Shih, JL. et al. (Eds.) (2023). Proceedings of the 31st International Conference on Computers in Education. Asia-Pacific Society for Computers in Education

The Effect of Genres and Reading Orders on Interest, Reading Comprehension, and Process: Evidence from Eye Movement of Multiple-text Reading

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Abstract: With the rise of online learning, multiple-text reading has become a prevailing trend and involves complex cognitive processes. Previous research often employed controversial socio-scientific issues in the form of expository texts to examine reading processes and comprehension. However, the story is relatively accessible, which can enhance learners' interest in reading. Moreover, the reading order could affect how learners integrate multiple texts. Therefore, in this study, we employed eye-tracking technology to investigate how different genres and reading orders of conflicting texts influence readers' change of interest, learning performance, and eye movement patterns. The study included 21 participants who were divided into two groups: expository text first and story first. Each participant was provided with two stories and two expository texts to read. Their interests were recorded before and after reading, alongside their eye movements were recorded during the reading. After completing the reading, participants were required to write an essay and take a multiple-choice test to assess their comprehension. The findings revealed that, regardless of reading order, participants' interest heightened after reading. however, the expository-text-first group had higher writing scores than the story-first group. As for the eye movement measures, this study showed that although the first-pass reading time was not affected by reading order and genre, the rereading time was. Specifically, the expository-text-first group spent more rereading time on the expository text compared to the story-first group, indicating that these readers devote more rereading time to the expository text, focusing on taking its basic concepts and theories, resulting in greater integrated comprehension. Therefore, they exhibit superior performance in deep-level reading comprehension. This study demonstrates that reading order influences readers' reading comprehension, providing useful insights for future scientific topic education and discussions.

Keywords: Scientific controversial multiple texts, genre, reading order, eye movement, reading comprehension performance

1. Introduction

With the onset of COVID, persons must quarantine themselves at home. It caused at-home online learning to become more commonplace. (Fewella, 2023). The process of consuming online information frequently entails navigating through interconnected multiple-text resources (Liu et al., 2008). Consequently, engaging with multiple texts has become a crucial aspect of contemporary life. In this circumstance, the impacts of online learning are mostly influenced by students' self-directed learning (SDL). Students often face difficulties in overcoming challenges and persevering during the learning process (Zhu, 2021). Teachers' direction and instruction are important in students' learning.

Reading multiple texts occurs in a dynamic interplay between several top-down and bottom-up processes (Britt & Rouet, 2012). This intricate process involves the iterative construction of propositions based on textual information, the assessment of reliability and

relevance among the texts, and the subsequent integration of acquired information with preexisting knowledge and personal experiences. This integration culminates in the creation of a coherent mental representation, facilitating a comprehensive understanding of the text (Kintsch, 1988; Richter, 2011).

Prior research has often employed controversial socio-scientific issues written in an expository style as reading materials (Bråten et al., 2018; Stadtler et al., 2020; Yen & Wu, 2017). Recently, the topics of gene editing, nuclear power generation, and ecological conservation have gained significant attention. The texts on this issue often are conflicting, which means that supporting and opposing perspectives exist on this issue. After reading these texts, learners usually need to evaluate the two-side positions and decide to stand for one of the positions. This behavior made readers overwhelmed because readers not only might lack interest in reading this issue (List & Alexander, 2017), but they also might confront difficulty in understanding the expository texts (Clinton et al., 2020). Chambliss & Calfee (1998) pointed out that expository texts are often used to express opinions, state facts, or describe and explain various phenomena, which lead readers to generate more inferences and can be more challenging to read than stories (Clinton et al., 2020). Compared to expository texts, stories that emphasize characters, storylines, and storytelling can help students understand the text's overall meaning. In sum, it is possible to use stories and expository texts simultaneously to evoke readers' interest to read. Given this situation, teachers should carefully consider each student's unique capabilities, reading skills, and prior knowledge while planning the material design and setting the reading order.

