inquiry Tool (Figure 1) was used to support students' online inquiry (Kiili, Coiro, & Hämäläinen, 2016). First, students added the given claim into the graph (i.e., GMO should be allowed or SM increases people's quality of life) and searched the Internet to find reasons for and against the claim within each perspective. Under each reason box, there was space for a link to the online source where students found a particular reason. In addition, the tool prompted students to evaluate the credibility of sources with the help of traffic lights: green indicating that the text appeared to be credible, yellow somewhat credible, and red not credible. After selecting a traffic light, a pop-up box appeared to prompt students to give reasons for their credibility evaluation of each source. These features were designed to help students attend to the content-source links. Finally, after completing the graphs, students were able to open a summary view of their graph and use it when composing their essay.

---FIGURE 1---

### **Procedure**

Before the exam, teachers introduced the Online Inquiry Tool and explained how to use different features of the tool with the help of an example topic. After this introduction, students practiced using the tool with two self-selected online sources on the example topic.

In the exam session, students, first, filled in a prior knowledge and topic interest questionnaire individually. Then, teachers assigned students to work either individually (36 readers) or in pairs (52 paired readers). Teachers were allowed to choose the work mode that best aligned with course activities.

Task instructions included information about task phases, available topics, and evaluation criteria. Students were asked to list their references at the end of the essay but instructions did not prompt them to embed citations in their essays. Criteria for evaluating essays included: essay organization, quality of argumentation, versatile use of sources, language and style, and quality of conclusion.

In the exam, students worked in two phases. In phase one (40–70 minutes), students searched for and explored Internet sources and filled in an argument graph embedded in the Online Inquiry Tool. In phase two (1.5–2.5 hours), students composed their essays while referring to notes. Throughout both task phases (searching and writing), students worked either individually or in pairs.

### **Data**

Data consisted of argument graphs ( $n = 88$ ) and essays ( $n = 88$ ) on GMO or SM composed by 1<sup>st</sup> and 2<sup>nd</sup> year students either individually or in pairs. Altogether, students' argument graphs about GMO ( $n = 33$ ) included 155 links to online texts ( $M = 4.70$ ;  $SD = 1.72$ ) representing 68 different texts. Graphs about SM ( $n = 55$ ) included a total of 302 links to online texts ( $M = 5.49$ ;  $SD = 2.69$ ) and they represented 163 different texts. All online texts were saved for later access to original sources. Unfortunately, one teacher misinterpreted our instructions, and therefore, we did not receive answers to prior knowledge and topic interest measures from 10 students.

## Qualitative Analyses

Citations were analyzed as follows: (1) We identified essay citations ( $n = 195$ ) and translated them into English. We counted the number of citations in each essay and formed the variable “Number of citations”; (2) We matched these citations to original online sources by tracing 189 citations; (3) We identified source features of each traced citation, counted them, and compared them to features of the original online text. This information was used to code each citation in terms of its accuracy and to count the number of source features in citations across the whole essay. Finally, (4) we categorized types of online texts represented by citations.

**Number of source features across citations.** First, the number of source features in each traced citation was identified and counted. The source features in citations represented aspects such as author’s name, credentials, expertise and affiliation, venue or publication, date, document type, URL-address, and purpose of the online text. Second, the number of source features across all citations in the essay was summed to form the variable “Number of source features across citations.”

**Accuracy of citations.** A citation was coded as accurate if source features were used in a precise manner without giving misleading or false information about the source that students had actually read and cited. The following citation is an example of an inaccurate citation: “*The news agency of Vatican announced 2003...*” (Student pair 291, GMO). This citation gives an impression that students have read a text provided by Vatican news agency. However, the student pair’s actual source was a liberal web magazine that also publishes anonymous texts. The example illustrates a situation in which the citation does not give any information about the actual document students read. From each essay, accurate citations were counted to form the variable “Number of accurate citations.”

**Categories for cited online texts.** Cited online texts were classified into nine categories according to their source: 1) websites of universities, research institutions, or scientific publications; (2) websites of organizations or associations; (3) company websites; (4) established media sources (e.g., newspapers); (5) other media sources; (6) Wikipedia; (7) user platforms; (8) sources with political, ideological, or religious motives; (9) websites of schools or teachers.

