When Experts Disagree: Sourcing Practices While Reading Conflicting Online Information Sources

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Abstract: Laypeople who use the Internet to learn about issues of personal or social relevance often encounter online information sources that present conflicting expert accounts. The aim of the current study was to provide a close observation of spontaneous sourcing practices while reading conflicting online information sources, to examine the relation between sourcing while reading and subsequent argument construction, and to assess the role of epistemic perspectives, topic interest, and topic knowledge in sourcing. 61 university students thought aloud while reading four blog-posts that provided conflicting accounts of a socio-scientific controversy. The findings revealed a wide range of sourcing practices. High sourcing participants made more sourcing activities, paid more attention to source characteristics, and made source-source comparisons. Higher levels of sourcing were found to be related to subsequent argument complexity. Epistemic perspectives and gender played a significant role in sourcing practices and highlighted their socio-cultural nature.

Introduction

The ubiquity of Internet and Web 2.0 technologies has created a contemporary learning challenge: On the one hand, information technologies have dramatically increased the abundance and variety of information sources that are available to laypeople who wish to learn about current issues. On the other hand, the diverse and conflicting nature of Internet sources often makes it difficult to make sense of their claims and to reach informed decisions. Effectively dealing with online information necessitates, therefore, acquiring digital literacy strategies, such as the ability to critically evaluate and integrate multiple information sources (Eshet-Alkalai, 2004; Goldman & Scardamalia, 2013). A crucial aspect of evaluation and integration strategies is the ability to form connections between sources and their contents: Knowledge construction from multiple information sources entails attributing information to specific sources and paying attention to the ways in which source characteristics, such as identity, expertise, perspectives, motivation, and credibility, impact the information presented (Rouet, 2006; Wineburg, 1991). However, multiple studies indicate that learners often ignore or downplay source characteristics and tend to focus on medium and content characteristics (Britt & Aglinskas, 2002; Gasser, Cortesi, Malik, & Lee, 2012).

Sourcing involves attending to and evaluating source information and using source information to interpret the content (Bråten, Britt, Strømsø, & Rouet, 2011; Britt & Aglinskas, 2002). Wineburg (1991) noted that sourcing provides anticipatory frameworks for the subsequent encoding of text. Although sourcing has been often studied in the context of reading historical documents, recent studies have focused on sourcing processes with varied types of documents, including online information sources (e.g., Goldman, Braasch, Wiley, Graesser, & Brodowinska, 2012; Strømsø, Bråten, Britt, & Ferguson, 2013). Sourcing studies often present learners with information sources of varying levels of expertise and authority, thereby highlighting evaluation of author trustworthiness. In the current study we were interested in examining what happens when learners encounter conflicting information sources written by authors of comparable expertise and authority. Such examination may help improve the understanding of how online readers process and evaluate source information as they learn about socio-scientific controversies. Additionally, the study examined whether or not sourcing matters in terms of argument construction and how sourcing might be related to learners' views of knowledge and knowing, to their topic interest, and to their topic knowledge.

Multiple Document Comprehension

The challenge of comprehending multiple information sources stems from the fact that these information sources often do not provide a single coherent account of the issue or situation at hand, but rather may provide partially or wholly inconsistent accounts (Rouet, 2006; Wineburg, 1991). For example, online searching about socio-scientific controversies, such as cell phone use or global warming, can yield numerous search results in which experts provide conflicting accounts and explanations. Therefore, source expertise and authoritativeness are necessary but insufficient criteria for evaluating and integrating online information sources about such controversies. Deeper understandings of author backgrounds and perspectives and of the supports they offer for their claims are needed. The *Documents Model* (Bråten et al., 2011; Britt & Rouet, 2012; Rouet, 2006) describes the structures and mechanisms of multiple document comprehension. In brief, the Documents Model proposes that readers construct an *Integrated Mental Model,* which integrates information across documents, as well as an

Intertext Model, which represents the documents and their relations. Constructing the Intertext Model involves forming a representation of each document (i.e. author and document characteristics, rhetorical goals, and key claims or position), creating source-content links (i.e. connecting source information to content and using that information to interpret the content), and creating source-source links between documents (i.e. comparing documents and noting similarities and differences). Although the Documents Model has been used as a framework in multiple studies, there have not been, to the best of our knowledge, many attempts to examine the model *in situ* using think-aloud techniques (cf. Strømsø et al., 2013). In this study we focused on examining how learners construct Intertext Models by analyzing spontaneous references to source representations, source-content links, and source-source links while reading.