Similar research conducted by McCrudden et al. (2022) showed that if the reading order was a principal text first, followed by presenting with pertinent exemplar-based texts, the reading performance could be better than the pertinent exemplar-based texts first. In other words, the reading order would affect how learners process the texts. However, the reading process between exemplar-based text and principal text remains unclear. Moreover, the study did not observe a significant interest difference between groups reading the exemplar-based text first or principal text first. Yet, promoting learners' interest is important in reading multiple texts, which could lead readers to apply more reading strategies to reach deep-level comprehension (List & Alexander, 2017) and need more research.

Previous studies used the think-aloud method to collect reading process data, which might interfere with deep learning results (Cerdán & Vidal-Abarca, 2008). Eye-tracking technology is one of the non-intrusive methodologies and can provide rich and moment-to-moment cognitive processes (Rayner, 1998). Therefore, more and more multiple-text reading research adopt eye-tracking technology to collect reading process data (Salmerón et al., 2018; Stadtler et al., 2020). Given this, the purpose of this study is to use eye-tracking technology to record readers' reading processes when engaging with various genres and reading orders of conflicting socio-scientific multiple-texts. Additionally, we also explore the impact of reading orders on the reading process, comprehension, and changes in interest before and after reading. The research findings will be used as a reference for teacher instruction and material design. Three research questions of this study were as the following:

RQ1: Do different reading orders affect readers' change of interest?

RQ2: Is there a difference in learning performance between different reading orders?

RQ3: How do readers' eye movement patterns differ with various reading orders?

2. Method

2.1 Participants

21 (16 females and 5 males) postgraduates and undergraduates in northern Taiwan participated in this study. Their ages were between 18 to 30 years old (M = 24, SD = 2.55). They were randomly assigned into two groups: the "expository-text-first group" (N = 11) and the "story-first group" (N = 10). The expository-text-first group involved reading the expository text first and then reading the story, while the story-first group was the reverse.

2.2 Materials

2.2.1 Reading materials

All participants needed to read four texts designed by the researchers. The topic was Gene-Edited Babies in Biology. The reading materials were categorized into two types of texts: "expository text" and "story." Two arguments were generated for each type. One was on the opposing side, and the other was on the supporting side. The length of the articles ranged from 351 to 353 words. The presentation order was manipulated into two versions: one with the expository text preceding the story and the other with the story preceding the expository text. This was done using counterbalancing. To maintain the experiment's simplicity, the reading sequence of the participants will be controlled, and they will not be allowed to backtrack during their reading (McCrudden et al., 2022).

2.2.2 Apparatus

An EyeLink 1000 desktop remote eye-tracker system (SR Research Ltd., Canada) with a sampling rate of 1000 Hz and an accuracy of 0.5 degrees recorded participants' eye movement. Two monitors were used. One was for monitoring the eye movement information, and the other was for displaying the stimulus. The participant's head position was fixed using a chinrest placed 60 cm away from the screen. The eye movement measures used in this study were first-pass reading time and rereading time. The first-passing reading time indicated the cumulative time that readers spend on their initial fixation on areas of interest within the text, reflecting the early processing of words and the construction of meaning, such as the extraction of word meanings, decoding, and syntax analysis. The rereading time indicated the cumulative time that readers spent on their subsequent fixations on areas of interest within the text, reflecting the processing difficulties encountered after the first reading or the process of integrating the article with previous information or relevant knowledge (Hyönä et al., 2002; Zhang et al., 2019).

2.2.3 Topic interest measure

Topic interest measure was a self-report scale that was developed by researchers to measure readers' interest in genome editing. The scale was given to participants to fill out before and after reading. This scale included six items with a 6-Likert scale (1 = *very not agree*, 6 = *very agree*). The coefficient alpha reliabilities for this scale before and after reading were 0.79 and 0.84.

