Fostering secondary-school students' intertext model formation when reading a set of websites: The effectiveness of source prompts

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ARTICLE INFO

ABSTRACT

The present study examined whether a paper-based worksheet that provided source prompts fostered secondary-school students' intertext model formation, that is, their mental representations of sources and source-to-content links, in an Internet-reading context. In a classroom setting, $N = 45$ ninth-graders were tasked to read nine websites that differed in the type of source, in order to complete a worksheet with information from each site concerning an unsettled scientific issue. In addition to content information from the websites that should be filled into the worksheet, the worksheet provided source prompts to fill in website names and to classify the websites according to given source categories. To test the effectiveness of these source prompts, half of the students received a worksheet without such prompts. The study results indicate that students who had been working with the worksheet providing source prompts outperformed controls in their memory for sources, their discrimination between credible and less credible sources, and their mental representations of source-to-content links. To conclude, source prompts seem to be an effective way in supporting secondary-school students in the formation of an intertext model when reading a set of websites.

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1. Introduction

Offering a wealth of information on scientific topics, the Internet is increasingly being used by students to complete school assignments (cf. Julien & Barker, 2009; Kingsley & Tancock, 2014; Mason, Junyent, & Tornatora, 2014; Van Strien, Brand-Gruwel, & Boshuizen, 2014; Walraven, Brand-Gruwel, & Boshuizen, 2009). Information sources on the Internet, however, can vary widely in terms of their reliability and validity, as not only official institutions or scholars but also laypersons, journalists, or commercial information providers can publish information online. Hence, in order to avoid the formation of misconceptions based on inaccurate information, students need to consider information about the sources, e.g., about who provided the information and for what reason, and to integrate this source information into their mental representation of the Internet documents (Britt & Rouet, 2012). The purpose of the present study was to investigate the effectiveness of a paper-based worksheet intervention in supporting ninth-graders' reflection about and representation of sources in an Internet

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reading task. The worksheet that was implemented within a classroom context included written prompts to attend to and evaluate source information and to tag content for its source. Prompts in general are an instructional approach of providing scaffolds to execute certain strategies that learners already possess, but that they do not execute spontaneously (cf. Bannert, 2009; Glogger, Holzäpfel, Schwonke, Nückles, & Renkl, 2009).

1.1. The documents model framework

A theoretical framework that addresses the evaluation and representation of source information when reading a set of printed or digital documents is the documents model framework by Britt and colleagues (Britt & Rouet, 2012; Britt, Perfetti, Sandak, & Rouet, 1999; Perfetti, Rouet, & Britt, 1999; Rouet, 2006; Rouet & Britt, 2014). The documents model framework is an extension of the construction-integration model by Kintsch (1998) that describes how a reader constructs a mental representation of a single document. Britt and colleagues suggest that an adequate mental representation of multiple documents — in addition to the representation of the content of each single document — must include an additional layer, the *intertext model*. The intertext model contains document nodes and source-to-content links. Document nodes are a reader's mental representations of the documents' sources (i.e., source representations) and can include both objective information (e.g., the author's or the website's name) and evaluative information (e.g., suspected commercial interests) (Britt & Rouet, 2012). Source-to-content links are a reader's mental representations of which source says what. That is, through the construction of source-to-content links document nodes are connected to content, which allows qualifying content by its source (Britt & Rouet, 2012). In order to construct document nodes and source-to-content links (i.e., to form an intertext model) the reader needs to apply sourcing strategies. These include attending to and evaluating source information prior to or during reading of a document, interpreting contents based on source information, and tagging content for its source (e.g., Rouet & Britt, 2014; Strømsø, Bråten, Britt, & Ferguson, 2013; Wineburg, 1991).

1.2. Students' spontaneous reflection and evaluation of sources when reading multiple documents

Britt and colleagues (Britt & Rouet, 2012; Britt et al., 1999), however, do not expect every reader in every situation to form an intertext model. Instead they expect "students learning in school settings where they often see their task as one of learning about the topic" (Britt et al., 1999, p. 219) to rather generate a so-called *mush model* — especially if no prompts are provided to attend to sources. In such a mush model no source information but solely content information is mentally represented.

In line with this theoretical assumption, several empirical studies indicate that secondary- or high-school students and even university students only rarely attend to and represent source information spontaneously when reading multiple documents about historical or scientific issues (Britt & Aglinskas, 2002; Gerjets, Kammerer, & Werner, 2011; Kiili, Laurinen, & Marttunen, 2008; Maggioni & Fox, 2009; Metzger, Flanagin, & Zwarun, 2003; Nokes, Dole, & Hacker, 2007; Walraven et al., 2009; Wiley et al., 2009; Wineburg, 1991). In a thinking-aloud study, Maggioni and Fox (2009) found that high-school students working with multiple history texts mostly treated the presented documents as authorless and did not evaluate the documents' credibility, that is, the perceived ability (expertise) and intentions (trustworthiness) of the sources to provide accurate information (e.g., Danielson, 2006; Hovland, Janis, & Kelley, 1953). Further thinking-aloud studies by Kiili et al. (2008) with upper secondary-school students and by Walraven et al. (2009) with ninth-graders revealed similar results. The students mainly evaluated the online documents by content relevance, that is, whether or not the websites addressed the topic of their inquiry task. Results by Britt and Aglinskas (2002) also indicated a very low consideration of source information in high-school students when reading a set of history documents. Most students only rarely referred to the documents' sources in their notes taken during reading or in their post-reading essays and remembered only few sources correctly in a source-knowledge test taken after reading.