Contributors to Multiple Document Comprehension

Several contextual and individual factors may contribute to multiple document comprehension. Source and content characteristics have been found to impact attention to and memory for sources. Specifically, conflicts between information sources have been found to increase source salience, source comprehension, and memory for sources (Braasch, Rouet, Vibert, & Britt, 2012). Interest in the topic may lead people to pay closer attention to messages, to evaluate their arguments and sources more carefully and critically, and thus improve document comprehension and memory for sources (Strømsø, Bråten, & Britt, 2010). Disciplinary expertise and topic knowledge may also affect learners' capacity to evaluate sources critically (Wineburg, 1991). Finally, learners' personal epistemology, that is, their thinking about knowledge and about how people know, has also been found to have an impact on source evaluation and multiple document integration (Barzilai & Zohar, 2012; Bråten et al., 2011).

In the current study, personal epistemology was conceptualized using a model proposed by Kuhn and her colleagues (Kuhn & Weinstock, 2002). In brief, this model distinguishes between three main epistemic perspectives: (1) absolutism— knowledge is perceived as objective, absolute, and certain; (2) multiplism — knowledge is perceived as subjective, relative, and uncertain; and (3) evaluativism— knowledge is perceived as combining subjective and objective aspects, and although it is uncertain can be evaluated and improved. Learners' epistemic thinking develops with age and schooling and is shaped by disciplinary standards as well as by socio-cultural values (Tabak & Weinstock, 2008). Learner's epistemic thinking includes both metacognitive knowledge, skills, and experiences regarding the nature of knowledge and knowing, as well as cognitive strategies and processes for reasoning about the epistemic characteristics of specific information, knowledge claims, and their sources (Barzilai & Zohar, 2014). Thus, reasoning about the reliability of specific information sources and about the justification and coherence of their claims are cognitive-level epistemic processes (epistemic cognition). Whereas learners' views regarding the certainty, sources, structure, and justification of knowledge and knowing are a meta-level epistemic knowledge (epistemic metacognition). Learners' epistemic metacognitive knowledge is proposed to interact with their cognitive-level epistemic processes (Barzilai & Zohar, 2012, 2014).

The Present Study

The goal of the present study was to observe and analyze learners' spontaneous sourcing practices as they read online information sources that present conflicting expert accounts regarding a socio-scientific controversy. In addition, the study examined some of the predictors and products of sourcing.

The study questions were:

1. To what extent do learners spontaneously attend to source information and process that information while reading conflicting online information sources? Specifically, do learners spontaneously form source representations, source-content links, and source-source links, while reading?
2. What are the characteristics of learners' sourcing practices?
3. Is sourcing while reading related to subsequent argument construction?
4. Is sourcing while reading related to learners' epistemic perspectives, topic interest, and topic knowledge?

Method

Participants

Participants were 61 Hebrew-speaking students from a distance learning university (64% female; 84% BA students; 16% MA students; mean age = 30.50 years, *SD* = 8.44).

Materials

The topic chosen for the study was the socio-scientific controversy regarding whether or not Israel should develop an extensive seawater desalination system to supply growing water demands. We designed several short blog-posts that were all based on authentic online sources. The blog-posts were of similar length, writing style,

and author expertise. All authors were presented as owning a doctoral degree and working as consultants to government departments and agencies. However, the authors presented conflicting arguments for and against desalination from different disciplinary perspectives (economic and environmental). Thus, in contrast to many previous sourcing studies, the sources were of similar expertise and authority, thereby focusing the attention on differences between source perspectives and positions.