2.2.4 Prior knowledge

The prior knowledge test is multiple choice and includes six items selected from the entrance exam to test participants' prior knowledge. These six items were related to the topic of genome editing. Each item scored 10 points. The total score was 60 points.

2.2.5 Reading comprehension performance

Reading comprehension performance included two tests: multiple-choice and writing essay tasks. Multiple-choice was designed to evaluate students' memory of the reading material by directly extracting information from the text. On the other hand, writing essays assessed students' ability to integrate information from multiple texts. The participants received the following instruction: "After reading the texts, synthesize and compare different viewpoints presented in the articles, and finally, present and support your stance." Our rubric to score students' written responses was divided into four dimensions: two-sided reasoning, elaboration, integration, and evidence use. Description and examples of the dimensions are detailed in Table 1. We also calculated the scores of all the dimensions as total scores (Lee & List, 2021). Two raters coded all student responses. The inter-rater reliability for each was

higher than 0.8. For the disagreement, a discussion was conducted until two raters reached a consensus.

Table 1. *Description and examples of the rubric dimensions*

Dimensions	Description	Example
Two-sides reasoning	Whether readers respond to opposing views, present instances, and make refutations.	"…If everyone may select their desired genes, it appears that biological variety may be lost…"
Elaboration	Whether readers articulate their own perspectives.	"…I think gene editing has a lot of potential in terms of treating human disorders. However, there are still a lot of technological and moral issues to think about…"
Integration	Whether readers integrate information across different articles.	"…People who favor gene editing believe that it has the potential to change a child's DNA so they can fend off the effects of AIDS. However, it is also evident that unrestricted gene editing may result in problems that cannot be fixed…"
Evidence use	Whether readers cite content from the articles.	"…As mentioned in the last article, even if one matches their children's genes to exhibit desirable physical attributes and intelligence,…"

2.3 Procedure

This study employed eye-tracking technology to gain insights into the reading processes of the subjects and consisted of three main parts. Firstly, participants were told the experiment procedure and completed the topic interest measure. During the second part, a nine-point calibration was conducted before participants started reading the texts. While reading, participants determined the pace themselves; however, revisiting previous pages was not permitted. After the experiment, participants underwent the writing essay task and the multiple-choice test, followed by an interview to ascertain whether the narrative articles assisted them in constructing a comprehensive understanding of the text during the reading process.

2.4 Statistical Method

As for the RQ1, we used mixed-design ANOVA to examine the change of interest (pre- and post-test) between two groups (Expository-Story and Story-Expository). As for the RQ2, we ran the linear regression to examine whether the differences in the writing essay task (four dimensions and total scores) existed between the two groups after including the number of words as a control variable. We also used the independent t-test to compare the score of the multiple-choice test between the two groups. As for the RQ3, we analyzed the eye-movement measures by using linear mixed model with the reading order and genres as fixed effects while the participants and the sentence as random effects. The eye-movement measures (first-pass reading time and rereading time) were dependent variables. The sentence length was also included in the models as a control variable.

3. Result

3.1 Pre-test and post-test interest performance of each group

To understand the impact of different reading orders on readers' interest (RQ1). Mixed-design ANOVA was conducted with pre-post as within variable and reading order as the between variable. As shown in Table 2, readers' interest increased after reading the texts in both groups ($F_{(1,19)} = 14.75$, $p = .001$). Nevertheless, the main effect of reading order and the interaction effect did not reach a significant level (reading order: $F_{(1,19)} = 0.01$, $p = .92$; interaction effect: $F_{(1,19)} = 0.03$, $p = .85$). These findings suggest that readers in both groups exhibited heightened interest after reading the texts, but there was no difference in interest between groups.

