

Investigating Elementary School Students' Text-based Argumentation with Multiple Online Information Resources

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Abstract

In this study, we explored how elementary school students used multiple information resources in responding to a text-based argumentation task asking them to research a set of online texts in order to state and justify their stance on a controversial health-related issue. Results showed that most students took a stance that was consistent with the majority of the information resources that they read, that they mainly drew on more reliable resources in their written task products, and that they justified their stance by providing one or more supporting reasons. Students relied much more on copying and paraphrasing content from the online resources than on integrating information within and across the resources, however, and they very rarely referred to the sources in their written products. In general, girls were found to outperform boys on measures of content, argumentation, and integration in the written task products, and these aspects of the written products were also positively related to students' basic reading and reasoning skills. The discussion highlights the challenges many elementary school students experience in this complex literacy task context, suggests some avenues for future research, and discusses instructional implications of the study.

Keywords: Multiple information resources; task-based argumentation; new literacies; elementary school students.

1. Introduction

Recent accounts of literacy skills have highlighted changes in the literacy landscape that accompany the advent and rapid dissemination of digital information technologies (Alexander & the Disciplined Reading and Learning Research Laboratory, 2012; Bråten, Braasch, & Salmerón, in press; Leu & Maykel, 2016; Magliano, McCrudden, Rouet, & Sabatini, 2018). Thus, the “modern reader” (Magliano et al., 2018) is afforded new opportunities in terms of the availability and accessibility of information resources but also faces new challenges in terms of the cognitive resources required to process and use online information that varies immensely with respect to accuracy and reliability (Bråten et al., in press). This situation has represented fertile ground for literacy researchers seeking to understand how learners are able to exploit the affordances and, at the same time, cope with

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

the challenges of the digital age, resulting in several edited volumes documenting the progress made in this area of research (e.g., Braasch, Bråten, & McCrudden, 2018; Coiro, Knobel, Lankshear, & Leu, 2008; Mayer, 2014). This research suggests that students often encounter challenges when learning from digital media, such as the Internet. For example, students may struggle to find relevant and reliable online resources to read, and their engagement with online information may be superficial, resulting in a fragmented representation of the issue at hand (Kiili, Laurinen & Marttunen, 2008; Kirschner & van Merriënboer, 2013, Pérez et al., 2018).

However, one notable limitation of our current understanding of how the modern reader negotiates the affordances and challenges of the 21st century literacy landscape is that it is largely based on research including secondary and postsecondary students (Barzilai, Zohar, & Mor-Hagani, 2018; Brante & Strømsø, 2018). This highlights the need to focus on how elementary school students work with multiple information resources to complete particular tasks. As noted by Barzilai et al. (2018), students use multiple information resources for a range of online inquiry tasks already in elementary school, and better understanding of how they are dealing with such tasks may be helpful in planning and implementing teaching to promote their literacy skills.

A particularly challenging literacy task concerns writing from multiple information resources, such as to produce an argument based on a set of diverse texts that discusses a controversial issue from different perspectives. Following Litman et al. (2017), we define text-based argumentation tasks as tasks in which students are required to construct and communicate a justified position on an issue on the basis of claims, reasons, and evidence presented in multiple textual information resources. To successfully complete such tasks, students must interpret task assignments (Rouet, Britt, & Durik, 2017), base their argumentation on accurate and reliable sources (Brand-Gruwel, Kammerer, van Meeuwen, &

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

van Gog, 2017), integrate information within and across multiple resources (Mateos et al., 2018), and attribute ideas included in their written products to their respective sources (Strømsø, Bråten, Britt, & Ferguson, 2013). Further, students' written products should not only reproduce ideas retrieved from various sources in a knowledge-telling way but, preferably, elaborate and transform information to display independent reasoning about the issue (Bereiter & Scardamalia, 1987). Text-based argumentation tasks thus involve a complex interplay between reading, writing, and reasoning (McNamara & Allen, 2018). When working with multiple online resources in a web-based environment, in particular, such tasks represent a formidable challenge regardless of educational level, with younger students presumably being especially prone to experiencing cognitive overload due to task complexity (Sweller, Ayres, & Kalyuga, 2011). In addition, younger students may lack instructional experiences needed to learn the skills that mastery of text-based argumentation tasks requires (Hemphill & Snow, 2018; Litman et al., 2017). In the current research, we therefore set out to explore how elementary school students used multiple online resources in responding to a text-based argumentation task in which they were asked to research a set of online texts in order to state and justify their position on a controversial health-related issue.

1.1 Theoretical Framework

Recently, there has been an increased interest in developing theoretical frameworks for the purposes of better understanding the affordances and challenges of learning from and with multiple information resources. Among them are the Multiple-Document Task-based Relevance Assessment and Content Extraction Model by Rouet and Britt (2011), the New Literacies Framework by Leu, Kinzer, Coiro, Castek, and Henry (2013), the Integrated Framework of Multiple Text Use by List and Alexander (2019), and the Integrative Framework of Multiple Source Comprehension and Information Problem Solving by Goldman and Brand-Gruwel (2018). Common to these frameworks is a focus on the interplay

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

between individual differences, processes, and information resources that is occurring within the context of a specific goal or task. As a goal- or task-oriented activity, learning with multiple information resources may also be considered a form of problem-based learning (Hmelo-Silver, 2004). This perspective has particularly been emphasized within literacy research by Britt and colleagues (Britt, Rouet, & Durik, 2018), who proposed a model of reading as problem solving in which individuals construct mental representations of tasks or problems that, in turn, guide their text processing and problem solutions. Accordingly, in the current study, students were asked to solve a problem relevant to their school context, process multiple online textual resources, and construct and communicate a solution to that problem. Because the new literacies framework focuses on online research and comprehension, in particular, we built on this framework in designing the current study.

The new literacies framework identifies a set of five practices that typifies problem-solving and question answering in web-based environments (Kinzer & Leu, 2017; Leu et al., 2013). In the first phase, learners identify and represent a task that needs to be completed, such as a question that needs to be answered regarding a health-related issue (e.g., regarding potential health risks associated with energy drinks consumption). In the second phase, learners research online information resources for the purpose of identifying information that may help them answer the question, and in the third phase, they critically evaluate this information in terms of its accuracy and reliability. Then, in the fourth phase, learners synthesize information deemed useful for answering the question across multiple resources to build a coherent mental representation of the issue. Finally, in the fifth phase, learners create an external task product (e.g., a written note or report) addressing the question or task as interpreted by the learners and communicate the result of their online research and comprehension processes to their audience (Leu et al., 2013).