In contrast to students' detrimental spontaneous sourcing activities, Stadtler, Babiel, Rouet, and Bromme (2014) found that ninth-graders were well able to perform explicit sourcing tasks that required to identify sources in short news texts or to judge the sources' expertise. Furthermore, Keck, Kammerer, and Starauschek (2015) showed that secondary-school students expected information authored by an expert and presented on a university website as being of significantly higher quality than information authored by a high-school student and presented on a forum website. Similarly, Kammerer and Gerjets (2012a, 2014) showed in two studies that when high-school students were asked explicitly to judge the trustworthiness of different types of websites about a health-related topic, they were able to differentiate between a credible institutional website and less credible commercial websites. Still, they differentiated less between these websites in their credibility evaluations than university students (Kammerer & Gerjets, 2014).

In summary, although school students in principle might be able to identify and evaluate source information, without being prompted to do so, they seem to form only detrimental source representations and source-to-content links when reading multiple websites about historical or scientific issues. Thus, instructional approaches that prompt students to attend to and evaluate source information and to tag content for its source might be an effective way to promote the construction of an intertext model.

1.3. The instructional method of using prompts

Prompts can be defined as a kind of "scaffold" to support strategic learning (e.g., Bannert, 2007; Lin, Hmelo, Kinzer, & Secules, 1999). A central aim of prompting is to direct students' attention towards important aspects of their learning process and to reflect about them (Rosenshine, Meister, & Chapman, 1996). Therefore, prompts should increase students' awareness of otherwise unconsidered mental activities (Bannert, 2007). Bannert (2009) defined prompts as recall or performance aids. This means that prompts "stimulate cognitive, metacognitive, motivational, volitional, and/or cooperative activities" (Bannert, 2009, p. 140) that students are already able to execute, but that they do not execute spontaneously.

Prompting has a long tradition and is a common instructional method used in all kinds of learning paradigms (Bannert, 2009). Prompts can vary from general unspecific questions to explicit execution instructions (Bannert, 2009).Whereas Davis (2003) found that unspecific prompts were more effective than specific prompts in improving students' reflection on their learning and their understanding of the learning content, Glogger et al. (2009) found the opposite. Glogger et al. argued that particularly younger, less experienced learners might need more concrete instructions to guide their learning activities. Unspecific prompts, in contrast, might provide too little scaffold for them. Besides the issue of specificity, the timing of the prompts also matters (Bannert, 2009). There is empirical evidence that prompts are most effective when given during the learning process instead of before (e.g., Thillmann, Künsting,Wirth, & Leutner, 2009). Finally, it can be differentiated between cognitive prompts that support the direct processing of the learning content and metacognitive prompts that support learners' monitoring and control of their information processing (e.g., Bannert, 2007, 2009; Davis & Linn, 2000). For the purpose of the present study, we focus on a special kind of metacognitive prompts, namely *source prompts*, in the following.

1.4. The use of source prompts to promote students' intertext model construction

Source prompts aim to support students' reflection on and evaluation of information sources when dealing with multiple documents. Apart from comprehensive training programs that teach students over a time span of several weeks or months *how* to evaluate information sources when reading multiple printed or Internet documents (Argelagós & Pifarré, 2012; Gerjets & Hellenthal-Schorr, 2008; Kuiper, Volman, & Terwel, 2008; Nokes et al., 2007; Walraven, Brand-Gruwel, & Boshuizen, 2013), a few studies have examined short-term interventions that prompted students to critically evaluate information sources during Internet inquiry (e.g., Braasch, Bråten, Strømsø, Anmarkrud, & Ferguson, 2013; Britt & Aglinskas, 2002; Gerjets et al., 2011; Mason et al., 2014; Stadtler & Bromme, 2007, 2008; Wiley et al., 2009). As will be reviewed in the following, results of these studies indicate that the use of source prompts is a promising way to promote the construction of an intertext model when reading a set of documents.

In a study by Gerjets et al. (2011) that examined different kinds of thinking-aloud instructions, in one experimental condition university students were prompted to mention the evaluation criteria they applied to select search results and to assess websites during an Internet inquiry task. The instructions were given beforehand and were repeated during Internet inquiry in case that participants stopped talking. As compared to students that were only instructed to verbalize their thoughts, those that were prompted to mention evaluation criteria verbally reflected more about the credibility and up-to-dateness of the information sources and paid increased attention to user ratings displayed on web pages. However, no increased attention was drawn to references and author or publisher information. Britt and Aglinskas (2002) found that prompting college students only beforehand to attend to information about the authors and their potential biases or lack of knowledge when reading multiple historical documents did not improve their use of and memory for source information. As argued above, particularly for less experienced students it might be important to provide more specific prompts (Glogger et al., 2009) that furthermore are presented during learning (Thillmann, Künsting, Wirth, & Leutner, 2009; for a similar argumentation also see Stadtler, Scharrer, Macedo-Rouet, Rouet, & Bromme, 2016).

Indirect support for this assumption is given by a study by Stadtler and Bromme (2007; 2008). The authors examined specific source prompts that were provided by the computer-based tool *met.a.ware* while gathering information about a health topic. For each website visited, the application presented source prompts to judge the website author's expertise and potential biases as well as one's own trust in the information. These judgments had to be made before leaving a website. Study results with undergraduate students showed that, while not affecting students' factual knowledge and comprehension of the subject matter, the source prompts increased the degree to which students correctly recalled source information (Stadtler & Bromme, 2007; 2008). Furthermore, when asked to select their three preferred websites, students who had received source prompts more often justified their selection according to the source than controls. Similar results were achieved by Britt and Aglinskas (2002), Wiley et al. (2009), and Mason et al. (2014) who combined short training units about how to evaluate online information (including declarative information and interactive exercises) with source prompts.