Table 2. *Results of descriptive statistics for pre-test and post-test interest performance, prior knowledge test and reading comprehension performance of each group*

Group	Pre-test interest	Post-test interest	Prior knowledge	Multiple-choice test
	M (SD)	*M (SD)*	*M (SD)*	*M(SD)*
Expository text first (N=11)	18.45 (4.01)	22.09 (6.06)	41.82 (13.28)	48.18 (9.82)
Story first (N=10)	18.80 (4.16)	22.10 (3.21)	48.00 (11.35)	46.00 (12.65)

3.2 Reading comprehension performance of each group

To comprehend the differences in learning performance between readers who read different text orders (RQ2), linear regression was used for the writing essay tasks with the reading order as the independent variable, and the word count as the control variable. Besides, the t-test was used to compare the multiple-choice score between the two groups. Before the main analysis, the prior knowledge between the two groups was examined. The result of descriptive statistics has shown in Table 2. The result of the t-test showed that there was no significant difference in the multiple-choice scores between the two groups ($t(19) = -1.14$, $p = .26$). Therefore, the following analysis didn't consider prior knowledge.

In the case of the writing essay task, a significant difference was found between the two groups. As shown in Table 3, the results of regression demonstrated that students with longer writing lengths achieved higher scores ($b = 0.03$, $SE = 0.01$, $t = 4.44$, $p < .001$). After controlling for word count, the group that read the expository text first outperformed the group that read the story first ($b = 2.46$, $SE = 0.75$, $t = 3.30$, $p = .003$).

Furthermore, when comparing the performance of different groups across various dimensions of the writing task, the results showed that the group reading the expository text first performed better in the dimension of "two-sides reasoning" and "integration" than the group reading the story first (two-sides reasoning: $b = 0.91$, $SE = 0.40$, $t = 2.30$, $p = .03$; integration: $b = 0.84$, $SE = 0.35$, $t = 2.42$, $p = .003$). However, as shown in Table 4, there were no significant differences between the two groups in the dimensions of "elaboration" and "evidence use" (elaboration: $b = 0.28$, $SE = 0.20$, $t = 1.41$, $p = .17$; evidence use: $b = 0.43$, $SE = 0.34$, $t = 1.25$, $p = 0.23$).

Table 3. *Results of regression analyses for variables predicting performance on total score, two-sides reasoning, and integration*

Predictor	Total scores			Two-sides reasoning			Integration		
	B	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Number of words	0.03	0.01	0.69***	0.01	0.00	0.55**	0.01	0.00	0.58**
Reading order	2.46	0.75	0.51**	0.91	0.40	0.43*	0.84	0.35	0.44*

*$p < .05$, **$p < .01$, ***$p < .001$

Table 4. *Results of regression analyses for variables predicting performance on the elaboration and evidence use*

Predictor	Elaboration			Evidence use		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Number of words	0.00	0.00	0.33	0.01	0.00	0.47*
Reading order	0.28	0.20	0.31	0.43	0.34	0.26

*p < .05, **p < .01, ***p < .001

3.3 Analysis of eye movement data of each group

To comprehend the process of eye-movement patterns between different reading orders (RQ3). The linear mixed model was used in this study. The fixed effects included genre with two levels (story and expository text) and reading order with two levels (story first and expository text first). Besides, the sentence length was entered into models as a control variable. The mean and standard deviation are presented in Table 5, and the statistical results are summarized in Table 6.

Table 5. *Mean and standard deviation for eye-movement measure*

	Expository text first		Story first	
	Expository text	Story	Expository text	Story
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
First-pass reading time	777.73 (754.22)	703.49 (654.26)	621.08 (675.19)	588.62 (603.09)
Rereading time	595.80 (908.57)	499.69 (744.71)	326.62 (616.83)	414.78 (622.20)

For the first-pass reading time, the sentence length was significant (b = 47.49, SE = 3.73, t = 12.74, p < .001). However, the main effects and interaction effect were not significant (Reading order: b = -135.76, SE = 120.48, t = -1.13, p = .27; Genre: b = -64.11, SE = 38.44, t = -1.67, p = .10; Reading order × Genre: b = 41.79, SE = 46.77, t = 0.89, p = .37). These results indicated that readers spent the equal time constructing the semantic process (such as extracting word meanings, decoding, and syntactic analysis) regardless of genres or reading order they encountered.