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

In this study, we were particularly interested in the fifth phase of the new literacies framework, that is, in the written task products that elementary school students generated in response to a text-based argumentation task, including to what extent they drew on online resources in their written products, represented elements of argumentative reasoning (e.g., claims, reasons, and counterarguments; Reznitskaya et al., 2008), and transformed or integrated content across the online resources. In school, students often work with multiple information resources online (OECD, 2015). We therefore assumed that contextualizing the text-based argumentation task in a web-based environment would increase the ecological validity of our study.

1.2 Prior Research

A range of previous studies have assessed students' learning from and comprehension of multiple information resources by means of their post-reading written products (for reviews, see Barzilai et al., 2018; Primor & Katzir, 2018). These written products have typically been analyzed in terms of the quality and quantity of arguments and the transformation and integration within and across information resources (Primor & Katzir, 2018). Further, most of the studies using writing tasks to evaluate post-reading, written argumentation and integration have included secondary (e.g., Bråten, McCrudden, Stang Lund, Brante, & Strømsø, 2018; De La Paz & Felton, 2010; Kiili, 2013; Litman et al., 2017) and postsecondary (e.g., Anmarkrud, Bråten, & Strømsø, 2014; Barzilai, Tzadok & Eshet-Alkalai, 2015; Gil, Bråten, Vidal-Abarca, & Strømsø, 2010; Stadtler, Scharrer, Brummernhenrich, & Bromme, 2013) students. In general, this body of research demonstrates that without specific training targeting writing from multiple information resources (Granado-Peinado, Mateos, Martin, & Cuevas, 2019; Mateos et al., 2018; Weston-Sementelli, Allen, & McNamara, 2018), even upper-secondary and postsecondary students tend to perform surprisingly poorly on such tasks. For example, Anmarkrud et al. (2014), who evaluated the

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

overall quality of undergraduates' written, multiple-source based argumentation using an adapted version of a holistic scoring rubric developed by Reznitskaya, Kuo, Glina, and Anderson (2009), found that students, on average, did not take opposing claims and reasons into consideration or tried to integrate such claims and reasons across different information resources.

Although it seems fair to say that older students have been given the lion's share of attention in this area of research, some researchers have also studied learning from and comprehension of multiple information resources among younger students attending grades 4-7 (e.g., Blaum, Griffin, Wiley, & Britt, 2017; Davis, Huang, & Yi, 2017; Goldman, Lawless, & Manning, 2013; Litman et al., 2017; Macedo-Rouet, Braasch, Britt, & Rouet, 2013; Macedo-Rouet et al., 2019). This research has indicated that students in this age group may encounter particular challenges when tasked to integrate information across multiple information resources and evaluate the quality of those resources, especially when trying to judge the credibility of the sources in light of specific source features (e.g., author competence). Moreover, several researchers have studied argumentative reasoning about multiple perspectives or multiple resources, as displayed in written products, in this age group (e.g., Kuhn & Crowell, 2011; Schwarz, Neuman, Gil, & Ilya, 2003; Wissinger & De La Paz, 2016). In this research, it has been found that without extensive intervention, preferably in the form of collaborative dialogic argumentation about ill-structured problems or controversial issues (Bråten Muis, & Reznitskaya, 2017; Kuhn, 2015, 2018), students tend to disregard counterarguments and rebuttals and fail to integrate opposing arguments to reach a more balanced conclusion. This is consistent with other research focusing on the effects of students' preexisting positions or stances, to which we turn next.

Thus, students' positions or stances on particular issues, often termed topic beliefs in the literature (Bråten & Strømsø, in press), have been found to influence their processing and

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

comprehension when encountering different perspectives in a range of studies. More specifically, students have been found to be biased toward their own preexisting topic beliefs when evaluating arguments and conclusions about controversial issues or phenomena (McCrudden & Barnes, 2016; McCrudden, Barnes, McTigue, Welch, & McDonald, 2017; Strømsø & Bråten, 2017), as well as when they interpret the contents of belief-consistent and belief-inconsistent texts (Maier & Richter, 2013, 2014; Maier, Richter, Nauroth, & Gollwitzer, 2018). Recently, this line of research has also indicated that arguments consistent with students' preexisting beliefs are prioritized in their written products (Maier, Richter, & Britt, 2018). In the present study, we were particularly interested in the extent to which the elementary school students who participated changed their preexisting stance on the controversial issue discussed across the online information resources and adopted a stance consistent with the majority of those resources.

1.3 Individual Differences

As demanding as text-based argumentation tasks may be, students' performance on such tasks can be assumed to vary considerably, with higher levels of reading and reasoning skills likely associated with better performance. With respect to reading skills, both reading fluency and reading comprehension may play a role. As noted by Barzilai and Strømsø (2018), working with multiple information resources may require higher levels of reading fluency than do simpler reading tasks. Presumably, this is because fluent reading may free cognitive resources for more complex tasks, such as argumentative reasoning and integration across resources. Thus, when required to read multiple information resources in a limited amount of time, more fluent readers can spend less time and effort on reading the resources and, consequentially, devote more time and effort to other aspects of the text-based argumentation task, such as reflecting on the texts and constructing their written products. This assumption is consistent with a prominent view within reading psychology that considers

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

automatic and efficient word recognition to allow readers' cognitive resources to be allocated to higher-level literacy skills (e.g., Perfetti, 1985; Stanovich, 1986), indicating that reading fluency may be a necessary but not sufficient condition for more advanced skills (Stanovich, 2000). Of note is that this view is supported by a range of studies showing that word recognition efficiency may be an independent predictor of comprehension performance at different educational levels (e.g., Andreassen & Bråten, 2010; Cunningham, Stanovich, & Wilson, 1990; Samuelstuen & Bråten, 2005). Because most studies have been conducted with students supposed to possess fluent reading skills, there is currently limited evidence to support the idea that reading fluency may make a difference when working with multiple information resources, however (for review, see Barzilai & Strømsø, 2018). Yet, in one of the few studies addressing this issue, Bråten, Ferguson, Anmarkrud, and Strømsø (2013) found a positive correlation between 10th graders' word recognition skills and their writing from multiple textual information resources, in particular, their ability to integrate information across texts. Needless to say, more research is needed to explore this issue among younger students who can be expected to vary importantly in regard to reading fluency.

