



## The Effects of Introduction Type on Comprehension and Memory for Scientific Explanations

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**Abstract**

The current study examined the effects of introductions on reading times and immediate and delayed recalls for brief scientific texts across two experiments ( $N = 219$ ). The findings suggest that introductions improved participants' memory for scientific explanations, both immediately and after a delay, without changes to reading times for scientific content. Both narrative and expository genres provided similar memorial benefits for scientific content, with narrative introductions also proving quite memorable for readers.

*Keywords:* learning, memory, scientific text comprehension, text genre

## **The Effects of Introduction Type on Comprehension and Memory for Scientific Explanations**

Science educators and authors are often advised to use compelling stories to introduce scientific information to students (Kerby et al., 2018). Educators may anticipate stories will increase interest in scientific lessons, and authors may expect that stories can help readers remember scientific content by providing a familiar scaffold. Indeed, text-based introductions can provide numerous benefits for readers, such as raising interest, activating prior knowledge, and providing an advanced organizer for comprehension of difficult information. Indeed, authors and teachers may elect to introduce science content with either engaging narratives (Kerby et al., 2018) or more textbook-style expository introductions that preview the organization and utility of the content to be learned (Lorch & Lorch, 1996).

The current study examined the effects of these different types of introductions on reading times and memory for scientific content. We generally predicted that introductions would be beneficial for recalling scientific content. But we also tested whether narratives might lead readers to develop inappropriate frameworks for subsequent information, resulting in worse memory for scientific content compared to the expository introductions (Golke, Hagen, & Wittwer, 2019). This was in part due to expectations that engaging narrative introductions would be better remembered compared to more technical expository introductions. We explored these predictions across two experiments that examined the effects of introductions on both immediate and delayed learning scenarios.

## Method

### Participants

114 undergraduate students from a Midwestern university participated in Experiment 1.

### Materials

16 texts were adapted from Millis and Graesser (1994) as *science content*, each consisting of a title and five sentences describing scientific processes (i.e., mitosis, photosynthesis). Two three-sentence introductions were created for each text. *Narrative introductions* introduced a character with the goal of understanding the scientific explanations, and *expository introductions* provided a technical rationale for why the science content was worth reading.

### Procedure

Participants were assigned to one of three conditions: a narrative condition with science content was preceded by a narrative introduction, an expository introduction utilizing expository introductions, or a control condition which offered no introductions. Participants read the texts one sentence at a time on a computer and completed a recall for four of the 16 texts.

### Data Analysis

All analyses used linear-mixed effects models with a fixed between-subjects factor of introductory genre (narrative, expository, control) and the within-subjects factor of sentence type (introduction, scientific explanation) where possible. Character reading times were calculated for each sentence and section, and recalls were coded and averaged into proportions for introductory and scientific content for each text.