For the rereading time, the sentence length was significant (b = 38.13, SE = 3.40, t = 11.24, p < .001). Besides, although the two main effects were not significant (Reading order: b =-177.04, SE = 121.04, t = -1.46, p = 0.16; Genre: b = -12.62, SE = 35.00, t = -0.36, p = 0.72), the interaction effect was significant (b =184.24, SE = 55.30, t = 3.33, p < .001), as shown in Figure 1.

Table 6. *Results of linear mixed model for first-pass reading time and rereading time*

	First-pass reading time				Rereading time			
	b	*SE*	*t*	*p*	*b*	*SE*	*t*	*p*
Sentence length	47.49	3.73	12.74	< .001	38.13	3.40	11.24	< .001
Reading order	-135.76	120.48	-1.13	.27	-177.04	121.04	-1.46	.16
Genre	-64.11	38.44	-1.67	.10	-12.62	35.00	-0.36	.72
Reading Order × Genre	41.79	46.77	0.89	.37	184.24	55.30	3.33	< .001

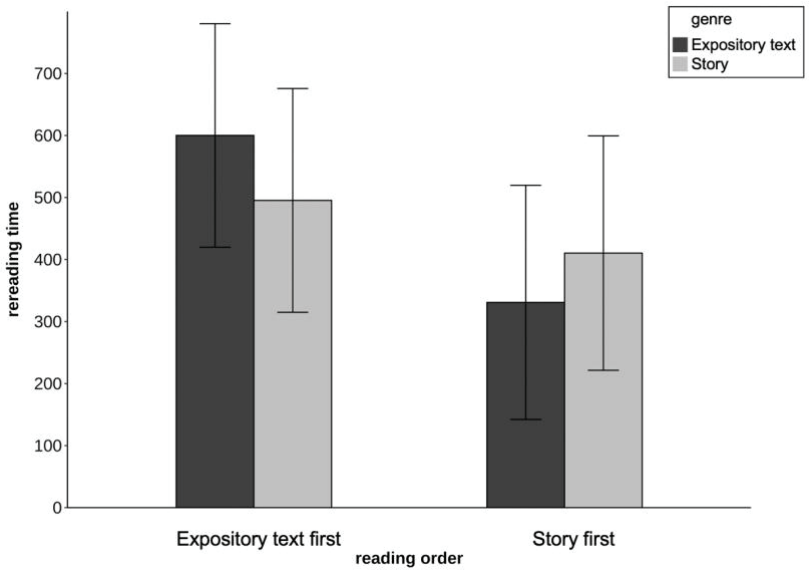

Figure 1. The interaction effect of reading order and genre on rereading time.

Table 7 shows the result of the simple main effect of rereading time. When reading the expository text, the group reading the expository text first had significantly longer rereading time on the expository test than the group reading story first (*b* =269.2, *SE* = 124, *t* = 2.17, *p* = .04); while this effect was not found when reading the story (*b* =84.9, *SE* = 124, *t* = 0.68, *p* = .50). Additionally, the group reading the expository text first significantly spent more rereading time on the expository text than on the story (*b* =104.7, *SE* = 43.8, *t* = 2.39, *p* = .01). However, the group reading story first slightly spent less rereading time on expository texts compared to story which only reach marginal significant (*b* =-79.5, *SE* = 45.4, *t* = -1.75, *p* = .08).