Presumably, argumentative reasoning and integration also require basic reading comprehension skills, for example, to identify relevant texts based on main ideas and construct a coherent understanding of each single text. This assumption is consistent with the view that efficient processing of each single text is an important element of multiple text integration (List & Alexander, 2019), as well as with prior research indicating that students' effort to understand each text may predict integration across texts (Britt & Sommer, 2004). Several previous studies have also found positive correlations between measures of reading comprehension and aspects of multiple source comprehension and integration among secondary school students, mostly in the .20s and .30s (Bråten, Brante, & Strømsø, 2018; Kammerer, Meier, & Stahl, 2016; Mason, Scrimin, Tornatora, Suitner, & Moè, 2018; Mason,

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

Scrimin, Tornatora, & Zaccoletti, 2017). However, this issue needs to be further explored with elementary school students who can be assumed to vary considerably with respect to basic reading comprehension skills.

Because multiple information resources rarely include intertextual references or elaborations that tell learners how to reason and integrate information across the resources, it seems likely that individual differences with respect to reasoning skills also are related to performance on post-reading writing tasks (Anmarkrud et al., 2014). However, Mason, Junyent, and Tornatora (2014), who had secondary school students read eight different information resources on a controversial health-related issue in a web-based environment, found no relationship between students' performance on informal reasoning tasks and their post-reading argumentative reasoning and integration in essays. In the present study, we explored this issue further with elementary school students, assessing their basic reasoning skills by means of a standardized nonverbal reasoning test.

Finally, the role of gender needs to be further explored in the context of writing from multiple online information resources. As recently reviewed by Barzilai and Strømsø (2018), studies have reported mixed results regarding the relationship between gender and the comprehension of multiple information resources, with girls scoring higher, lower, or no different than boys. This issue seems particularly pertinent in a Nordic context, where girls have been found to outperform boys on literacy tasks to a greater extent than in most other OECD countries (Brozo et al., 2014). Finland, for example, has been found to have one of the widest gender gaps in the favor of girls on the Program for International Student Assessment (PISA) literacy tests, which may be related to differences in reading fluency as well as motivation and reading experience (Torppa, Eklund, Sulkunen, Niemi, & Ahonen, 2018). Accordingly, Brozo et al. (2014) reported that gender differences, as shown on the PISA

assessment, were particularly large in Finland. Less is known about gender differences when elementary school students work with multiple online information resources, however.

1.4 The Present Study

Given this background analysis, we had a sample of Finnish elementary school students work with four online information resources on a controversial health-related issue: the consumption of energy drinks. Based on the four resources, their task was to construct an email to a fictitious school principal in which they justified their position on whether the school should purchase an energy drink vending machine (see *Method* below). This allowed us to address questions regarding the positions or stances taken in the emails and the resources on which those stances were based, the communicative purposes of students' emails (e.g., claims and reasons), and the extent to which they transformed and integrated content present in the online resources. Because we included measures of students' reading and reasoning skills, associations between these individual difference variables (as well as gender) and aspects of their written responses could also be explored.

Specifically, we set out to address the following research questions in this study:

1. To what extent did students change their preexisting stance on the issue and take a stance that was consistent with the majority of the online information resources?
2. To what extent did students utilize the online information resources in their emails?
3. What kinds of communicative purposes did students' emails include?
4. How did students transform and integrate the content of the online information resources in their emails?
5. To what extent were students' reading fluency, reading comprehension, nonverbal reasoning, and gender associated with the content, argumentation, and integration displayed in their emails?

2. Method

2.1 Participants

Participants were 340 sixth graders from 24 classes at eight Finnish elementary schools who completed an online research task designed for the purpose of this study. The sample included 168 boys and 172 girls with a mean age of 11.73 years ($SD = 0.32$). Mothers' educational level was either university/college (55%) or upper-secondary/vocational (41%) education. Similarly, 48% of fathers had university level education and 47% had completed upper-secondary or vocational education.¹

2.2 Individual Difference Measures

Individual differences were assessed by means of three reading fluency measures, one reading comprehension measure, and one nonverbal reasoning measure. Descriptive statistics and reliability estimates for these measures are displayed in Table 1. The individual difference measures are further described in the following subsections.

2.2.1 Reading fluency

Reading fluency was measured by means of three different tests: a time-limited word identification test (Lindeman, 1998), a time-limited word chain test (Holopainen, Kairaluoma, Nevala, Ahonen & Aro, 2004), and an oral pseudoword reading test (Eklund, Torppa, Aro, Leppänen, & Lyytinen, 2014). Of note is that the word identification and word chain tests contained high-frequency words that were well known to the participants, both phonologically and semantically. As such, these tests did not represent any challenges with respect to vocabulary skills for our participants.

Word identification measure. We assessed word identification with a subtest from a Finnish standardized reading test battery for Grades 1-6 (Lindeman, 1998). The test included 80 items, each consisting of one picture and four alternative words. Students were tasked to connect as many pictures to the corresponding words as possible within two minutes (max

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

score = 80). The reliability estimate (Cronbach's α) for students' scores on the word identification test was .94.

Word chain measure. This test consisted of 100 words in 25 chains, with each chain containing four words written without any space between the words. During a period of 90 seconds, students were tasked to identify as many words as possible by drawing a vertical line between the words. Students' scores were the number of correctly identified words (max score = 100). The reliability estimate (Cronbach's α) for students' scores on the word chain test was .97.

Oral pseudoword reading measure. On this test, students were tasked to read aloud a text consisting of 38 pseudowords as quickly and accurately as possible (Eklund et al., 2014). The pseudowords and the sentence structures resembled Finnish but the words and the text did not have any meaning. Students' reading was recorded. Scoring was done by computing the time (in seconds) that students used per correctly read word. The reliability estimate (Cronbach's α) for students' scores on the pseudoword reading measure was .77.