**Inter-rater reliability.** First, the first and second author coded all traced citations ( $n = 112$ ) from the SM essays together. Then, to establish inter-rater reliability, they independently coded all 77 traced citations in the GMO essays. The Kappa value for accuracy of citation was .72, and .84 for number of source features in citation. All disagreements were resolved by discussion.

### **Statistical Analyses**

The association between prior knowledge and topic interest with selection of inquiry topic was examined using paired samples *t*-test. Cohen's *d* (Cohen, 1988) was reported as a measure of effect size. Descriptive statistics for all variables are presented in Table 2. The relationship between topic, grade level, work mode, and language arts grade and quality of students' citations was examined with Poisson regression (Coxe, West, & Aiken, 2009) to account for the fact that our dependent variables were non-normally distributed count variables. Each dependent variable (number of citations, source features across citations, and number of accurate citations) was analyzed separately.

---TABLE 2---

Notably, all of our dependent variables were overdispersed (i.e. the variance of each outcome was larger than mean of that variable), thus violating the assumptions of standard Poisson regression (Coxe et al., 2009). The reason was a large number of zeros in each outcome, but reasons for the zero counts varied by outcome. Therefore, depending on the

reason, either negative binomial regression or zero-inflated Poisson regression was used as a method of analysis. Because the zero counts for *number of citations* and *number of source features across citations* were produced by one reason, that is, lack of citations in an essay, we used negative binomial regression to deal with the overdispersion (Coxe et al., 2009). It models the log of expected count of citations/source features as a function of independent/control variables while taking into account overdispersion. Furthermore, when analyzing number of source features, we additionally controlled for number of traced citations in the analysis, as number of source features could depend on number of citations student(s) provided in the essay. To simplify interpretation, regression coefficients were presented as incident rate ratios (IRRs). See Appendix for interpretations of IRR values.

For *number of accurate citations*, we used zero-inflated Poisson (ZIP) regression analysis (Coxe et al., 2009), as the variable value could be zero for two different reasons: Either the essay did not include any citations or the essay did include citation(s) but student(s) failed in providing accurate citations. ZIP regression model estimates two equations simultaneously: a basic Poisson regression model for the count model (including zeros from failing in providing accurate citations) and binary logistic regression model for the excess zeros (i.e. no citations in an essay). Results of the Poisson part of the model are presented as IRRs and statistical significance was determined by using 95% confidence intervals. Results of logistic regressions are presented as odd ratios (OR). See Appendix for interpretations for OR.

All regression analyses were conducted using Mplus (Version 8.0; Muthén & Muthén, 1998–2017) with the Full-Information-Maximum-Likelihood (FIML) procedure (Enders, 2010). FIML uses all available information in the data to estimate the model without imputing missing values. Model parameters were estimated using maximum likelihood

estimation with non-normality robust standard errors (MLR) (Muthén & Muthén, 1998–2017).

## Results

### Prior Knowledge and Interest on Inquiry Topics

Table 3 shows that on average, students perceived to have more prior knowledge on SM than on GMO,  $t(74) = -8.51, p < .001, d = 0.98$ . This was the case among those who chose SM,  $t(45) = -11.17, p < .001, d = 1.65$ , and those who chose GMO,  $t(28) = -2.19, p = .37, d = 0.41$ . However, students who selected GMO as their essay topic had more prior knowledge on GMO compared to students who selected SM,  $t(74) = 3.01, p = .004, d = 0.69$ .

Students had also a tendency to select the topic that they showed higher interest in. Students who chose GMO found it more interesting than SM,  $t(29) = 3.87, p = .001, d = 0.71$ , and the situation was opposite for those who selected SM,  $t(43) = -3.98, p < .001, d = 0.60$ . Thus, it seems that prior knowledge level and interest were reflected in students' topic choice.

---TABLE 3---

### Citations, Source Features and Accurate Citations in Students' Essays

Students collected, on average, 5.2 ( $SD = 2.4$ ) online texts in their graphs (SM:  $M = 5.5; SD = 2.7$  and GMO:  $M = 4.7; SD = 1.7$ ). Individuals collected, on average, 4.42 ( $SD = 1.83$ ) online texts whereas pairs collected, on average, 5.73 texts ( $SD = 2.61$ ). However, students cited these resources quite sparsely. Essays included, on average, 2.2 citations ( $SD = 2.2$ ) but as much as 33% of essays (29 out of 88) did not include any citations. About one fifth of essays (19%) were abundant in their citations, including at least five citations.