Measures

Scenario-Based Epistemic Thinking Assessment: Learners' epistemic perspectives were measured using a scenario-based assessment that related to the desalination context (Barzilai & Weinstock, 2014). The assessment is a topic-specific measure of learners' epistemic metacognitive knowledge. Participants were asked to rate their agreement with typical absolutist, multiplist, and evaluativist views, on a scale from one to ten (e.g., an absolutist statement was "eventually there will be one right answer"). Internal consistency reliabilities of the scales were: absolutism, 10 items, α = .87; multiplism, 8 items, α = .85; and evaluativism, 10 items; α = .83. A score for each position was calculated based on the item mean. Mean scores were: absolutism, M = 7.49, SD = 1.54; multiplism, M = 3.39, SD = 1.66; and evaluativism, M = 6.76, SD = 1.62.

Topic Interest: Topic interest was assessed using a 10-item questionnaire by Mason, Gava, and Boldrin (2008) that was translated to Hebrew and adapted to the task topic. Items were scored on a six-point scale. Internal consistency reliability was α = .92. The topic interest score was based on the item mean, M = 3.76, SD = 1.03.

Topic Knowledge: We developed a multiple-choice test composed of 12 items, which related to the claims made in the blog-posts. Internal consistency reliability was α = .45 which is lower than desirable and may have resulted from the fact that the assessment tapped multiple areas of knowledge regarding desalination and Israel's water sources. The topic knowledge score was based on the sum of the correct responses, M = 4.75, SD = 2.09.

Argument task: Following reading, the participants were asked to write arguments presenting their position regarding the desalination controversy. The writing instructions were: "Please write an argument that addresses the question: Should the State of Israel continue to encourage the construction of seawater desalination plants? Present your position on this issue and justify it". The arguments were coded for complexity and the number of sources that the argument was based on.

- Argument complexity - Coding was based on criteria employed by Schwarz et al. (2003):
  - No sound argument (0 points) - A claim is not provided or no justifications are provided for a claim.
  - One-sided argument (1 point) - A single claim is supported by a reason or a series of reasons.
  - Two-sided argument with partial justification (2 points) – A claim and a counter-claim or a two-sided claim is presented but reasons are provided for only one of the sides.
  - Two-sided argument with full justification (3 points) - A claim and a counter-claim or a two-sided claim is presented and reasons are provided for both sides. The first two authors independently coded 40 arguments. Interrater reliability was Cohen's kappa = .92.
- Sources in argument - The number of blog-posts referenced in the participants' arguments was counted. Interrater reliability was Cohen's kappa = .74.

Procedure

All questionnaires, blog-posts and tasks were displayed on a computer screen via an Internet browser. Data collection was conducted individually. We used the think-aloud method (Ericsson & Simon, 1993) to tap learners' sourcing activity. Participants were instructed and trained to say everything they think or do as they read. If participants were silent for more than 15 seconds they were reminded to think-aloud, using prompts such as "please tell me what you are thinking". No other instructions or feedback were provided.

Coding Scheme

The unit of analysis was defined as a comment or a set of comments that relate to specific source information (Strømsø et al., 2013). The coding scheme was developed by adapting and expanding a coding scheme by Strømsø et al. (2013). Two main additions were made to the Strømsø et al. scheme: (1) Because readers made references to themselves as a source of knowledge, the reader was added as one of the possible sources; (2) Source-source link activities were added to the coding scheme. Interrater reliability ranged from Cohen's kappa .87 to 1.00. The coding scheme is provided in Table 1.