Reading fluency measure. We created an overall measure of reading fluency based on an exploratory factor analysis of students' sum scores on the three reading fluency tests described above. Thus, a principal axis factor analysis with promax rotation indicated one factor, in which the word identification test, the word chain test, and the oral pseudoword reading test loaded 0.70, 0.86, and 0.64, respectively. The reading fluency factor explained 68.8% of the total sample variation. The result of the Kaiser-Meyer-Olkin (KMO) test was 0.68, indicating that our data were suitable for factor analysis (Kaiser, 1974). Students' reading fluency factor scores were used in subsequent correlational analyses.

2.2.2 Reading comprehension measure

Reading comprehension was assessed with a subtest of Lindeman's (1998) standardized Finnish reading test battery. On this test, students read a two-page expository

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

text entitled "Instructions for Customers" and responded to 12 multiple-choice items, each with four response alternatives (max score = 12). The text was available when students responded to the items. The items covered detail/fact (one item), cause-effect/structure (one item), conclusion/interpretation (four items), concept/phrase (three items), and main idea/purpose (three items). The reliability estimate (Cronbach's α) for students' scores on the reading comprehension measure was .66. Although somewhat lower than desirable, this estimate may be considered acceptable for research purposes (Hair, Black, Babin, Anderson, & Tatham, 2006; Kerlinger & Lee, 2000).

2.2.3 Nonverbal reasoning measure

Nonverbal reasoning was assessed with Raven's Standard Progressive Matrices (Raven, 1998), which is suitable for children over 11 years of age. We used a shortened version of the test by removing every second item from the 60 items. This shortened version (max score = 30) has been shown to provide a valid indication of nonverbal reasoning (e.g., Wytek, Opgenoorth, & Presslich, 1984). The reliability estimate (Cronbach's α) for students' scores on the nonverbal reasoning measure was .75.

2.3 Writing Task and Online Resources

Text-based argumentation was explored in the context of an online research task where students were asked to research the health effects of energy drinks in order to take a justified position on whether a school principal should allow an energy drink machine at the school. This topic was chosen for its relevance to elementary school student's lives. Further, the health effects of energy drinks are currently publicly debated, at least in Finland, and thus likely to be a somewhat familiar and engaging topic for the students.

Students worked with a Finnish adaptation of an online reading comprehension assessment originally developed by Leu and his colleagues (Leu, Coiro, Kulikowich, & Cui, 2012; Leu et al., 2015). This Finnish adaptation was validated and described in more detail by

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

Kiili et al. (2018). The task was structured by phases included in online research (locating information, collecting information, evaluating information, synthesizing information, and communicating information). Students completed all these phases (i.e., locating, collecting, evaluating, synthesizing, and communicating information), although our study focused on the last phase of the task (i.e., communicating the results of the online research). Students' work in the web-based environment was guided by two virtual students who communicated with the students via a discussion forum or chat tool. The guidance included instructions for the sub-tasks (e.g., what to do next and how to use digital tools in the environment), task prompts (e.g., to use information from the online resources in the email), and encouraging comments (e.g., Great!). The guidance of the virtual students was predetermined and adapted to student behavior (e.g., reminders if students did not proceed with the task).

At the beginning of the task, students received the task assignment in an email from a fictitious school principal. In the email, the principal asked for help in deciding whether to purchase an energy drink vending machine for the school and wanted students to research health risks associated with the use of energy drinks for her. Further, she asked them to send her an email in which they present their views on the issue and justify why she should or should not purchase such a machine. The entire email is shown in Appendix A.

In completing the assignment, students read four online resources, took notes from these resources, and responded to the principal via an email. They were asked to locate two of the online resources themselves by means of a search engine (# 2 and 4 in Table 2), while they were provided with the two other resources (# 1 and 3 in Table 2). All students in the present study were able to access the online resources and completed the assignment. When reading the online resources and completing the assignment, students used a note-taking tool providing a writing space for each of the four resources. In this space, they were asked to write in their own words the most important idea from each resource, with the space for each

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

note limited to 300 characters. The copy and paste functions were deactivated, and students could not proceed with the task without writing something in the allotted space. Students were allowed to access their notes in completing the assignment. During the task, students were also asked to evaluate the credibility of two of the resources (#2 and 3 in Table 2).

Table 2 presents an overview of the four online resources. As can be seen, the resources presented different perspectives on the issue. Three of the resources (# 1, 2, and 4) referred to expertise or research regarding the issue, whereas one resource (# 3) presented the views of the head of the marketing department of an energy drink producer. The latter presented a one-sided view in favor of energy drinks and was the only resource that recommended energy drink consumption.

Two of the resources (# 1 and 4), both news articles, were authentic. However, resource # 1 was slightly modified (i.e., simplified) for the sixth-grade students. Resources # 2 and 3 were designed for the purpose of this study, yet their content was based on authentic web resources. All four resources included several elements typical of web pages, such as logos, pictures, commercials, and navigation bars, but all the links on the pages were deactivated.

In selecting and designing the materials, we ensured that all four texts had about the same length and were appropriate in terms of vocabulary and sentence structure for sixth-grade readers. Each resource consisted of five to six short paragraphs and each paragraph included one to four sentences. They varied in length from 147 to 187 words. Even though each resource provided unique content, they slightly overlapped with respect to some factual details (e.g., the ingredients of energy drinks).

2.4 Procedure

Data were collected at students' schools during four regular 45-minute lessons on three different days. On day 1, students completed the word identification and reading

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

comprehension tests during one lesson, and on day 2, they completed the word chain and nonverbal reasoning tests during one lesson. On day 3, each class was divided into two groups in two subsequent lessons. One group of students completed the online research task on their laptops at their own pace during the first lesson. Before starting on the task, they were presented with three statements and asked to choose the one that best represented their stance on energy drinks. The three statements were: a) selling energy drinks to children under 15 years of age should be prohibited (negative stance), b) selling energy drinks to children under 15 years of age should be allowed (positive stance), and c) I do not have a clear opinion about this issue (neutral stance). If needed, they were allowed to use their 15-minute recess to complete the research task. In the first lesson, the other group of students had regular classroom instruction with their teacher, during which they individually completed the oral pseudoword reading task together with a researcher outside the classroom (i.e., in another, silent room). After the first lesson, the two groups switched tasks.

2.5 Data Analysis

Data consisted of 340 emails that varied in length from 2 to 183 words ($M = 34.16$, $SD = 26.10$). Of note is that the Finnish language has a highly productive compounding system, a rich derivational system, and an agglutinative morphology (Aro, 2004), which means that the same content would require substantially more words in English. The content of students' emails to the principal was analyzed in terms of a) the position or stance taken in the email message, b) the use of online resources, c) the communicative purpose of the email, and d) the transformation of content from the online resources.