Table 7. *The simple main effect of the interaction effect on rereading time*

Fixed level	Compare	Rereading time			
		b	*SE*	*t*	*p*
Expository text	Expository text first - Story first	269.2	124	2.17	.04
Story	Expository text first - Story first	84.9	124	0.68	.50
Expository text first	Expository text - Story	104.7	43.8	2.39	.01
Story first	Expository text - Story	-79.5	45.4	-1.75	.08

4. Discussion and Conclusion

The purpose of this study was to investigate the effect of reading order (story first or expository text first) on multiple-text reading comprehension and the process reflected by eye movement measures. Besides, we also examine the effect of reading order on the change of interest. We proposed the following research findings. First, regardless of the reading order, readers' interest increased after reading the texts compared to before reading the texts. This result is inspiring because after reading such a conflicting topic, the readers promote their interest in this topic instead of decreasing it, which implies that readers might change their original attitude after reading the texts and search for more information to read beyond experimental texts. As a result, when creating materials, teachers can take into account the different abilities and prior knowledge of their students. This may increase students' interest in reading and promote their self-directed reading.

Secondly, the comprehension performance of multiple-choice was not different between reading the story first and reading the expository text first. However, as for the writing essay task, the group reading the expository text first performed better than the group reading story first. In this study, the multiple-choice test was regarded as the surface-level representation, whereas the writing essay task represented deeper-level understanding (Chen et al., 2014). In other words, readers in this study had no difficulty in understanding and remembering the basic information the texts provided. However, their deep-level representation was influenced by the reading orders, especially for the "two-sides reasoning" and "integration." These results can be explained by the eye-movement data.

Specifically, the two groups with different reading orders had no significant difference in first-pass reading time. These results showed that readers spend equal time establishing semantic understanding regardless of the reading order, which seems consistent with the impact of the multiple-choice test because readers could remember as much as possible and were not affected by the reading orders. As for the rereading time, readers in the expository first group spent more time on the expository to integrate information than readers in the story first group. This behavior entailed readers to understand the expository text better; therefore, they could make more integrate with the following stories and provide more arguments to justify their positions, which led to better two-sides reasoning scores. However, readers in the reading story first group did not demonstrate this cognitive process which implied that after reading the story, they could not integrate the following expository text better and spent almost equal time on these two genres. This result was consistent with the previous study conducted by McCrudden et al. (2022), who also found that the principal text first promoted readers to have more cross-text integration.

In conclusion, our study yielded several significant insights. As for the interest, we found that readers' interest increased after reading multiple texts, which led the educators to have confidence in using socio-scientific issues as materials to teach judging the information and writing a convincing argumentation. As for the reading process and comprehension, readers might use diverse reading strategies in different reading orders. Although readers had satisfying learning outcomes in surface-level reading comprehension; however, the group that read the expository text first had better deeper-level reading comprehension involving two-side reasoning and integration. The reason for this is that readers spent more time reading the expository text in order to integrate and infer understanding, then they used the story to validate what they had learned, leading to increased deep-level comprehension.

Our study suggests two instructive implications. Firstly, educators can use a teaching method that mixes expository and story genres in computer-assisted instruction, including scientific multiple-text to increase learners' interest and knowledge of the topics. Secondly, teachers can also teach students reading strategies for scientific multiple-text, such as reading the expository part first to understand the issue and then using the story as an illustrative example to achieve better integration and comprehensive reading comprehension.

References

Bråten, I., Brante, E. W., & Strømsø, H. I. (2018). What really matters: The role of behavioural engagement in multiple document literacy tasks. *Journal of Research in Reading*, *41*(4), 680-699. https://doi.org/10.1111/1467-9817.12247

Britt, M. A., & Rouet, J.-F. (2012). Learning with Multiple Documents: Component Skills and Their Acquisition. In J. K. M. Lawson (Ed.), *Enhancing the Quality of Learning: Dispositions, Instruction, and Learning Processes* (pp. 276–314). Cambridge: Cambridge University Press. https://doi.org/doi:10.1017/cbo9781139048224.017

Cerdán, R., & Vidal-Abarca, E. (2008). The effects of tasks on integrating information from multiple documents. *Journal of Educational Psychology*, *100*(1), 209-222. https://doi.org/10.1037/0022-0663.100.1.209

Chen, G., Cheng, W., Chang, T.-W., Zheng, X., & Huang, R. (2014). A comparison of reading comprehension across paper, computer screens, and tablets: Does tablet familiarity matter? *Journal of Computers in Education*, *1*(2), 213-225.