After a tutorial on source evaluation, the computer application *Sourcer's Apprentice* by Britt and Aglinskas (2002) prompted students to fill in note cards with source information concerning the type of document, the publication date, the author, and provided references, while reading a set of historical documents. High-school students who had worked with the Sourcer's Apprentice cited more sources in their notes and in their post-reading essays and also performed better in a source-knowledge test taken after reading than control students. Similarly, in the studies by Wiley et al. (2009) and Mason et al. (2014) after a short training unit, students performed an Internet inquiry task while receiving prompts to judge the website authors' credibility as well as the scientific evidence of the information, and to write this information into a worksheet. Study results by Wiley et al. and Mason et al. with university students and ninth-graders, respectively, showed that after

having explored these websites, the intervention group differentiated more between the most credible and least credible websites than controls. However, from these studies it remains unclear whether the source prompts alone would have resulted in similar effects. Research by Graesser et al. (2007) aimed at answering this question in a sample of university students who conducted an Internet inquiry task on a scientific issue. While in a first study the authors only tested the provision of source prompts, in a second study they varied both the provision of source prompts and the provision of a preceding instructional unit between participants. In the condition with source prompts, a computer application prompted students during reading to judge the credibility of each website (cf. Stadtler & Bromme, 2007; 2008) as well as to fill in author information into an online form (cf. Britt & Aglinskas, 2002). The training unit provided didactic instruction and exercises on how to determine the credibility of websites. However, as indicated by the results of the two studies neither the source prompts nor the preceding instructional unit increased students' ability to differentiate between credible and less credible websites or their essay quality. It should be noted though, that students in all conditions were well able to differentiate between credible and less credible websites, as indicated by their judgments on rating scales.

Besides such direct interventions, Kammerer and Gerjets (2012b) examined an experimental search interface that grouped websites according to different source types, namely to subjective, objective, and commercial information. Results showed that when using this search interface undergraduate students who were asked to inform themselves about a complex medical issue accessed more objective websites (i.e., from official institutions) and less commercial websites than when the websites were presented in a regular list without any source classification provided. Whereas in the study by Kammerer and Gerjets (2012b) the categorization of websites according to source types was provided by the system, another possibility might be to prompt students to assign documents to such source categories by themselves.

1.5. The present study

The primary aim of the present study was to test an instructional material that prompts students during Internet inquiry to attend to and evaluate source information and to tag content for its source. Specifically, we aimed at testing the effectiveness of such source prompts to foster students' construction of an intertext model, that is, their mental representations of information about the websites' sources as well as about which source says what (cf. Britt & Rouet, 2012) when reading multiple websites about an unsettled scientific issue. Instead of examining a high-school or undergraduate population (e.g., Britt & Aglinskas, 2002; Stadtler & Bromme, 2007; 2008), we tested the instructional approach of source prompts with secondary-school students, specifically with ninth-graders (cf. Mason et al., 2014). In so doing, we wanted to investigate whether source prompts alone, without any training on how to evaluate information sources (Argelagós & Pifarré, 2012; Mason et al., 2014), could be beneficial in this age group. Related to this question, at a descriptive level we also wanted to examine how well ninth-graders were able to follow these source prompts.

Other than previous approaches that involved sophisticated computer applications (Britt & Aglinskas, 2002; Graesser et al., 2007; Stadtler & Bromme, 2007; 2008) we tested a simple paper-based worksheet that could be used in the classroom context independently of a specific software. In this paper-and-pencil-application, students were prompted to write down core ideas of each website together with the name of the websites (cf. Britt & Aglinskas, 2002) and to assign the websites to given source categories (cf. Kammerer & Gerjets, 2012b). Prompting students to write down the names of websites should foster students' awareness of the creators of a website, that is, who is responsible for its content. Assigning the websites to different source categories should increase their awareness for the heterogeneity of information sources on the Internet. This increased attention to the websites' sources triggered by the source prompts, should also stimulate students to evaluate the websites' credibility and to mentally represent the respective source information. Moreover, by tagging content to its source (by writing down core ideas of each website together with the name of the website), students should establish better source-to-content links, that is, remembering which website said what. This should enable students to analyze the content of the websites more critically in relation to the sources and to mentally represent the results of these reflections.

To test the effectiveness of our approach, a worksheet without source prompts was provided to a control group. This group was only prompted to fill in core ideas of the websites into the worksheet. Based on previous research (Britt & Aglinskas, 2002; Stadtler & Bromme, 2007; 2008), we expected that the worksheet that provided source prompts would result in the construction of a better developed intertext model than the worksheet without source prompts. Specifically, we hypothesized that students who had received source prompts, after reading would outperform controls in terms of their source representations, that is, their memory for sources (Hypothesis 1) and their discrimination between more and less credible sources (Hypothesis 2), as well as in their representation of source-to-content links (Hypothesis 3).

2. Method

2.1. Participants and design

Participants were 45 ninth-graders from a German secondary school (intermediate track). Students' average age was 14.91 years ($SD = 0.47$). 53.3% were male. For all students parental approval for participation was obtained. The majority (77.5%) of the students reported to use the Internet every day. All students reported to possess a cell phone or smart phone and to have access to a computer at home.

As independent variable the provision of source prompts in the worksheets was varied between participants. Whereas all worksheets provided boxes to fill in content information from the websites (one box per website), the worksheets with source prompts (see Fig. 1) also contained written prompts to fill in website names (cf. Britt & Aglinskas, 2002) and to classify the websites according to four given source categories. The four source categories were "websites of scientific institutions" (e.g., institutes, organizations), "journalistic websites" (e.g. newspapers, magazines), "websites of private individuals" (e.g., forums, blogs, i.e., Web 2.0 sites), and "commercial websites" (e.g., shops, advertisement) (cf. Kammerer & Gerjets, 2012b). Given the set of nine websites the students had to work with (for details see section 2.2), two boxes were available for the institutional websites, three boxes for the journalistic websites, another three boxes for the websites by private individuals, and one box for commercial websites. Thus the worksheet gave a direct hint about the number of websites that should be classified to each source category. The worksheet without source prompts (see Fig. 2), in contrast, only included nine empty boxes without prompts to write down the website names and without any source categories presented. In both conditions students were instructed that notes about the websites should be taken separately for each website (i.e., one box for each website). The worksheets were printed in A3 format. Students were randomly assigned to the two worksheet conditions. $N = 22$ students worked with the worksheets with source prompts, $n = 23$ with the worksheets without source prompts.