The unit of analysis for students' stance on the energy drink issue (i.e., regarding the purchase of the energy drink vending machine) was an email. Each email was coded as taking a) an explicit stance against the purchase of the machine, b) an implicit stance against the purchase of the machine, c) a conditional stance for and/or against the purchase of the

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

machine, d) an explicit stance for the purchase of the machine, or e) an unclear stance regarding the issue. When taking an explicit stance against purchase, students explicitly stated that the energy drink vending machine should not be purchased by the school or that children should not consume energy drinks. When taking an implicit stance against purchase, students did not explicitly state that the energy drink vending machine should not be purchased; yet all their reasons clearly indicated that they were against the purchase. When taking a conditional stance for and/or against the purchase, students stated that the energy drink vending machine could and/or could not be purchased under certain conditions (e.g., it could be purchased under the condition that the consumption of energy drinks was controlled). When taking an explicit stance for the purchase, students explicitly stated that that energy drink vending machine should be purchased by the school. Finally, when taking an unclear stance on the issue, students did not explicate their position regarding the purchase of the energy drink vending machine. Nor did any reasoning in the email unambiguously support a particular stance.

The unit of analysis for the use of online resources, the communicative purpose, and the transformation of textual content was an idea unit ($n = 1512$). As defined by Magliano, Trabasso, and Graesser (1999), idea units contained a main verb expressing an event, activity, or state, with infinitives and complements included in an idea unit with the main verb. With respect to the use of online resources, we identified which resource or resources students utilized in each idea unit. In 55 instances, however, we were not able to trace the origin of an idea because of overlapping information in the online resources. The codes for communicative purpose and transformation, respectively, are described and exemplified in Tables 3 and 4. These codes emerged from content analysis (Krippendorff, 2004), with the analysis of both communicative purpose (Barzilai et al., 2015; Nussbaum, 2008) and transformation (Bråten, Britt, Strømsø, & Rouet, 2011) based on theoretical considerations

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

and previously applied categories. However, to more accurately represent expressions that were unique to the present data, we also applied inductive procedures (Bogdan & Biklen, 2003). Idea units that represented a misconception of textual content ($n = 15$) were not coded for communicative purpose or transformation. Because all idea units were coded for both communicative purpose and transformation, there is some overlap in the two coding systems. Specifically, the same idea units that were coded as “claim/conclusion” for communicative purpose were coded as “responding to task demands” for transformation. The first and third authors independently coded 18% of the idea units, obtaining Kappa values of .863 for communicative purpose and .834 for transformation. All disagreements were solved through thorough discussion between the coders.

3. Results

3.1 Stances in the Emails

Before starting on the online research task, most students ($n = 220$, 64.7%) took the stance that selling energy drinks to children under 15 years of age should be prohibited, whereas only 21 students (6.2%) indicated that it should be allowed. The remaining 98 students (28.8%) indicated that they did not have a clear opinion about this issue. Table 5 shows the stances that students took on the issue of whether the school should purchase an energy drink vending machine in their emails, that is, after they had studied the four online information resources. As can be seen, the vast majority (87.6%) explicitly or implicitly stated that they were against the purchase of the energy drink vending machine. Of those who indicated that energy drinks should be allowed for children under 15 years at the outset, 62% were now against the purchase of the vending machine. Of the students indicating a neutral stance at the outset, 81% were against the purchase after having studied the four online resources. Thus, many students changed their preexisting stance on the issue and adopted a stance that was consistent with the majority of the online information resources that they read.

3.2 Use of Online Resources in the Emails

The majority of the students drew on more than one online resource in their emails. While 12.9% included ideas from all four resources, 32.6% included ideas from three resources, and 24.7% included ideas from two resources in their emails. However, 17.6% of the students relied on only one online resource when writing their emails, and 12.1% did not seem to rely on any resource at all.

Of the 1512 idea units that were identified in students emails altogether, 1198 (79.2%) could be traced back to one or more of the four online textual resources. The three resources that could be regarded as more reliable (i.e., # 1, 2, and 4 in Table 2) were utilized to a similar extent, accounting for 28.8%, 29.8%, and 33.9% of the text-based idea units, respectively. In contrast, the commercial resource presenting one-sided information in favor of energy drinks was utilized quite seldom, that is, in 7.5% of the text-based idea units. This indicates that students mainly drew on more reliable resources that provided convergent information about the issue when constructing their emails.

3.3 Communicative Purpose in the Emails

Table 6 shows the communicative purposes that were reflected in the idea units included in students' essays. In accordance with the task assignment, most of these purposes involved elements of argumentation in the form of stating a claim or a conclusion ($M = 0.93$; $SD = 0.54$) and providing reasons for or against the purchase of the vending machine ($M = 2.86$; $SD = 1.95$). Elements of argumentation in the form of counterarguments and rebuttals were not represented in students essays, however (Reznitskaya et al., 2008). In accordance with other research on students' sourcing skills (Bråten, Stadtler, & Salmerón, 2018), references to sources (i.e., the attribution of ideas to their respective sources) were very seldom observed in the emails, as was directly addressing the audience (i.e., the principal requesting the recommendation).

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

Of note is that the eight students who communicated a conditional stance (see Table 5), on average, provided fewer reasons in their emails ($M = 1.75$, $SD = 1.04$) than the entire sample ($M = 2.86$, $SD = 1.95$) but still displayed a more balanced reasoning than the entire sample (0.88 reasons against and 0.77 reasons for compared with 2.57 reasons against and 0.29 reasons for in the entire sample). Seven of these students communicated that the energy drink vending machine could be bought if consumption was either restricted or monitored, and five of them justified their conditional stance with the fact that energy drinks are not harmful if consumption is moderate.

3.4 Transformation of Textual Content in the Emails

Even though students relied more on copying/paraphrasing content from the online resources ($M = 2.20$; $SD = 2.20$) than on integration ($M = 1.02$; $SD = 1.18$) in their emails, as indicated by a Wilcoxon Signed Ranks test, $Z = -8.415$, $p < .001$, $r = .46$, 61% of the students showed some evidence of integration. As can be seen in Table 7, integration of content within and across the online resources (i.e., intratextual and intertextual integration) was more common than integration in the form of embedding textual content within the task context (i.e., contextualization) and connecting textual content to prior knowledge, with multiple comparisons with Wilcoxon Signed Ranks tests yielding $Zs > 4.64$, $ps < .001$, $rs > .25$.