Citations included, on average, 2.17 ( $SD = 1.23$ ) source features. As much as 34.4% of citations contained only one source feature. However, some citations (7.9% of all citations) were rich in source features including at least four features. The total number of source

features across citations in essays was, on average, 4.66 ( $SD = 5.75$ ). From these citations, 83% were accurate.

### **Cited Source Types**

Table 4 shows how frequently students cited various source types. Students seemed to cite somewhat different types of sources when writing about GMO and SM. In GMO essays, sources with ideological, political, or religious motives were the most common source type, accounting for 54% of cited online sources. In SM essays, this source type was not used at all. Instead students cited most often media sources of which 29% were established media sources and 14% other media sources. Notably, students seldom cited websites of universities or research institutions, or scientific publications, in particular when writing about GMO (5%). In the SM essays, this source type was somewhat more often cited, accounting for 14% of all citations.

---TABLE 4---

### **Associations of Self-Selected Topic, Grade Level and Work Mode to Students' Citations**

Grade level and work mode predicted number of citations and accurate citations (Table 5). Second year students had 4.23 times more citations and 4.77 times more accurate citations than first year students. Furthermore, student pairs had 1.50 times more citations and 1.14 times more accurate citations than students who worked individually. None of the independent variables predicted number of source features across citations or having zero accurate citations. Topic or language arts grade was not associated with any aspect of students' citations.

---TABLE 5 ---

### **Discussion**

The present study examined students' citations in their essays; the sourcing practice which has received little attention in online inquiry research. We sought to understand what

kinds of self-selected sources students cited in their essays, how they cited them, and whether students' grade level, self-selected topic and work mode played a role in citing. First, we discuss core results and limitations of the study, and then, provide some instructional ideas for supporting students' citing practices.

Composing an essay on the basis of online sources is a result of a self-directed reading process in which each reader creates a unique reading path in an unbound information space (Coiro & Dobler, 2007). Our data demonstrated this: 88 essays across two topics were composed with the help of graphs for which students collected a total of 457 links representing 231 online sources. Even though students' graphs were quite rich in resources and graphs prompted students to record the source link and evaluate the credibility of selected sources in earlier phases of their online inquiry, students seldom cited sources in their essays (see also Britt et al., 2004; Knight-Davis & Sung, 2008). As many as 37% of essays did not include any citations. One reason that the tool was not able to better support citing relates to the fact that technological affordances do not automatically evoke students' effective use of these affordances. The value of these affordances needs to be carefully explained and modeled for students (Coiro, 2011). In this study, teachers had only limited time to introduce multiple features of the tool designed to support different aspects of online inquiry. Explicit instruction focused on citing while using the tool would have more likely fostered students' learning of citing practices.

Further, essay instruction did not include explicit sourcing prompts. Students were asked only to provide a list of references in their essays. This may be one reason why some students focused only on presenting ideas they had collected from the online texts. Sourcing prompts in the essay instructions might have helped students to better integrate appropriate citation practices into their task model (cf. Rouet, Britt, & Rudik, 2017). Previous research

has shown that sourcing prompts support citing (Bråten et al., 2018; Stadtler & Bromme, 2008), even with elementary students (Paul, Stadtler, & Bromme, 2019).

Even though students cited sparsely, those who included citations cited the sources mostly accurately. Most of the students' citations were not that rich in source features, and about the third of the citations contained only one source feature. This implies that there is room for students to pay more attention to features that could be communicated to readers. However, it depends on the source when determining how much information is enough for the reader to evaluate the credibility of the source used in the essay. This aspect of citing could be discussed by providing students with various examples, so that they could learn to calibrate their use of source features in their citations.

Our findings showed that students cited somewhat different types of sources in their essays when writing about GMO and SM. Of concern, half of students' citations in GMO essays represented sources with political, ideological, or religious motives without criticizing their potential biases. This happened even though students were prompted to evaluate sources they selected for their graphs. In GMO essays, students seldom cited universities or research institutions (5% of all citations). In SM essays, students did not cite sources with political, ideological, or religious motives at all. Instead the most cited sources were established media, organizations and associations. It might well be that selection of sources was guided by topic relevance. Students are often satisfied with sources containing information that matches the task assignment regardless of the expertise or motives of the source, even if students may show skepticism to the source credibility when evaluating it in the tool. This would be in line with previous research suggesting that students tend to rely more on relevance than source credibility (Kiili, Laurinen, & Marttunen, 2008) or personal experience (Bråten, Strømsø, & Andreassen, 2016).