Table 1: Sourcing coding scheme

Sourcing process	**Category**	**Sub-category**	**Description**
Source represent-ation (SR)	Type of source	Present blog	Reference to the source of the current blog.
		Other blog	Reference to the source of one of the three other blogs.
		Other source	Reference to a source that is not part of the document set (e.g., a newspaper article previously read).
		Reader as source	Explicit and reflective reference to the reader as a source of knowledge (e.g., "*I remember that* after the last winter, the water level in the Sea of Galilee actually rose").
	Type of reference	Explicit	Clear and precise expression of source characteristics such as source name, profession, or affiliation (e.g., "Dr. Rabinovich, hydrologist").
		Implicit	Statements that indicate sourcing without precise verbalization of source characteristics (e.g., "S*he* says that…").
	Source character-istics	Expertise	Explicit reference to source expertise, qualifications, professionalism, prior experience, and knowledge (e.g., "They are all *doctors*…").
		Position	Explicit reference to source's stance regarding the desalination controversy (e.g., "It seems as if she is *for desalination*").
		Disciplinary perspective	Explicit reference to the disciplinary perspective or point of view of the source (e.g., "She has an *ecological* approach and not just an *economic* one").
		Motivation	Explicit reference to financial, professional, or social motivations and interests (e.g., "He may have *financial interests* …").
		Currency	Explicit reference to the time in which the blog was written (e.g., "I wonder if these blogs are *up-to-date*").
		Other	Any other source characteristic (e.g., writing style or familiarity).
	Sourcing activity	Attention	Mention of the above source information without any further consideration of source reliability.
		Evaluating source reliability	Explicit evaluation of the trustworthiness of the source (e.g., "I am thinking if *he is right or not*").
Source-content (SC) links	Sourcing activity	Predicting	Use of source information to anticipate information to appear in the blog (e.g., "*This is going to be different* because he is a consultant…").
		Connecting	Relating source information to a specific knowledge claim made in the blog (e.g., "*She writes that* the population is expected to grow").
		Interpreting	Using source information to interpret a specific knowledge claim.
		Evaluating content reliability	Using source information to evaluate the reliability of the blog's content (e.g., "I am not familiar with the data but I assume that *he is familiar*").
Source-source (SS) links	Sourcing activity	Comparing source claims	Comparing and contrasting specific knowledge claims made by the sources (e.g., "*In the previous blog they said* that the water wells were becoming salty *but here they say* that there are other water wells").
		Comparing source perspectives or positions	Comparing and contrasting source point of views, opinions, or positions (e.g., "She says that *desalination shouldn't be done* and the previous one said that it *should*").
		Comparing source character-istics	Comparing and contrasting source characteristics such as expertise, affiliation, or currency, not including source positions or perspectives (e.g., "Before there was someone who was employed in *the Water Authority* and he is an *economist*").
		Comparing source reliability	Comparing and contrasting the trustworthiness of the sources (e.g., "It seems as if *everyone is exaggerating a bit")*.

Results

Sourcing Profiles

The participants made a total of 219 sourcing comments that related to at least one document (i.e., present blog, other blog, or other source) while reading (3.6 comments per participant on average). However, examination of sourcing activities revealed substantially different patterns of sourcing. Using the Documents Model, four distinct sourcing profiles were identified:

Profile A - No sourcing – 12 participants (19.7%) made no sourcing comments at all.

Profile B - Minimal sourcing: Source representations only – 2 participants (3.3%) mentioned SR only without making SC or SS links. This profile was quite rare because SR were usually connected to blog content.

Profile C - Low sourcing: Source representations and source-content links – 20 participants (32.8%) mentioned SR and made SC links only. Participants in this group referred to the authors of the blogs, to their claims, and sometimes to their characteristics, but did not engage in explicit comparisons. For example:

> It is not clear to me if when *she* speaks of alternative sources *she* is speaking about desalination or something else… OK, so this is actually pro desalination… [Goes on to read another blog] I agree with what is written here… I'm not sure this is sufficient, such a solution…. OK… What *he* says is interesting… [P40; emphasizes by the authors]

Profile D - High sourcing: Source representations, source-content links, and source-source links – Lastly, 27 participants (44.2%) mentioned SR and made both SC and SS links. For example:

> It seems as if *she* has an *interest* in this because *she* is a *consultant to the Water Authority*… *Compared to the previous one, they* didn't mention the [pollution of the] water wells… It is clear that *she* supports desalination… [Goes on to read another blog] … This doesn't make sense, in *the first blog* they mentioned different data and the numbers don't work out… *Here they* don't talk about desalination and *they* do talk about other solutions… [P7; emphasizes by the authors]

Participants in the high sourcing profile also made considerably more sourcing activities. See Figure 1.