2.2. Task and materials

Students were instructed to read all given websites in order to inform themselves about the unsettled scientific issue of cell phone use and potential health risks (cf. e.g., Strømsø et al., 2013). Specifically, students were tasked to fill in core ideas from each of the websites into the worksheet (one box per website), in order to gain an overview of the different documents. The nine websites were provided as a link list on a class-project website of another secondary school. It was indicated that as part of a class project this other ninth-grade class recently had compiled a link collection on the topic of cell phone use and potential health risks. The reason why we did not present the websites in a Google mockup was that we wanted the students to read all websites instead of making a preselection. The websites were shortened versions of real existing websites, all providing up-to-date information (as indicated by recent publication dates on all websites). The design of the websites was kept as original, but all hyperlinks within the websites were removed. The nine resulting texts within the websites were between 154 and 346 words in length ($M = 276.22$ words, $SD = 57.08$). At the top of the page each website contained a logo

Fig. 1. Worksheet with source prompts, translated from German.

Fig. 2. Worksheet without source prompts, translated from German.

with the name of the website. The mock websites were presented in an Internet browser, with the websites' URLs (also including the names) displayed in the address bar of the browser.

The nine websites differed in the type of source, with the four different types of sources being presented in a mixed order. Two websites were from official institutions (e.g., the German Cancer Research Institute), three were from popular German online newspapers, three were Web 2.0 websites, that is, websites authored by "private individuals" (e.g., a science and technology blog), and one was a commercial website. This collection of websites resembled the distribution of websites that could be found on the Internet when searching for potential health risks of cell phone radiation. The commercial website stated that cell phone use is definitively dangerous and advertised and offered for sale a cell phone chip for radiation protection. In contrast, the other websites expressed more moderate views, for example that to date there is no clear evidence from scientific studies that cell phone radiation can cause cancer, though long-term data is not yet available.

2.3. Measures

2.3.1. Dependent measures

Students' source representations were assessed by two tasks. First, their *memory for sources* was measured by asking them to recall and write down as many website names as possible of the nine websites (as an indicator of objective information represented in students' document nodes). For each correctly recalled website name (e.g., German Cancer Research Institute) or paraphrase of it (e.g., institute for cancer research) they received one point. All answers were coded by two raters, who yielded an overall agreement of 94.81%. ($r = 0.98$, $p < 0.001$). Disagreements were resolved through discussion between the raters. Second, students' *credibility judgments* of the websites were assessed (as an indicator of evaluative information represented in students' document nodes). Students were presented a screenshot of each website and asked to judge the credibility of the site on a 5-point scale from 1 = *not at all credible* to 5 = *highly credible* (cf. Graesser et al., 2007; Kammerer & Gerjets, 2012a, 2014; Strømsø et al., 2013). To prevent that students reread the website texts before making the judgment, the content parts of the websites were blurred. Students' credibility judgments were aggregated for each type of website, that is, for the two institutional websites, the three journalistic websites, the three Web 2.0 websites, and the commercial website.

Students' mental representations of source-to-content links were measured with a *source-to-content mapping task*. Students were presented with nine sentences that contained information that was central and unique to one of the nine

websites. The task was to map these sentences to the respective source (i.e., the website) by drawing a connection line between the statement and the website name (cf. Strømsø, Bråten, & Britt, 2010 [1]). To provide an example to the students, one source-to-content connection was already drawn. Students had to correctly assign the remaining eight statements to the sources.

2.3.2. Control variables

To ensure the comparability of the two study conditions, students' prior attitude and prior knowledge about potential health risks of cell phone use as well as their reading comprehensions skills and reading speed were assessed as control variables. Students' prior attitude was assessed with the item "Do you think that cell phone radiation is harmful to one's health?" that had to be answered on a 5-point scale from 1 = *not at all* to 5 = *very much.*

Prior topic knowledge was measured with nine statements that had to be rated as true or false. To reduce the probability that students just guessed the answer, students were requested to choose a third box "don't know" instead of guessing, if they didn't know the answer (cf. Bromme & Stahl, 2002; 2005). Five of the statements were true statements based on factual content found in the institutional websites (e.g., "Cell phone radiation increases when reception is poor.") and four were false statements altered from correct content from the institutional websites (e.g., "The WHO has classified cell phone radiation as non-carcinogenic."). Each correctly answered item was scored with one point, resulting in a possible range of 0—9 points. In addition, to measure students' learning gains, after the Internet inquiry task they were presented this factual-knowledge test for a second time (topic knowledge post-test).

To assess students' reading comprehension skills and reading speed we used the LGVT 6-12, a standardized German screening instrument for grades 6 to 12 (Schneider, Schlagmüller, & Ennemoser, 2007), which can be administered as a group test. This paper-based cloze test requires reading a continuous text (1727 words). In (up to) 23 target sentences distributed across the whole text the reader has to underline one out of three words presented in brackets that fits into the context. Choosing the correct words requires (a) retrieving the meaning of single words, (b) semantic and syntactic integration on the sentence level, as well as (c) the integration of information between sentences and with prior and world knowledge. Students' reading comprehension score is calculated by counting 2 points for each correctly underlined word, −1 point for each incorrectly underlined word, and 0 points for no underlining (resulting in a score range from −23 to 46). Test time is limited to 4 min. Students' reading speed is measured by the number of words read in the given time.

2.3.3. Worksheet performance

For the experimental condition we analyzed how well students were able to follow the source prompts. First, we counted how many of the nine website names students had filled into the "website name" boxes. Spelling mistakes were disregarded. Second, we analyzed how many of the nine websites were correctly assigned to the four source categories.