Finally, regression analyses showed that students' grade level predicted number of citations and number of accurate citations. The second-year students had 4.2 times more citations in their essays than first-year students, and the proportion of students who did not cite at all was higher among first (56.5%) than second-year students (24.6%). Second year students are more exposed to academic writing practices, not only in language arts courses but also in other subjects, whereas first year students might not yet understand the importance of citing or are unfamiliar with citing practices. Therefore, students would benefit from teachers explaining the value of citing and introducing citing practices right at the beginning of upper secondary school. In contrast to our expectations, students' grade level was not associated with number of source features in their essays. One reason could be that second graders have been taught to add citations, but less emphasis has been put on how to embed multiple source features into these citations. Notably, student grades in language arts were not either associated with students' citations. One explanation for this might be that individual differences are blurred when students were paired. Another possible reason could be that learning how to cite is a practice with which all students need to be familiar, regardless of their proficiency in language arts.

Further, our results suggest that collaboration supported citing in the essays in some extent. Students who worked together had 1.5 times more citations, and 1.4 times more accurate citations than students who worked alone. Working with a partner offers opportunities to share knowledge on citing practices and also opportunities to jointly monitor that sources get cited (cf. Dillenbourg, 1999). These findings were in line with our previous work (Kiili et al., 2019) showing that collaboration also supported students' evaluation of sources. Thus, it seems that collaborative activities are worthy of consideration when designing instructional practices for sourcing during online inquiry. However, individual readers and paired readers performed equally well in terms of embedding sources features in

their essays. This might be due to unfamiliarity with citing practices that would allow students to pay attention to richness of their citations. If both members in a partnership do not have knowledge on these practices, working with the partner does not help.

### **Limitations**

Our study was an exploratory study embedded into regular classroom practices. This caused some limitations that could be addressed in future studies. First, we allowed teachers to decide work mode and students were allowed to choose the inquiry topic from two options. This resulted in uneven numbers of students in different conditions. The uneven representation of topic choice reflects students' inclination to inquire about what they probably find to be a more accessible topic. Future research would benefit from more controlled settings.

However, our study suggested that students tended to select the topic they are more interested in and one they feel comfortable with in terms of prior knowledge. Allowing students to select the topic may decrease any negative effect that lack of interest or prior knowledge may cause to inquiry processes. Second, as each student or student pair had a unique collection of sources, we were unable to compare the quality of students' source-content links. This issue could be addressed in studies with limited number of pre-selected sources. As we only measured students' perceptions of their prior topic knowledge and topic interest, these variables were only used to understand how these perceptions were reflected in students' selection of the inquiry topic. Future research should measure students' prior topical knowledge with more objective measures to be able to evaluate its role not only in students' topic selections but also in their actual citing performance.

Finally, we did not prompt students to embed citations in their essays. If prompted, we would probably have had more citations to explore for their accuracy and richness. In

spite of these limitations, this study was able to illustrate complexities of working in the open Internet with an unlimited amount of sources.

### **Instructional Implications**

Drawing on our results, there are a number of instructional implications likely to support students in high school or later in higher education. As many students in our study did not cite their sources, they may not necessarily have understood *why to cite*. Therefore, when teaching sourcing, it is important to demonstrate the value of sourcing in various phases of online inquiry, including communicating source information in essays (cf. Paul et al., 2017). This could be done by showing how interpretations of the same text can change when source information is added to the text example (Bråten, Brante, & Strømsø, 2019). Because understanding the value of sourcing is an important starting point, discussing why to source is as important as executing the sourcing practices. If students are taught only to mechanically follow citing conventions, they might miss the opportunity to engage in deeper levels of thinking, such as using source features to compare and contrast information as well as thinking of the underlying motives of texts.