3.5 Associations between Individual Difference Variables and Content, Argumentation, and Integration in Emails

Table 8 shows Spearman correlations between individual difference variables (i.e., gender, reading fluency, reading comprehension, and nonverbal reasoning) and content, argumentation, and integration in the emails. Regarding content, all the individual difference variables were statistically significantly correlated with the number of textual idea units included in the emails and the number of resources utilized in the emails. Thus, girls were likely to include more idea units and utilize more online resources in their emails compared to

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

boys, and the higher students' level of reading fluency, reading comprehension, and nonverbal reasoning, the more idea units they included in their emails and the more online resources they utilized. Of note is that reading fluency was somewhat more strongly correlated with the number of idea units ($Z = 1.23, p = .10$) and the number of resources ($Z = 2.37, p < .01$) than was reading comprehension (Lenhard & Lenhard, 2014).

Regarding argumentation, all individual difference variables were statistically significantly correlated with the number of reasons included in the emails. Specifically, girls were likely to provide more reasons for their recommendations than were boys, and the higher students' level of reading fluency, reading comprehension, and nonverbal reasoning, the more reasons they provided for their recommendations. Reading fluency was somewhat more strongly correlated with number of reasons than was reading comprehension, although this difference was not statistically significant ($Z = 0.94, p = .17$).

Finally, the same pattern of correlations was found for the measures of copy and paraphrase and integration, respectively. All correlations between individual difference variables and integration were quite small, however (see Table 8).

4. Discussion

Ability to comprehend and use multiple information resources presented through different mediums is an important characteristic of a competent modern reader (Magliano et al., 2018). However, becoming a modern reader can be considered a lifelong journey that starts already in the early grades. In this study, we provided a unique window on this journey by exploring how a sample of Finnish elementary school students dealt with the challenge of writing from multiple online resources to produce an argument concerning a controversial issue relevant to their school context.

First, it was found that most students were able to respond to the task assignment by taking an explicit stance on the issue in question. At the same time, however, nearly one fifth

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

of the students were not explicit or clear in responding to the assignment, which may suggest that they had difficulties interpreting the task or constructing an adequate task model (Rouet et al., 2017). Still, very few students conveyed a view that ran counter to the view of the three most reliable sources that the participants studied, suggesting that they may have corroborated information across those resources or noted that this information came from less biased resources than did information about the positive effects of energy drinks. Of note is that such corroboration and sourcing strategies can be regarded as quite sophisticated strategies in multiple document contexts (Wineburg, 1991). Given the 3:1 ratio of more and less reliable resources in this study, however, we also cannot exclude the possibility that students were influenced by the sheer number of resources speaking against energy drinks when taking a stance on the issue.

Second, although the vast majority of the students took a stance consistent with the more reliable resources, nearly one third based their written product on only one information resource or no resource at all. Such lack of content coverage when writing from multiple information resources has been observed even among secondary and postsecondary students (Britt, Wiemer-Hastings, Larson, & Perfetti, 2004; van Strien, Brand-Gruwel, & Boshuizen, 2014), especially when students hold pronounced prior attitudes about an issue (van Strien et al., 2014). It also seems likely that many students in the present study did not realize that they might have strengthened their recommendation by justifying their stance by referring to multiple sources (Kendeou, Braasch, & Bråten, 2016).

Third, students generally provided one or more reasons for their recommendation to the principal, as required, but did not provide any counterarguments or rebuttals, which also are considered important elements of argumentation (Reznitskaya et al., 2008). Presumably, this lack of counterarguments and rebuttals was related to the fact that students were tasked to take a particular stance on the issue and justify that stance, which may have made it less

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

relevant to provide reasons against their stance or statements in response to anticipated objections (i.e., rebuttals; Reznitskaya et al., 2008). Also, the general lack of source references is consistent with previous findings that students across educational levels often disregard such sourcing conventions when working with multiple information resources (e.g., Barzilai et al., 2015; Kiili, Leu, Martuunen, Hautala, & Leppänen, 2018; Britt & Aglinskas, 2002). Obviously, it would have been important for a person making a decision about the issue to know on which source(s) a recommendation was based. Further, students did not directly address the audience in their emails. One reason for this may be that they did not consider it appropriate to address the principal in such personal terms. However, another possibility is that they did not consider this relevant given the task assignment, asking them to present and justify their own view on the issue.

Fourth, although students very seldom cited any sources, they mainly relied on copying and paraphrasing textual information in constructing their emails. Still, we also observed some effort to integrate ideas within and across the online resources, as well as to integrate textual information with information about the task context (i.e., contextualization). Although sparse, integration in the form of contextualization suggests that some students were able to construct an interpretation of the context (i.e., a context model; Britt et al., 2018) that represented the physical and social situation of the principal's request and link that situation to textual information. As was the case with respect to argumentation, students' reliance on copying and paraphrasing rather than integration may be related to the way the task assignment (i.e., the principal's email) was formulated in the present study. That said, previous research using other tasks and materials has also indicated that both younger and older students tend to rely on copying and paraphrasing rather than integration and have problems taking counterarguments and rebuttals into consideration (e.g., Anmarkrud et al., 2014; Davis et al., 2017; Kuhn & Crowell, 2011).

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

Fifth, the correlational analysis showed that the individual difference variables of gender, reading fluency, reading comprehension, and nonverbal reasoning were associated with content, argumentation, and integration in students' emails, with girls generally outperforming boys and with students' reading and reasoning skills generally being positively related to these aspects of their written products. Of note is, however, that all correlations between the individual difference variables and writing measures were small to medium. This suggests that being a good sixth-grade reader and thinker in no way ensures good text-based argumentation from multiple information resources. Rather, such complex tasks likely involve an interplay between reading, writing, and reasoning (McNamara & Allen, 2018) that requires specific training and guided practice (De La Paz & Felton, 2010; Granado-Peinado et al., 2019; Mateos et al., 2018; Weston-Semenetti et al., 2018). While the new literacies framework was found to be appropriate and applicable for research with elementary school students, our findings also highlighted some of the specific challenges that students at this educational level may encounter with the set of phases assumed to typify online research and comprehension, especially with the phase of creating a well-argued and integrated task product in addressing a particular audience (Leu et al., 2013).