In addition, for all students we analyzed the content information they had written into the worksheet. In a coding scheme central idea units from the websites were defined. Students could achieve one point per website for correctly stating at least one central idea unit from a site. Two raters coded 30% of the worksheets. The overall agreement was 84.92% ($r = 0.82$, $p < 0.001$). Disagreements were resolved through discussion between the raters. One rater coded the remaining worksheets.

2.4. Procedure

The study was carried out in a classroom setting in groups of 22—23 students during a 90-min class period. The study took place instead of a regular science lesson. In each classroom half of the students were randomly assigned to the worksheet condition with source prompts and the other half to the worksheet condition without source prompts. Each student was seated at an individual desk, where a laptop as well as a folder with the questionnaire materials and the worksheet were provided. Students didn't know that two types of worksheets existed. Students were orally instructed to complete the questionnaires in the order they were presented in the folder. Furthermore, they were instructed by the experimenter (the second author) when to start and to end each task.

First, demographic data and control variables were assessed. Subsequently, students received the instructions to inform themselves about the unsettled scientific issue of cell phone use and potential health risks by reading nine websites that students from another secondary school had collected as part of a class project. Students were instructed to fill in information from each of the websites into the worksheet (one box per website), in order to gain an overview of the different documents. Students were informed that they would have 40 min to read the nine websites and to fill in the worksheet. By clicking on a start button, a browser window with the class-project website of the other secondary school that contained the hyperlink-collection was opened. In the top right corner a countdown with the remaining time was presented. Students could use the browser to navigate back and forth between the websites. When time was up, the browser window was closed automatically and the experimenter collected the worksheets and handed out the post-knowledge test (the same nine items as in the prior knowledge test) and the memory for sources test were students had to list as many website names as they remembered. Afterwards the experimenter collected the tests and handed out the source-to-content mapping task and the credibility evaluation task. When students had completed these two tasks, the experimenter collected the tests. Finally, students were

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[1] Note that in Strømsø, Bråten, and Britt (2010) this task is called "memory for sources".

Table 1
Means (and standard deviations) for control variables as a function of source prompts.

Control variables	With source prompts	Without source prompts
Prior topic knowledge (from 0 to 9 points)	1.91 (1.41)	2.09 (1.50)
Prior attitude (from 1 = not at all harmful to 5 = very harmful)	3.73 (0.94)	3.17 (1.30)
LGVT reading comprehension skills (from −23 to 46 points) [Norm-referenced percentile ranks of reading comprehension scores]	12.32 (4.76) [57.73 (25.50)]	12.22 (4.74) [57.91 (25.25)]
LGVT reading speed (# words read) [Norm-referenced percentile ranks of reading speed scores]	630.23 (242.15) [42.23 (27.55)]	630.26 (145.17) [43.96 (21.29)]

Note. The LGVT is a German reading speed and reading comprehension test by Schneider et al. (2007).

debriefed and thanked for their participation. Students were rewarded for their participation by a contribution to their class funds (4.50€ per participating student).

3. Results

3.1. Preliminary analyses

First of all, we tested whether students across the two conditions were comparable with regard to their prior topic knowledge and attitude about cell phone use and potential health risks, and their reading speed and reading comprehension scores (see Table 1 for means and standard deviations). For all statistical tests reported in this paper, an alpha-level of 0.05 (two-sided) was used. ANOVAs revealed no significant differences between conditions for any of the four variables ($Fs < 1$, or F $(1, 43) = 2.66$, $p = 0.110$ for prior attitude). Students' reading comprehension scores were correlated to several dependent variables, namely to students' memory for sources ($r = 0.28$, $p = 0.061$) and their credibility judgment of the commercial website ($r = -0.33$, $p = 0.030$), as well as to the content information filled into the worksheets ($r = 0.37$, $p = 0.012$). Therefore, we decided to use reading comprehension skills as a covariate in all further analyses. The three other control variables were not significantly correlated to any of the dependent variables (for reading speed all $ps > 0.320$, for prior knowledge all $ps > 0.200$, and for prior attitude all $ps > 0.140$).

3.2. Students' worksheet performance

Students who worked with the worksheet that provided source prompts were well able to follow these prompts. On average they correctly filled in $M = 8.31$ ($SD = 1.21$) of the nine website names. Furthermore, on average they correctly assigned $M = 7.86$ ($SD = 2.12$) of the nine websites to the correct source category.[2] Besides, it should be noted that also some of the students in the control condition, that is, without being prompted to write down the website names, did so, namely 34.8% (with 2–9 correctly filled in website names per student).

With regard to content information filled into the worksheets, students in the two worksheet conditions did not differ in their performance, $F (1, 42) = 1.32$, $p = 0.257$, as revealed by an ANCOVA with source prompts (worksheet with vs. without source prompts) as between-subjects variable and reading comprehension skills as covariate.[3] That is, the extra effort of filling in source information did not impair students' performance of filling in content information into the worksheet. Students who worked with worksheets providing source prompts on average achieved $M = 4.66$ points ($SD = 1.64$) and students who worked with worksheets without source prompts $M = 5.15$ points ($SD = 1.40$), out of a maximum of 9. Reading comprehension skills were significantly related to students' performance in filling in website contents, $F (1, 42) = 6.87$, $p = 0.012$, $\eta_p^2 = 0.14$. The better students' reading comprehension skills, the better was their performance in filling in website contents into the worksheet.

3.3. Results with respect to the quality of students' intertext model

To test our hypotheses, for each dependent variable an ANCOVA with source prompts (worksheet with vs. without source prompts) as between-subjects variable and reading comprehension skills as covariate was conducted (see Table 2 for means and standard deviations).

With regard to students' memory for sources, a significant main effect for source prompts was shown, $F (1, 42) = 71.83$, $p < 0.001$, $\eta_p^2 = 0.63$. Compared to control students, students who had worked with the worksheets providing source

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[2] One student did not assign any of the websites to the correct category. This student apparently had overlooked the source categories. Without this student, the average number of correctly assigned websites would be even higher, namely 8.11 ($SD = 1.22$).