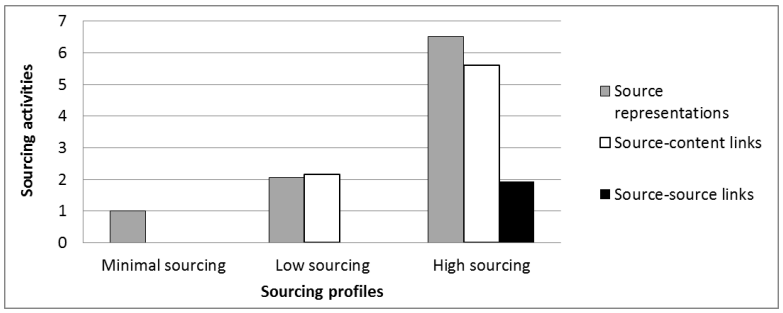

Figure 1. Sourcing profiles: Mean number of sourcing activities by sourcing process

Source Representations

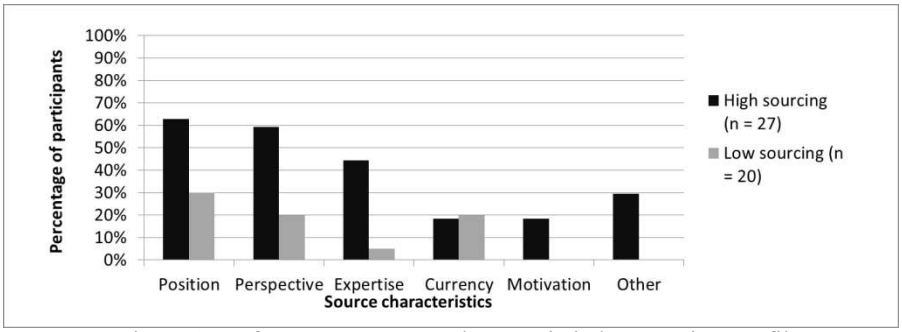

Figure 2. References to source characteristic by sourcing profile

The sourcing comments were overwhelmingly implicit (79.5% of the comments). However, high sourcing participants were more likely to make explicit source references compared to low sourcing participants, χ^2 (1, *N*

= 47) = 15.09, $p < .001$. High sourcing participants were also significantly more likely to mention other blogs in their sourcing comments than low sourcing participants, χ^2 (1, N = 47) = 35.66, $p < .001$. Lastly, high sourcing participants referred to a wider range of source characteristics. See Figure 2.

Sourcing Activities

Among SR activities, attention to the source (84.9% of the comments) was much more frequent than explicit evaluation of source reliability (15.1% of the comments). Figure 3 provides the percentage of participants who engaged in each sourcing activity. Low sourcing and high sourcing participants were equally likely to engage in simple attention activities. However, high sourcing participants were marginally more likely to reflect on source reliability, χ^2 (1, N = 47) = 3.64, p = .056. The predominant SC activity was creating connections between sources and claims, i.e., noting who says what (75.8% of the comments). Use of source information to evaluate content reliability was a much less frequent activity (12.3% of the comments). With a single exception, participants did not predict or interpret the content using source information. High sourcing participants made more SC activities than the low sourcing participants but there were no significant differences between groups in the distribution of SC activities. The most frequent SS activity was comparing source claims (13.7% of the comments), followed by comparing source perspectives or positions (6.8%), comparing source characteristics (2.7%), and comparing source reliability (0.5%).