Clinton, V., Taylor, T., Bajpayee, S., Davison, M. L., Carlson, S. E., & Seipel, B. (2020). Inferential comprehension differences between narrative and expository texts: a systematic review and meta-analysis. *Reading and Writing*, *33*(9), 2223-2248. https://doi.org/10.1007/s11145-020-10044-2

Fewella, L. N. (2023). Impact of COVID-19 on distance learning practical design courses. *International Journal of Technology and Design Education*. https://doi.org/10.1007/s10798-023-09806-0

Hyönä, J., Lorch, R. F., Jr., & Kaakinen, J. K. (2002). Individual differences in reading to summarize expository text: Evidence from eye fixation patterns. *Journal of Educational Psychology*, *94*(1), 44-55. https://doi.org/10.1037/0022-0663.94.1.44

Kintsch, W. (1998). *Comprehension: A Paradigm for Cognition.* New York, NY: Cambridge University Press.

Lee, H. Y., & List, A. (2021). Examining students' self-efficacy and perceptions of task difficulty in learning from multiple texts. *Learning and Individual Differences*, *90*. https://doi.org/10.1016/j.lindif.2021.102052

List, A., & Alexander, P. A. (2017). Cognitive Affective Engagement Model of Multiple Source Use. *Educational Psychologist*, *52*(3), 182-199. https://doi.org/10.1080/00461520.2017.1329014

Liu, O. L., Lee, H.-S., Hofstetter, C., & Linn, M. C. (2008). Assessing knowledge integration in science: Construct, measures, and evidence. *Educational Assessment, 13*(1), 33–55. https://doi.org/10.1080/10627190801968224

McCrudden, M. T., Kulikowich, J. M., Lyu, B., & Huynh, L. (2022). Promoting integration and learning from multiple complementary texts. *Journal of Educational Psychology*, *114*(8), 1832-1843.

Rayner, K. (1998). Eye movements in reading and Information processing 20 years of research. *Psychological Bulletin*, *124*(3), 372-422. https://doi.org/10.1037/0033-2909.124.3.372

Richter, T. (2011). “Cognitive flexibility and epistemic validation in learning from multiple texts,” in *Links Between Beliefs and Cognitive Flexibility*, eds J. Elen, E. Stahl, R. Bromme, and G. Clarebout (NewYork, NY: Springer), 125–140.

Salmerón, L., Gil, L., & Bråten, I. (2018). Using eye-tracking to assess sourcing during multiple document reading: A critical analysis. *frontline Learning Research*, 105-122. https://doi.org/10.14786/flr.v6i3.368

Stadtler, M., Scharrer, L., & Bromme, R. (2020). How Relevance Affects Understanding of Conflicts Between Multiple Documents: An Eye-Tracking Study. *Reading Research Quarterly*, *55*(4), 625-641. https://doi.org/10.1002/rrq.282

Yen, M.-H., & Wu, Y.-T. (2017). The role of university students' informal reasoning ability and disposition in their engagement and outcomes of online reading regarding a controversial issue: An eye tracking study. *Computers in Human Behavior*, *75*, 14-24.

Zhang, D., Hyönä, J., Cui, L., Zhu, Z., & Li, S. (2019). Effects of task instructions and topic signaling on text processing among adult readers with different reading styles: An eye-tracking study. *Learning and Instruction*, *64*. https://doi.org/10.1016/j.learninstruc.2019.101246

Zhu, M. (2021). Enhancing MOOC learners’ skills for self-directed learning. *Distance Education*, *42*(3), 441-460. https://doi.org/10.1080/01587919.2021.1956302