[3] There were no significant interactions between source prompts and reading comprehension skills (z-standardized) for any of the analyses, all $Fs < 1$ (i.e., the assumption of homogeneous regression slopes was satisfied for all analyses). Therefore, all ANCOVAs were run without interaction terms included.

Table 2
Means (and standard deviations) for dependent variables as a function of source prompts.

Dependent variables	With source prompts	Without source prompts
Memory for sources (max. 9)	5.86 (1.25)	2.30 (1.79)
# Source-to-content links (max. 8)	3.36 (1.43)	1.70 (1.29)
Mean credibility rating for the institutional websites (from 1 = not at all credible to 5 = highly credible)	4.07 (0.70)	3.82 (0.82)
Mean credibility rating for the journalistic websites (from 1 = not at all credible to 5 = highly credible)	2.97 (0.62)	3.48 (0.66)
Mean credibility rating for the Web 2.0 sites (from 1 = not at all credible to 5 = highly credible)	2.73 (0.70)	2.82 (0.79)
Credibility rating for the commercial website (from 1 = not at all credible to 5 = highly credible)	1.95 (1.17)	2.75 (1.44)

prompts recalled significantly more website names. Reading comprehension skills were also significantly related to students' memory for sources, $F(1, 42) = 10.02$, $p = 0.003$, $\eta_p^2 = 0.19$. The better students' reading comprehension skills, the better was also their memory for sources.

With regard to students' credibility evaluations, a mixed-model ANCOVA with source prompts as between-subjects variable, reading comprehension skills as covariate, and the type of source (institutional, journalistic, Web 2.0, and commercial) as within-subjects variable was conducted. There was a significant main effect of type of source, $F(2.35, 96.48) = 34.93$, $p < 0.001$, $\eta_p^2 = 0.46$, Greenhouse-Geisser corrected). This effect was qualified by a significant interaction between source prompts and type of source, $F(2.35, 96.48) = 3.65$, $p = 0.023$, $\eta_p^2 = 0.08$, Greenhouse-Geisser corrected). Posthoc tests showed that students who had worked with the worksheets providing source prompts judged the commercial site as significantly less credible than controls, $F(1, 41) = 4.10$, $p = 0.049$, $\eta_p^2 = 0.09$. Likewise, the mean credibility rating of the three journalistic sites was also significantly lower in the source-prompts condition than in the condition without source prompts, $F(1, 41) = 6.79$, $p = 0.013$, $\eta_p^2 = 0.14$. In contrast, the groups did not differ in their mean credibility ratings of the three Web 2.0 sites and the two institutional sites, $F < 1$ and $F(1, 41) = 1.11$, $p = 0.298$, respectively. Furthermore, we also analyzed the posthoc tests as a function of source prompts. In the condition with source prompts students judged the credibility of the institutional sites as significantly higher than the credibility of the three other types of sources (all $ps < 0.001$). In contrast, in the condition without source prompts the mean credibility rating for the institutional sites was higher than those for the Web 2.0 sites ($p < 0.001$) and the commercial site ($p = 0.004$), but not higher than the credibility rating for the journalistic sites ($p = 0.331$). Moreover, while students in the source-prompts condition judged the credibility of the commercial site as significantly lower than the credibility of the Web 2.0 sites ($p = 0.002$), students in the condition without source prompts did not differentiate between these two types of sources in their credibility ratings ($p > 0.999$).

Furthermore, there was also a significant interaction between the type of source and reading comprehension skills, $F(2.35, 96.48) = 3.91$, $p = 0.018$, $\eta_p^2 = 0.09$, Greenhouse-Geisser corrected. Reading comprehension skills were significantly related to students' credibility judgment of the commercial site, $F(1, 41) = 5.32$, $p = 0.026$, $\eta_p^2 = 0.12$. The better students' reading comprehension skills, the lower they judged the credibility of this site. In contrast, reading comprehension skills were not significantly related to students' credibility judgments of the three other types of sources ($Fs < 1$ for the institutional and the Web 2.0 sites, and $F(1, 41) = 1.74$, $p = 0.195$ for the journalistic sites).

With regard to students' performance in the source-to-content mapping task, source prompts also had a significant effect, $F(1, 42) = 16.61$, $p < 0.001$, $\eta_p^2 = 0.28$. Students who had worked with the worksheets providing source prompts outperformed controls. However, there was no main effect for reading comprehension skills, $F < 1$.

Finally, it should be noted that as in Stadtler and Bromme's research (2007; 2008) students in the two conditions did not differ in their learning gains with regard to factual knowledge from pre-test to post-test, $F < 1$. In both conditions students had substantially increased their factual knowledge scores. In the condition with source prompts on average they had increased their test scores by 3.32 points ($SD = 2.17$) and in the condition without source prompts by 3.61 points ($SD = 2.19$). Reading comprehension skills were not related to students' learning gains, $F < 1$.

4. Discussion and conclusion

The Internet is increasingly being used by students to complete school assignments (cf. Julien & Barker, 2009; Kingsley & Tancock, 2014; Mason et al., 2014; Van Strien et al., 2014). Because of the lowered threshold for publication of information on the Internet, students do not only have to understand the content during their learning process, but also to reflect about the validity of knowledge claims and with this about the credibility of Internet sources (e.g., Stadtler & Bromme, 2014). However, much research has shown that during Internet inquiry students spontaneously do not think critically about the sources from which they get their information (e.g., Kiili et al., 2008; Maggioni & Fox, 2009; Stadtler et al., 2014; Walraven et al., 2009; Wiley et al., 2009).