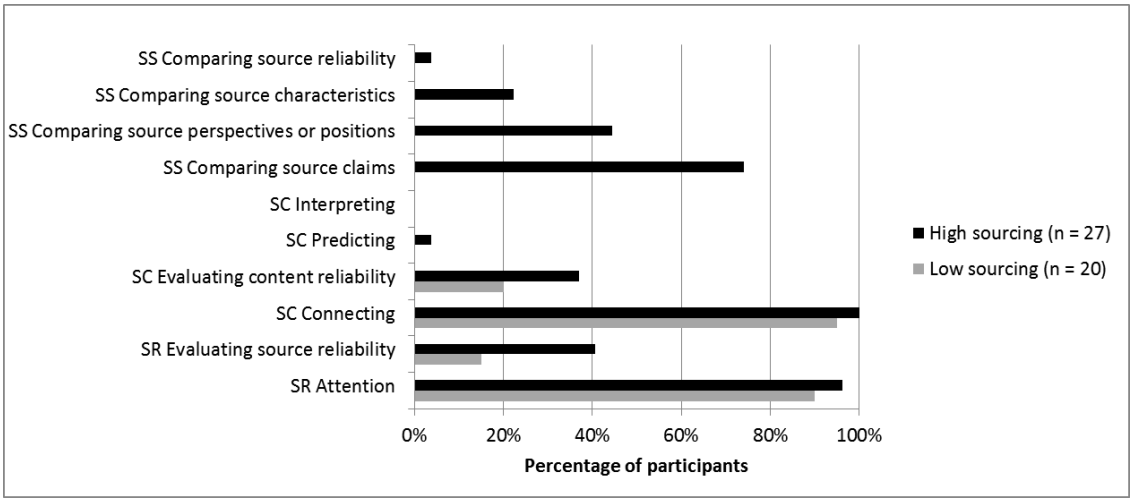

Figure 3. Sourcing activities by sourcing profile

Relation between Sourcing and Argumentation

In order to examine the relation between sourcing and argument construction we conducted ANOVAs with sourcing profile as a between-subjects variable (no sourcing, n = 12, low sourcing, n = 20, and high sourcing, n = 27) and argument complexity and argument sources as dependent variables. No effect of sourcing profile on the numbers of sources mentioned in the arguments was found. However, the effect of sourcing profile on argument complexity was statistically significant, $F(2,56) = 5.68$, $p = .006$, $\eta_p^2 = .17$. Post-hoc Tukey HSD tests indicated that high sourcing participants produced significantly more complex arguments, $M = 1.89$, $SD = .80$, than low sourcing participants, $M = 1.20$, $SD = .89$, $p = .013$, and no sourcing participants, $M = 1.17$, $SD = .58$, $p = .030$. No differences were found between no sourcing and low sourcing participants, $p = .993$. A possible explanation of the relation between sourcing and argumentation emerged from the participants' comments. Several high sourcing participants described in their arguments how source-source comparisons introduce epistemic doubt and promote an awareness of the complexity of the situation:

> *The articles presented contrary opinions that made me doubt the situation*. ... I am afraid that if financial aspects will dominate the ecological aspects we will destroy the ecological balance and create irreversible damages and *therefore I still have some reservations*… [P15; emphasizes by the authors]

> *My opinion is conflicted*. On the one hand, desalination has a positive aspect, and on the other hand, negative. My opinion is that we need to find the best solution, and when I say best I mean a solution that will cause minimal damage to nature while balancing the water sources. *I found it hard to base my opinion on what was written [in the blogs] because many positions and opinions were presented*. [P28; emphasizes by the authors]

Predictors of Sourcing

A multinomial logistic regression indicated that epistemic perspectives, topic interest, and topic knowledge were not significant predictors of sourcing profile (no sourcing, low sourcing, and high sourcing). We further examined the correlations between epistemic perspectives, topic interest, and topic knowledge, and specific sourcing activities among all participants who made document-related sourcing comments. Multiplism was found to be negatively correlated to SR activities, r_s = -.31, p = .031, and to SC link activities, r_s = -.31, p = .028. Accordingly, multiplism was also related to low attention to source characteristics, r_s = -.38, p = .007, and specifically to low attention to the positions and perspectives of the authors, r_s = -.31, p = .031, and to information source currency, r_s = -.33, p = .020. In contrast, multiplism was positively related to reference to the reader as a source of knowledge, r_s = .36, p = .012. Evaluativism was also positively correlated with references to the reader as source, r_s = .29, p = .040. However, evaluativism, in contrast to multiplism, was not significantly associated with document-related sourcing activities. Absolutism, topic interest, and topic knowledge were not correlated with sourcing activities.