Of course, our findings need to be interpreted in light of the students, the technology, the writing task, the online resources, and the measures that were included, and further research is needed to probe their generalizability. For example, the web-based environment included both technological affordances and potential constraints. On the one hand, it guided students through the phases of the task and thereby reduced the demand for regulation and facilitated engagement in relevant activities to complete the task. On the other hand, the environment restricted students' own choices in approaching the task. Thus, working in a more open environment might have revealed additional differences in student performance. Further, the possibility to take notes and use them in later phases of the task likely supported

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

students' memory for text content. However, this possibility might also have tempted some students to mechanically copy text content to their notes and, further, to their written products, with detrimental effects on students' efforts to integrate information within and across texts. It is also possible that presenting online resources that more systematically vary the representation of different positions on the issue and conflicting evidence, as well as the credibility of those resources, might yield different findings regarding students' ability to use and integrate information from reliable textual resources. Further experimental work is therefore needed. Yet another possibility is that coding students' written products in alternative ways might yield somewhat different findings. Although there is a precedent for using idea units as units of analysis when assessing integration within and across multiple information resources (e.g., Gil et al., 2010; Salmerón, Gil, & Bråten, 2018), future research could use other approaches, such as analyzing the use of linguistic connectives that explicitly signal connections between passages within and across texts (e.g., Latini, Bråten, Anmarkrud, & Salmerón, 2019; Taylor, Lawrence, Connor, & Snow, 2019).

Another limitation of the current study concerns the lack of process data. Lack of motivation and engagement for performing multiple document literacy tasks may lead to an underestimation of students' competencies, with especially their willingness to invest time, effort, and persistence in such tasks having the potential to influence results (Bråten, Brante, et al., 2018). Future researchers should therefore include process data, such as reading and writing times, eye movements, and verbal protocols, to explore individual differences in engagement as a predictor of text-based argumentation. Given the school-based nature of the task used in the current study, as well as the finding that Finnish boys are generally less motivated for and engaged in such tasks than are girls (Brozo et al., 2014; Torppa et al., 2018), process data may also help clarifying to what extent observed gender differences are

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

related to differences in motivation and engagement. Additionally, collecting data on students' prior knowledge and cognitive load seems pertinent in future research in this area.

Finally, our use of correlational data precludes any conclusions regarding causality. Future experimental work using a pretest posttest design with a control group is therefore needed to investigate causal predictors of text-based argumentation from multiple online information resources among elementary school students.

Despite such limitations, we believe that this study also has merits due to the instructional implications it may offer. One implication is that elementary school teachers should discuss students' interpretations of the context and content of the task assignment with their class and ensure that students' interpretations lay a foundation for task-relevant online research and comprehension (Britt et al., 2018). Another implication is that many elementary school students may need to experience modeling of and practice with covering the content adequately and linking that content to corresponding sources when working with multiple online information resources (Britt et al., 2004). As noted earlier, such instruction could profitably clarify that justifying one's view or conception by multiple sources is likely to influence the audience more than are justifications by one single source or own opinion (Kendeou et al., 2016).

Further, covering the content of multiple information resources and linking that content to corresponding sources are not only a matter of copying and paraphrasing, which seems to be the default strategy for many elementary school students. Students therefore need to be taught how they move from copying and paraphrasing textual information from multiple online resources to constructing a task product that transforms and builds knowledge through integrative processing (Bereiter & Scardamalia, 1987; Scardamalia & Bereiter, 2014). Presumably, this can be done in a stepwise fashion, with paraphrasing introduced as an intermediate step between copying and transforming, and with integration of information

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

within single resources preceding integration across multiple resources (Britt & Sommer, 2004). Importantly, such scaffolded movement toward mastery of text-based argumentation from multiple online information resources needs to be framed by an understanding of the complex interplay between reading, writing, and reasoning required by such tasks, such that neither teachers nor students lose sight of the overarching instructional goal and the embeddedness of particular learning activities within a larger whole.

Because students' basic reading fluency and comprehension skills also play a role when working with multiple online information resources, such foundational skills must not be neglected when teaching literacy in an online environment, and teachers need to take them into account when assigning tasks and providing instructional scaffolds for elementary school students. At the same time, however, the modest correlations that we observed between the basic reading skills and the writing measures may point to the important role of higher-level reading processes such as relevance judgment, source evaluation, and intertextual processing strategies in text-based argumentation. This study may therefore encourage future research and interventions focusing on higher-level literacy skills in text-based argumentation with multiple online information resources.

Note

¹ The sample of elementary school students in the current work also contributed to data reported by Kannianen, Kiili, Tolvanen, Aro, and Leppänen (2019) and by Kiili et al. (2018). However, the research questions, data, analyses, and findings included in this article are unique to this study.

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Appendix A

*The Email from the Fictitious Principal**

From: Kaisa Nieminen <kaisa.nieminen@kaitale.fi>

To:<myschool.com>

Subject: Energy drinks and health

Hello,

I am Kaisa Nieminen, the principle of Kaitale School. Our student union has proposed that this school purchase an energy drink vending machine. I would like to know more about the health effects of energy drinks. I am very busy, so I hope that you could examine this issue for me.

When you have completed your research, send me an email where you present your view on whether or not the school should purchase an energy drink vending machine. Justify your view by indicating **why** the energy drink vending machine should be purchased or **why** it should not be purchased.

Thank you for your help!