Therefore, the primary goal of the present study was to test a paper-based worksheet intervention that prompts students during Internet inquiry to attend to and evaluate source information and to tag content for its source. Specifically, we tested the influence of such source prompts on the intertext model (i.e., readers' mental representations of sources and source-to-

content links, cf. Britt & Rouet, 2012) that ninth-graders developed when reading multiple websites about an unsettled scientific issue. For this purpose, we provided half of the students with worksheets containing written prompts to fill in website names (cf. Britt & Aglinskas, 2002) and to classify the websites according to four given source categories (cf. Kammerer & Gerjets, 2012b). As in previous intervention studies that had found positive effects of source prompts (e.g., Britt & Aglinskas, 2002; Mason et al., 2014; Stadtler & Bromme, 2007, 2008; Wiley et al., 2009), the source prompts were presented during the learning process and were formulated specifically (cf. Bannert, 2009). The other half of the students worked with worksheets that did not contain such source prompts.

4.1. Students' ability to follow the source prompts

First of all, the results of our study demonstrate that ninth-graders are well able to identify the names of websites as well as to classify websites according to different source categories, when being prompted to do so. On average, over 90% of website names were correctly filled in by the students. Furthermore, about 90% of the websites, on average, were also correctly classified, indicating that students correctly understood the meaning of the four source categories. These findings corroborate recent research by Stadtler et al. (2014) that showed that ninth-graders performed well when explicitly being asked to identify sources in short news texts and to judge the sources' expertise.

It should be noted, however, that in the worksheet used in the present study the number of boxes per category was limited. Thus, the worksheet provided hints about how many websites had to be assigned to each category, namely two to the "institutional" category, three to the "journalistic" category, three to the "private individuals" category, and one to the "commercial" category. In case that students would work with the open Internet instead of a given set of websites, the number of websites per category could not be defined a priori, which would increase the difficulty of such classification task. In this case, in the worksheet an equal amount of boxes should be provided for all source categories and students should be informed that some boxes could be left empty. Future research is needed that tests students' performance in assigning websites to source categories when working on a free Internet inquiry task.

4.2. Effects of source prompts on students' intertext model formation

With regard to the effectiveness of our worksheet intervention, in line with our hypotheses the results of the present study indicate that source prompts improved students' formation of an intertext model of the websites. The ninth-graders who had worked with the worksheets providing source prompts outperformed controls in terms of their memory for sources (Hypothesis 1), their differentiation between different types of sources with regard to their credibility (Hypothesis 2), and their representation of source-to-content links (Hypothesis 3). Thus, the *concrete* source prompts that were provided in the worksheet and that, thus, were constantly available *during* Internet inquiry (cf. Bannert, 2009) seem to be beneficial for rather inexperienced learners such as the ninth-graders in this study. Moreover, our research suggests that source prompts alone, without any training on how to evaluate information sources (as provided, for instance, in the study by Mason et al., 2014), can be an effective instructional means to enhance the representation of sources and source-to-content links in this age group when reading a given set of websites. This extends previous research that examined the effectiveness of source prompts in undergraduate students (Stadtler & Bromme, 2007; 2008). In the following, the results of our study will be discussed in more detail, together with limitations of the present work and suggestions for future research.

First, when being prompted to fill in the website names into the worksheet, after Internet inquiry students remembered more than twice as many website names than without the prompts. Thus, prompting students to note down the website names during an Internet inquiry task seems to be an easy and effective way to increase students' memory for sources. At the same time, in line with previous studies (e.g., Kiili et al., 2008; Maggioni & Fox, 2009; Walraven et al., 2009) the respective performance of the control group indicates that without being prompted to note down the names of the websites, the majority of secondary-school students had paid little attention to the website names and, thus, to those responsible for a website's content. On average, they remembered less than one third of the names of the websites they had visited during Internet inquiry. Paying attention to the information providers, however, is important to critically assess the validity of the provided content (Britt & Rouet, 2012). For instance, when different websites provide conflicting information, evaluating the websites' credibility and determining which of the websites to believe, is one way to resolve the encountered contradictions (Stadtler & Bromme, 2014). This is especially the case if individuals cannot directly evaluate the validity of the contradictory knowledge claims because of lacking prior knowledge about the subject matter (cf. Bromme, Kienhues, & Porsch, 2010). Moreover, different websites might even use the same contents, but with different interpretations and/or conclusions depending on the information providers' own knowledge or interests. Therefore, it is important that students are aware of potential biases in the way the respective information is presented or interpreted on a website.

Second, in line with this reasoning, the provision of source prompts also resulted in a greater differentiation of students' credibility ratings of the different types of sources. Students who had received source prompts judged the credibility of the commercial website and the journalistic websites as significantly lower than control students. This indicated an increased awareness both for commercial biases and for the fact that journalistic sources might be less objective or of lesser expertise than official institutional sources (cf. e.g., Braasch et al., 2013; Bråten, Strømsø, & Salmerón, 2011). Students' increased awareness also resulted in the fact that students who had received source prompts judged (a) the credibility of the commercial website as significantly lower than the credibility of the Web 2.0 websites and (b) the credibility of the institutional

websites as significantly higher than that of the journalistic websites. In contrast, without source prompts students did not differentiate between these types of sources in their credibility ratings. To conclude, the source prompts did not only result in better source representations in terms of objective information (i.e., the website names), but also in terms of evaluative information (i.e., about the sources' perceived credibility). With regard to the latter finding, it should be stressed that the worksheet did not provide explicit prompts to judge the credibility, but only implicitly stimulated such reflections through the prompts to attend to website names and to classify the websites according to the source categories. Future studies, however, should examine which of the two types of prompts (i.e., the prompts to fill in the website names or the prompts to assign the websites to source categories, or both) fostered the mental representation of the evaluative source information. Moreover, while our worksheet focused on source information on the level of the information provider (i.e., the website), in the future it could be extended by prompts to fill in or judge information about the authors of the texts presented on the websites (cf. Britt & Aglinskas, 2002; Graesser et al., 2007; Mason et al., 2014; Stadtler & Bromme, 2007, 2008; Wiley et al., 2009).