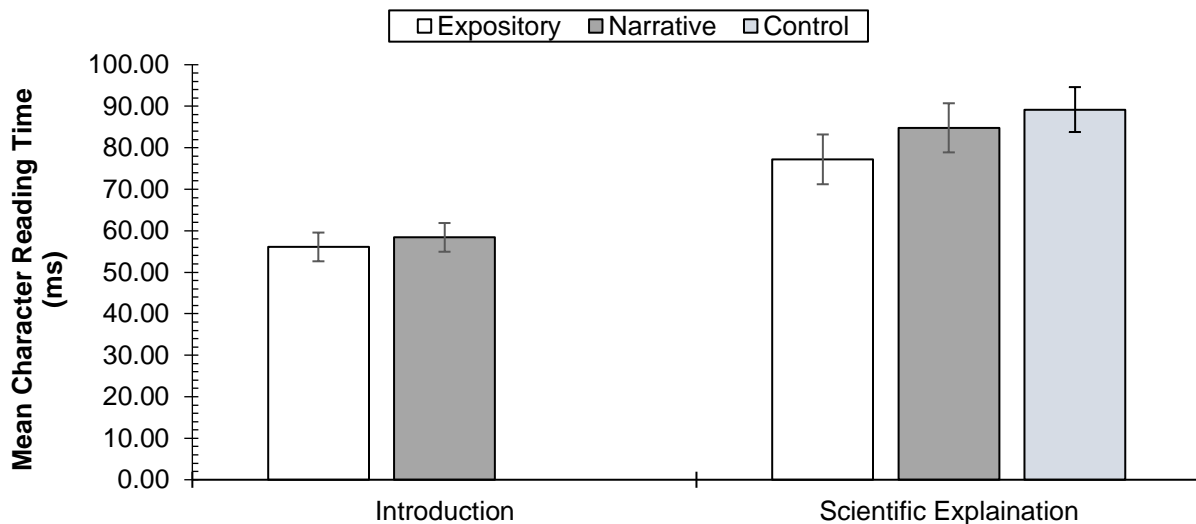
## Results

### Reading Times

As shown in Figure 1, a significant main effect of sentence type was obtained, with participants reading the introductory content more quickly as compared to their reading of the scientific explanations,  $F(1, 2097) = 790.07, p < .001$ . There was no main effect for condition ( $p = .26$ ), but a significant interaction between condition and sentence type obtained, ( $F(1, 2097) = 9.84, p = .001$ ). Participants read narrative introductions more quickly than they read scientific explanations ( $t(1, 2097) = 22.42, p < .001$ ), with a similar pattern observed for expository introductions ( $t(1, 2097) = 17.54, p < .001$ ); yet reading times for scientific explanations did not differ ( $p = .28$ ).

**Figure 1**

*Mean Character Reading Times by Introduction Condition in Experiment 1.*

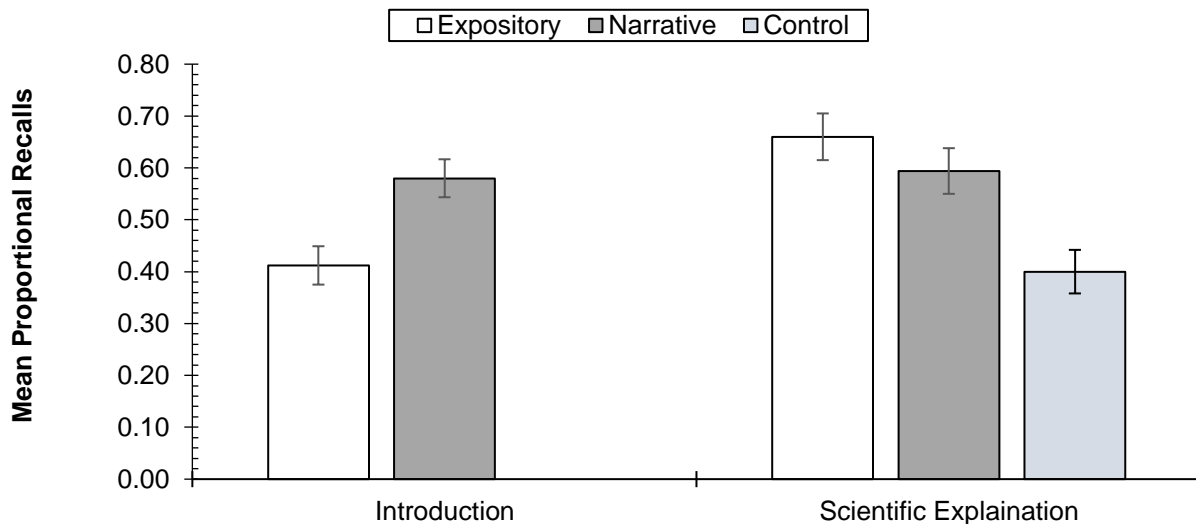


## Recalls

As shown in Figure 2, for participants who received introductions, a significant main effect of sentence type was obtained, with participants recalling more scientific explanations than introduction content, ( $F(1, 469) = 37.98, p < .001$ ). There was no main effect for condition ( $p = .17$ ), but a significant interaction between condition and sentence type obtained, ( $F(1, 469) = 26.72, p = .001$ ). Scientific content introduced by expository ( $t(1, 108) = -5.41, p < .001$ ) and narrative introductions ( $t(1, 106) = -4.09, p < .001$ ) was recalled better than if no introduction was included.