Unexpectedly, gender was found to be related to sourcing profiles, χ^2 (2, N = 59) = 6.80, p = .033. Examination of sourcing profiles revealed that 29.7% of the women and only single man were included in the no sourcing profile, 35.1% of the women and 31.8% of the men were included in the low sourcing profile, and 35.1% of the women and 63.6% of the men were included in the high sourcing profile.

Conclusions and Discussion

A close examination of spontaneous sourcing while reading conflicting online information sources, revealed a wide range of sourcing practices. Some learners did not explicitly engage in sourcing as they read, whereas others actively engaged in the full span of Intertext Model building activities. High sourcing participants made more sourcing activities, paid more attention to source characteristics, and made source-source comparisons. However, even though high sourcing participants were aware of source characteristics and relations, they did not often employ source information in order to explicitly evaluate source and content reliability and to predict and interpret the content of the blog-posts. That is, even when learners did create Intertext Models, these were often loosely connected to an understanding of the text at hand and were not always used in order to construct an integrated understanding of the documents. Nonetheless, higher levels of sourcing while reading were found to be related to argument complexity, suggesting that sourcing while reading is an important practice when constructing knowledge from diverse information sources. Source-source comparisons may highlight differences between source positions and perspectives and thus promote knowledge construction. Additionally, such comparisons may introduce epistemic doubt (Bendixen & Rule, 2004) which can lead learners to consider and weigh alternate accounts.

A possible interpretation of our findings is that the authors' expertise might have conferred high reliability on the information sources and therefore may have negatively impacted learners' tendencies to evaluate source and content reliability. Further studies will be needed in order to examine how different types of contrasts between online information sources and different task conditions might affect sourcing practices.

The finding that multiplism is negatively related to attention to sources of the documents and positively related to attention to the reader as source of knowledge is in line with previous findings that views of knowledge as subjective and of justification as personal are related to lower attention to the sources of knowledge (Bråten, Ferguson, Strømsø, & Anmarkrud, in press). Evaluativism was also related to attention to the reader as a source of knowledge. However, evaluativist perspectives were not related to lower attention to the sources of the documents, suggesting that, in this case, awareness of the reader as source was balanced by attentiveness to additional sources of knowledge. Topic interest and topic knowledge did not emerge as significant precursors of sourcing, possibly because topic interest was sufficiently high in our sample and because the texts were self-explanatory and did not require extensive background knowledge.

The study revealed that not all learners spontaneously engage in sourcing. In our study, women were much more likely than men to adopt a position of silence (Belenky, Clinchy, Goldberger, & Tarule, 1986) vis-à-vis the authors/authority of the information sources they were reading. The finding that gender may have a role in sourcing was unexpected and requires further examination. However, this finding suggests that sourcing is a socio-cultural practice that is deeply related to how learners' view themselves as knowers in relation to expert authorities and to how they perceive their role in the knowledge society.

Design Implications

Our findings suggest that all learners might benefit from instruction aimed at fostering sourcing while learning with information sources. Promoting closer attention to source characteristics, consideration of their implications, and creation of source-source links appear to be particularly important aims for sourcing instruction. We propose that the design of such instruction needs to take into account not only the nature of online information sources but also learners' existing sourcing practices. These practices develop in the context of everyday use of the Internet for information seeking and reflect learners' views regarding what it means to

know and regarding their roles and goals as knowers in the knowledge society. Therefore, learning sourcing is not just acquiring a set of skills; it is also learning how to become a knower and a producer of knowledge in increasingly networked and information-rich communities. This reflection leads us to conjecture that sourcing instruction that addresses learners' epistemic perspectives regarding the nature of knowledge and knowing and regarding their roles as knowers in society might promote more active and critical sourcing.

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