Another reason for limited citations in students' essays might be that students did not know *how to cite*. Consequently, students can benefit from instruction that models the citing practices of successful writers. Modeling (cf. Coiro, 2011) could include the following aspects: kinds of source features that can be embedded in citations; critical source features in various situations; and how to cite in a way that arouses readers' interest. Seeing that some students confused first- and second-hand sources, those concepts might also be explained to students during modeling. After modeling, students could engage in discussions about what various source features can reveal about the source and the quality of its information.

Finally, it is also important to discuss with students *when to source* and encourage them to do so during the entire inquiry process. This helps students use source features in

selecting information, evaluating credibility of information, and interpreting information. Because sourcing during online inquiry demands cognitive resources and constant monitoring of one's activities (Barzilai & Strømsø, 2018), students can benefit from sourcing prompts that relate to diverse inquiry processes. Prompts can be offered in various forms, such as task instructions, work templates, or as part of representational tools. When students pay attention to sources through the entire online inquiry, they can build a coherent representation of the topic that includes links between the sources and content as well as links across the sources (Perfetti et al., 1999). This representation helps students cite sources to justify their arguments in their essays. Furthermore, when students learn to compare and contrast diverse voices and perspectives by making the source information available, they can offer a compelling reading experience to their audience.

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Table 1

*Online Inquiry Processes and Related Sourcing Practices*

Online inquiry process	Sourcing practice
Planning of the inquiry	Thinking of potential sources of information (who could talk about the topic and in what kinds of settings)
Locating information	Using potential sources to formulate search queries
Evaluating information	Using available source features provided on a search result page to predict the usefulness and credibility of sources
Synthesizing information from multiple online sources	Using source features to evaluate credibility of sources in order to select an appropriate collection of texts to work with
Communicating information	Building a coherent representation of the issue by comparing and contrasting information presented by different voices
	Communicating to an audience whose voices are shared by citing the sources

Table 2

*Descriptive statistics for studied variables: means (M) and standard deviations (SD) are presented for dependent variables and language arts grade, and percentages (%) for categorical independent variables.*

Dependent variables (observed range)	<i>M (SD)</i>
Number of citations (0–8)	2.22 (2.24)
Number of accurate citations (0–8)	1.78 (2.10)
Number of source features across citations (0–32)	4.66 (5.75)
Independent variables	%
Topic (0 = GMO; 1 = SM)	37.50; 62.50
Grade level (0 = 2nd year; 1 = 1st year)	73.86; 26.14
Work mode (0 = pairs; 1 = individuals)	59.09; 40.91
Control variable	<i>M(SD)</i>
Language arts grade (5–10)	7.80 (0.84)

Table 3

*Means (M) and Standard Deviations (SD) of Students' Prior Knowledge (PK, max. 15) and Interest (max. 5) on GMO and SM by the Selected Topic*

	Students who selected GMO		Students who selected SM		All students	
	PK <i>M (SD)</i>	Interest <i>M (SD)</i>	PK <i>M (SD)</i>	Interest <i>M (SD)</i>	PK <i>M (SD)</i>	Interest <i>M (SD)</i>
GMO	8.38 (2.36)	3.53 (0.78)	6.90 (1.85)	2.78 (0.86)	7.47 (2.16)	3.09 (0.90)
SM	9.48 (1.97)	2.82 (0.77)	10.44 (1.77)	3.40 (0.70)	10.07 (1.89)	3.17 (0.78)

Table 4

*Online Texts Cited in Essays According to Their Source Type*

Source type	GMO		SM	
	<i>f</i>	%	<i>f</i>	%
Sources with political, ideological, or religious motives	44	54.32	0	0
Established media sources	12	14.81	33	28.95
User platforms	6	7.41	7	6.14
Wikipedia	5	6.17	1	0.88
Websites of universities or research institutions, or scientific publications	4	4.94	16	14.04
Websites of schools or teachers	3	3.70	4	3.51
Organizations or associations	2	2.47	24	21.05
Company websites	1	1.23	11	9.65
Other media sources	0	0	16	14.04
Untraceable	4	4.94	2	1.75
Total	81	100	114	100

Table 5

*Results for Number of Citations, Source Features Across Citations, and Accurate Citations. Results of Negative Binomial Regressions and Poisson Part of The Analyses for Accurate Citations Are Reported as Incident Rate Ratios (IRR) Whereas Results Of The Zero-Inflation Part of The Analyses for Accurate Citations Are Reported as Odd Ratios (OR). In addition, 95% Confidence Intervals (CI) for IRRs and ORs are Computed. Statistically Significant Results Are Bolded.*