## Figure 2

*Mean Proportional Recalls by Introduction Condition in Experiment 1.*



## **Experiment 2**

Experiment 2 replicated and extended the findings of Experiment 1 by implementing a within-participant design for the introductions, and also including a 7-day delayed recall for the texts. Materials and analyses were the same as Experiment 1.

## **Methods**

### **Participants**

105 undergraduate students from a Midwestern university participated in Experiment 2.

### **Procedure**

The procedure was identical to Experiment 1, with participants also returning to the lab after a 7-day delay to complete a delayed recall procedure for half of the texts.



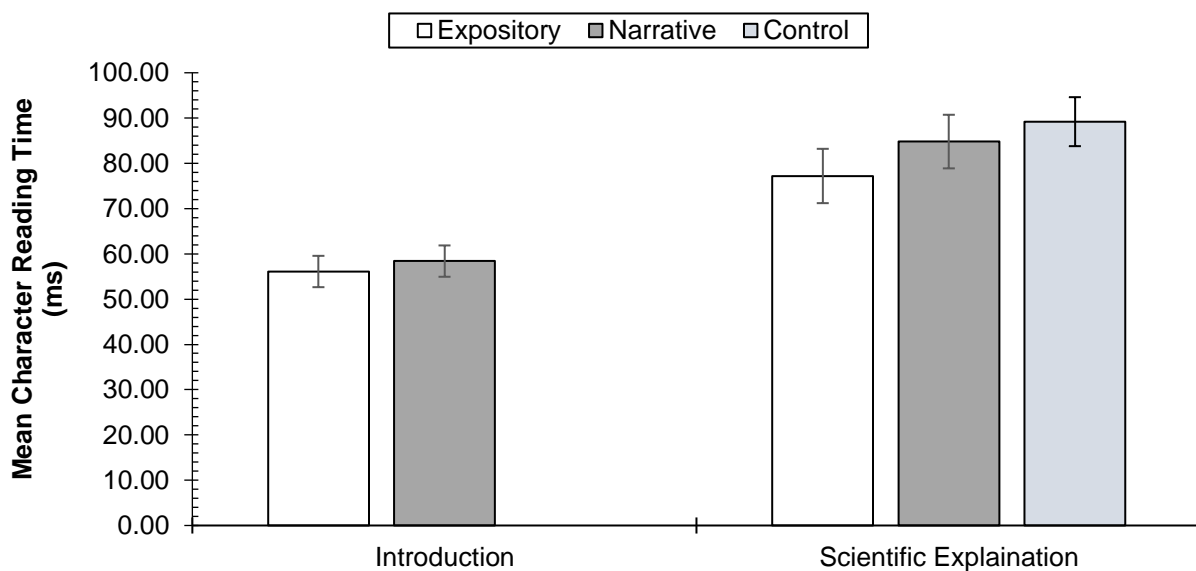
## Results

### Reading Times

As shown in Figure 3, a significant main effect of introductory genre obtained, with participants reading texts with expository introductions more quickly ( $M = 62.5$  ms) than they read texts containing narrative introductions ( $M = 64.8$  ms,  $F(1, 2108) = 6.00, p = .01$ ). A significant main effect of sentence type was observed, with participants reading introductory content more quickly than they read the scientific explanations, ( $F(1, 2108) = 615.74, p < .001$ ). A significant interaction between introductory genre and sentence type also obtained, ( $F(1, 2108) = 4.05, p = .04$ ), with scientific explanations being read more slowly following narratives compared to expository introductions ( $M_{DIF} = 4.30$  ms,  $t(1, 2108) = 3.16, p = .009$ ). Yet, scientific explanation reading times did not differ between introduction conditions ( $ps > .05$ ) when compared to controls.