Kaisa Nieminen
Principal, Kaitale School

* For the Finnish version of this email, see bit.ly/ILARes

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

Table 1

Descriptive Statistics and Reliability Estimates for the Individual Difference Measures

Measure	<i>n</i>	<i>M</i>	<i>SD</i>	Alpha
Word identification (max. 80)	337	48.83	9.30	.94
Word chain (max. 100)	334	44.04	14.44	.97
Oral pseudoword reading (time/correctly read words)	338	0.71	0.21	.77
Reading comprehension (max. 12)	337	7.25	2.55	.66
Nonverbal reasoning (max. 30)	333	22.44	3.61	.75

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

Table 2

An Overview of the Four Online Resources

Title	Publisher	Type of Resource	Purpose	Perspective and Evidence
1. Energy drinks are associated with adolescents' sleeping disorders ¹	Newspaper	News article	Informs about the results of research	Describes symptoms that energy drinks can cause in adolescents (against). Relies on the results of a large national study.
2. Energy drinks and health ²	University	Expert answering Frequently Asked Questions (FAQ) about energy drinks	Answers common questions about energy drinks from parents	Informs about circumstances under which energy drinks are safe to use and under which they may cause various symptoms (neutral). A university researcher from a health department answers questions relying on sources listed at the end of the page.
3. New energy drink to the stores ²	Energy drink producer (fictitious)	Press release	Promotes sale of a new energy drink product	Describes positive effects of energy drinks (for). Set forth by the head of the marketing department.
4. There are 14 lumps of sugar in a can of energy drink ³	Newspaper	News article	Expresses the concerns of health professionals about increasing consumption of energy drinks among youth	Reports negative consequences of energy drinks on health, in particular, on teeth (against). A researcher of the National Institute for Health and Welfare is interviewed.

Note. ¹ The original web page is not available on the Internet anymore. ² Resources # 2 and 3 can be accessed at bit.ly/ILARes ³ Resource # 4 can at the time of publication be accessed at bit.ly/OR_4

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

Table 3

Coding of Communicative Purposes

Code	Example
Claim/conclusion about the purchase of the energy drink vending machine or the consumption of energy drinks	You should not buy an energy drink vending machine for your school.
Reasoning Reason(s) against purchasing the energy drink vending machine or the consumption of energy drinks Reason(s) for purchasing the energy drink vending machine or the consumption of energy drinks	Energy drinks are harmful for our health in many ways. Caffeine can even have positive effects on our health.
Sourcing	I have read information from four different websites and I am even more convinced about this issue.
Description	Energy drinks include sugar and taurin.
Presenting an alternative solution or advice	In contrast, I recommend the water machine—it is difficult to drink from a water tap.
Addressing the audience	I hope you will make a good decision for the Kaitale school.

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

Table 4

Coding of Transformation in the Emails

Code	Description	Example
Idea unit including integration		
Intratextual	Content that originates from at least two different sentences in one online resource.	Energy drinks include a lot of sugar (sentence 6, resource 2), caffeine (sentence 4, resource 2), and other substances (sentence 5, resource 2).
Intertextual	Content that originates from at least two different online resources or draws a conclusion based on information originating from multiple resources.	It can cause hyperactivity (resource 1) and nervousness (resource 2).
Connecting textual content to prior knowledge	Content from an online resource is linked to prior knowledge.	Too much sugar causes cavity (the resource mentions tooth enamel)
Contextualizing textual content	Content from an online resource is contextualized within the situation described in the task assignment (school context).	For example, hyperactivity <i>that can harm school work</i> , sleeping problems, headache, and vapor.
Idea unit not including integration		
Copy or paraphrase	Content copied word by word or taken from one sentence and stated in own words.	Excessive drinking can cause serious symptoms. (original sentence lists multiple symptoms of extensive consumption of energy drinks).
Responding to task demands	Content addressing the task assignment.	You should not purchase the energy drink vending machine for the school.
Addition	Related content from prior knowledge that is not connected to a resource ^a OR addresses the issue in a way not asked for in the task assignment ^b .	^a One can easily become addicted to it. ^b Instead, I recommend a water machine.

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

Table 5

Students' Stances in the Emails

Stance	<i>n</i>	%
Explicitly against purchase of the energy drink vending machine	263	77.35
Implicitly against purchase of the energy drink vending machine	35	10.29
Unclear	27	7.94
Conditional stance for and/or against purchase of the vending machine	8	2.35
Explicitly for purchase of the energy drink vending machine	7	2.05
Total	340	100

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

Table 6

Communicative Purposes of the Idea Units

Communicative purpose	<i>n</i>	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Reasoning					
Reasons against	873	2.57	1.73	0	11
Reasons for	97	0.29	0.65	0	3
Reasoning total	970	2.86	1.95	0	12
Claim/conclusion	317	0.93	0.54	0	4
Description	160	0.47	1.06	0	7
Sourcing	16	0.05	0.26	0	3
Addressing the audience	15	0.04	0.22	0	2
Presenting an alternative solution or advice	10	0.03	0.19	0	2

Note. Idea units not applicable to the analysis of communicative purpose or coded as misconceptions are not included

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

Table 7

Transformations in the Idea Units

Type of transformation	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max
Copy or paraphrase	747	2.20	2.20	0	14
Integration					
Intertextual	155	0.46	0.68	0	3
Intratextual	126	0.37	0.69	0	4
Contextualization	56	0.16	0.48	0	5
Connecting to prior knowledge	10	0.03	0.17	0	2
Integration total	347	1.02	1.18	0	9
Responding to task demands	317	0.93	0.54	0	4
Addition	55	0.16	0.46	0	4

Note. Idea units not applicable to analysis of transformation or coded as misconceptions are not included.

ELEMENTARY SCHOOL STUDENTS' TEXT-BASED ARGUMENTATION

Table 8

Descriptive Statistics and Spearman Correlations among Individual Differences and Content, Argumentation, and Integration in the Emails

Variable	<i>M</i> (<i>SD</i>)	1	2	3	4	5	6	7	8	9
1. Gender ¹										
2. Reading fluency ²	0.00 (0.90)	-.282***								
3. Reading comprehension	7.25 (2.55)	-.079	.385***							
4. Nonverbal reasoning	22.44 (3.61)	-.087	.316***	.431***						
5. Number of idea units	4.45 (2.68)	-.317***	.280***	.209***	.148**					
6. Number of resources	2.17 (1.22)	-.218***	.274***	.136*	.157**	.750***				
7. Claim or conclusion	0.93 (0.54)	-.168**	.043	.104	.105	.115*	-.114*			
8. Reasons	2.86 (1.95)	-.262***	.248***	.193***	.138*	.885***	.733***	-.101		
9. Copy or paraphrase	2.20 (2.20)	-.220***	.219***	.144**	.092	.783***	.609***	-.157**	.761***	
10. Integration	1.02 (1.18)	-.156**	.135*	.133*	.127*	.411***	.521***	-.008	.465***	.007

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; ¹0 = female, 1 = male; ²Reading fluency factor score