Third, with regard to students' representations of source-to-content links, that is, their mental representations about which source said what, our findings indicate that students who received source prompts performed significantly better in the source-to-content mapping task than controls. Yet, even with source prompts students were only able to map about 40% of the contents to the correct source, on average. At this point, it should be noted that in the present study the time to complete the worksheet was limited to 40 min. Thus, it is reasonable to assume that students spent the whole time with filling in the worksheet, without being able to read through their notes again and to internalize the contents. It is likely that in situations where students have more time to complete the worksheet or can even use the worksheet as learning materials, for instance in preparation for an exam, better source-to-content links would be established.

To conclude, results of the present study indicate the effectiveness of the provided source prompts in fostering secondary-school students' formation of an intertext model when conducting an Internet inquiry task in the classroom. Furthermore, it should be noted that the extra effort of filling in source information as requested by the source prompts did neither impair students' performance of filling in content information into the worksheet, nor their learning gains with respect to factual knowledge as compared to the control group. These results are also in line with previous research by Stadtler and Bromme (2007; 2008). A question that remains unanswered by our research, however, is whether students really understood the importance of sourcing while working with the worksheet. Being able to identify the sources and to build an intertext model is different from understanding the relevance of sourcing per se and to apply sourcing strategies in future reading situations. The present study aimed only at the direct and exclusive effects of the worksheets on students' mental representations of sources and source-to-content links. Students' awareness about the necessity to engage in sourcing and respective changes in their online reading behavior instead were not addressed in the present study, but should be an important component of future research.

4.3. Practical applications for the classroom

In order to integrate the evaluation of source information into classroom curricula, it is important to provide teachers with curricular materials that can easily be used and that are applicable to different subject areas. As the worksheet used in this study is not topic-specific, teachers can easily apply it to various different topics and in various different school subjects. Furthermore, as it is paper-based it does not require any specific software and can conveniently be used in a classroom setting. This should reduce inhibitions of teachers to use it in their own lessons.

The worksheet could either be used (a) with a fixed set of preselected websites emphasizing information use, as it was the case in the present study, or (b) when working with the open Internet emphasizing information gathering. In the former case, teachers themselves need to prepare a link list consisting of a set of preselected websites, as it is typical, for instance, for WebQuest approaches (Dodge, 1995; also see e.g., Argelagós & Pifarré, 2012). In order to raise awareness for the variety of sources existing on the Internet, for each of the different source categories indicated in the worksheet (i.e., "institutional", "journalistic", "private individuals", and "commercial"), teachers should try to find a number of websites for the subject at hand. In so doing, they should also intentionally select a few websites of dubious quality. After having defined the link list, they need to prepare the worksheet with a given number of boxes per category depending on the number of websites they have selected. As in the present study, students' task then would be to assign the websites to the different source categories and to fill in the respective source and content information. Instead, when students' task is to work with the open Internet, teachers should provide the students with a worksheet with an equal amount of boxes for all source categories. Students' task then would be to find websites that belong to the different categories by themselves. For this purpose, students could either work individually or in pairs. Irrespective of whether students work with a given link list or with the open Internet, the completed worksheet, other than in the present study, could be discussed and evaluated in class. Furthermore, teachers should also reflect with their students about the importance of sourcing in Internet inquiry tasks.

Moreover, teachers can use this worksheet approach to discuss the nature of knowledge in their subject domains. Confronting students with controversial information and also controversial interpretations of the same contents in different Internet documents might be helpful to discuss epistemic aspects such as the uncertain and evolving nature of knowledge within a subject matter and, therefore, to promote students' epistemic cognition (e.g., Greene & Yu, 2016; Kienhues, Ferguson, & Stahl, 2016).

4.4. The role of reading comprehension skills in students' source representations

In addition to the effects of source prompts, in the present study reading comprehension skills have been shown to be positively related to the quality of students' intertext model, specifically, to their source representations. The higher students' reading comprehension skills, the better was their memory for sources and the less credible they judged the commercial website. These findings expand previous results by Macedo-Rouet, Braasch, Britt, and Rouet (2013) and Kammerer and Gerjets (2014) that showed that school students with higher reading comprehension skills were better able to judge the expertise of information sources or to provide source references in written summaries, while having the documents available. In contrast, in a recent study by Stadtler et al. (2016) reading ability (i.e., a composite score of reading comprehension and reading speed) was not related to vocational students' consideration of the sources' domain expertise or students' mental representations of source-to-content links, when reading a set of short and simple printed texts about scientific controversies.

With respect to the credibility judgments of the three other types of websites (i.e., the institutional, journalistic, and Web 2.0 sites), in the present study also no relationships with reading comprehension skills were found. This indicates that reading comprehension skills might be particularly important to detect commercial biases. Finally, reading comprehension skills were also not related to students' performance in the source-to-content mapping task. A potential reason for the lacking relationship might be the limited study time of 40 min that did not allow students to read through their notes again and to internalize the contents. Support for this assumption is given by the fact that reading comprehension skills were positively related to students' performance in filling in core ideas from the websites into the worksheets, but not to the resulting learning gains from pre-to post-test subsequent to their Internet inquiry.

To conclude, to the best of our knowledge, this is the first study that shows a relationship between reading comprehension skills and the quality of students' mental representations of objective source information, that is, the names of the websites, as well as of evaluative information about commercial biases. The weaker performance of students with poorer reading comprehension skills might be due to the fact that they have fewer cognitive resources available (cf. Naumann, Richter, Christmann, & Groeben, 2008) to encode source information, such as the websites' names, and that they aren't able to make use of textual cues indicating commercial biases. Yet, further research is needed to replicate these findings in a larger sample size and to examine the cognitive mechanisms underlying the found relationships. Furthermore, it should be mentioned that the results are only based on correlational data. Thus, in order to draw conclusions about causality further experimental work is required. In case that a causal relationship exists, apart from the use of source prompts reading comprehension trainings should also be an effective means to improve secondary-school students' formation of source representations when reading multiple websites on a scientific topic.

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