### Figure 3

*Mean Character Reading Times by Introduction Condition in Experiment 2.*



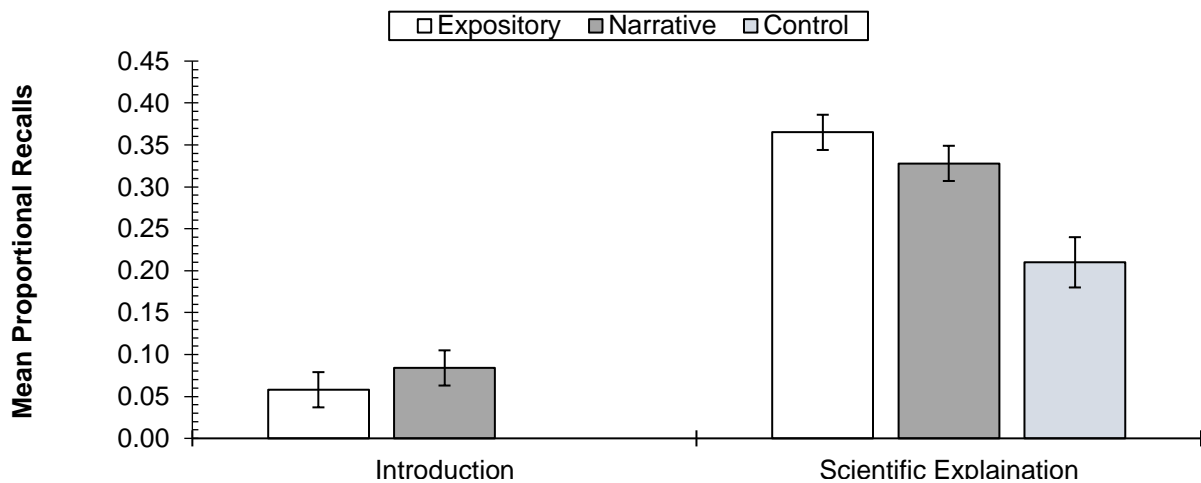
## Recalls

As shown in Figure 4, Participants recalled more scientific explanations than introductory content ( $F(1, 1032.6) = 500.21, p < .001$ ), with no main effect for condition ( $p > .05$ ). However, a significant interaction between introductory genre and sentence type was obtained, ( $F(1,1032.60) = 6.21, p = .01$ ), centered around the differences between recall for introductions compared to scientific explanations: Narratives were not recalled as well as scientific explanations ( $M_{DIF} = -.24$ ), ( $t(1,1032) = 14.05, p < .001$ ), and a similar effect obtained for expository introductions ( $M_{DIF} = -.31$ ), ( $t(1,1032) = 17.57, p < .001$ ).

Finally, significant effect of condition was observed, ( $F(2,181.86) = 13.67, p < .001$ ), with both recall of expository introduced scientific content ( $M_{DIF} = .16, t(1,108) = -5.41, p < .001$ ) and narrative ( $M_{DIF} = .12, t(1,106) = -4.09, p < .001$ ) proving superior to controls.

**Figure 4**

*Mean Proportional Recalls by Introduction Condition in Experiment 2.*



### **Discussion**

Introductions were read more quickly than scientific explanations, and those included introductions did not significantly influence reading times for the scientific explanations. Both narrative and expository introductions enhanced participants' immediate and delayed memory for scientific content, with these participants recalling more information from the stories than did participants who read texts without introductions. Narrative introductions were also particularly memorable for readers, although this benefit was only observed on an immediate test and did not persist after a week delay. The benefits from narrative introductions did not seem to harm associated memory for scientific content. These results suggest that authors and teachers of scientific content may enjoy desirable memory benefits when using stories to introduce scientific concepts, but these benefits might be general to a variety of kinds of preceding material, given similar benefits were obtained with expository introductions.

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