Independent variables	Number of Citations <sup>a</sup>	Number of Source Features across Citations <sup>a</sup>	Accurate Citations <sup>b</sup>	
			Number	No citations vs. No accurate citations
	IRR 95% CI	IRR 95% CI	IRR 95% CI	OR 95% CI
Topic (0 = GMO; 1 = Social media)	0.82 [0.57; 1.18]	1.27 [0.92; 1.76]	0.93 [0.69; 1.26]	1.48 [0.44; 4.94]
Grade level (0 = 1st year; 1 = 2nd year)	<b>4.23</b> <b>[2.38; 7.53]</b>	1.30 [0.74; 2.30]	<b>4.77</b> <b>[1.45; 15.69]</b>	0.71 [0.04; 12.37]
Work mode (0 = individually; 1 = pairs)	<b>1.50</b> <b>[1.02; 2.23]</b>	0.85 [0.62; 1.16]	<b>1.41</b> <b>[1.01; 1.96]</b>	0.92 [0.29; 2.94]
Language arts grade (mean centered)	1.19 [0.94; 1.51]	1.05 [0.86; 1.28]	1.14 [0.94; 1.40]	0.87 [0.50; 1.50]
Number of traced citations (mean centered)	-	<b>1.64</b> <b>[1.43; 1.88]</b>	-	-

*Note.* <sup>a</sup>Negative binomial regression, <sup>b</sup>zero-inflated Poisson regression. – not included in the analysis

<a href="#">Create new chart</a> <a href="#">Open chart</a> <a href="#">Save chart</a>	<a href="#">Append chart</a> <a href="#">Palette of Perspectives</a> <a href="#">Instructions</a>	<h1>Online Inquiry Tool</h1>
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**Claim**

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<span style="float: left; margin-right: 5px;">✖</span> <b>Perspective</b>	<b>Reasons for the claim</b>	<b>Reasons against the claim</b>	<b>Synthesis</b>
<div style="border: 1px solid black; padding: 5px; min-height: 40px;">&lt;Add perspective here&gt;</div> <div style="border: 1px solid black; padding: 5px; min-height: 40px;">&lt;Add questions that may help you to explore the issue&gt;</div>	<div style="border: 1px solid black; padding: 5px; min-height: 40px;">&lt;Add reason for the claim here&gt;</div> <div style="border: 1px solid black; padding: 5px; min-height: 40px;">&lt;Insert source information here&gt;</div> <div style="text-align: right; margin-right: 5px;"> <span style="display: inline-block; width: 10px; height: 10px; background-color: red; border-radius: 50%;"></span>  <span style="display: inline-block; width: 10px; height: 10px; background-color: yellow; border-radius: 50%;"></span>  <span style="display: inline-block; width: 10px; height: 10px; background-color: green; border-radius: 50%;"></span> </div> <div style="text-align: center; margin-top: 5px;"> <span style="background-color: #90EE90; padding: 2px 10px; border: 1px solid black; font-weight: bold;">Add reason for the claim</span> </div>	<div style="border: 1px solid black; padding: 5px; min-height: 40px;">&lt;Add reason against the claim here&gt;</div> <div style="border: 1px solid black; padding: 5px; min-height: 40px;">&lt;Insert source information here&gt;</div> <div style="text-align: right; margin-right: 5px;"> <span style="display: inline-block; width: 10px; height: 10px; background-color: red; border-radius: 50%;"></span>  <span style="display: inline-block; width: 10px; height: 10px; background-color: yellow; border-radius: 50%;"></span>  <span style="display: inline-block; width: 10px; height: 10px; background-color: green; border-radius: 50%;"></span> </div> <div style="text-align: center; margin-top: 5px;"> <span style="background-color: #90EE90; padding: 2px 10px; border: 1px solid black; font-weight: bold;">Add reason against the claim</span> </div>	<div style="border: 1px solid black; padding: 5px; min-height: 40px;">&lt;Write synthesis on the perspective here&gt;</div>
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**Why do you think so?**

<Write your justifications here>

OK

**Notes**

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Figure 1. Online Inquiry Tool.