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REVIEW ARTICLE

Using Fictional Sources in the Classroom: Applications from Cognitive Psychology

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Abstract Fictional materials are commonly used in the classroom to teach course content. Both laboratory experiments and classroom demonstrations illustrate the benefits of using fiction to help students learn accurate information about the world. However, fictional sources often contain factually inaccurate content, making them a potent vehicle for learning misinformation about the world. We briefly review theoretical issues relevant to whether learners process fictional sources differently before exploring how individual differences, learning activities, and assessment characteristics may affect learning from fiction. This review focuses on our own experimental approaches for studying learning from fiction, including learning from short stories and from films, while connecting to a broader educational literature on learning from fictional sources. Throughout the review, implications for educational use and future directions for experimental research are noted.

Keywords Fiction · Learning · Education · Knowledge · Suggestibility

The textbook is a staple in the classroom—students at all levels of education learn from expository, fact-based texts written by experts. This tradition of learning from an "authoritative text" has a long history in education (Bowen 1972; Elliott and Woodward 1990; Friesen 2011). However, there is another educational tradition with an even longer history—learning from fictional sources that blend the real and imaginary in a narrative form. In ancient Greece, epic poems such as the *Iliad* were used as pedagogical devices to teach history, geography, morals, and other important topics (Rubin 1995). The same is seen across other ancient cultures, including Roman, English, and Indian; the *Aeneid*, *Beowulf*, and *Mahabharata* are examples of epic poems that provide narrative accounts of historical people and events while mixing in mythical elements. The tradition of using fictional sources as teaching tools continues today as educators bring novels (e.g., *The Great Gatsby* and *Adventures of Huckleberry Finn*), television programs (e.g., *Rome* and *The Tudors*), feature films (e.g., *Flags of Our Fathers* and *The Alamo*), video games (e.g., *Medal*

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of Honor and *Call of Duty*), and plays (e.g., *The Tragedy of Julius Caesar* and *The Crucible*) into the classroom.

As part of this special issue linking cognitive psychology to work from educational psychology, the present article will explore the implications of learning from such fictional sources from a cognitive psychology perspective, with an emphasis on reviewing our own research. We begin with a discussion of the general educational issues involved, including why educators like to use fiction in the classroom and considering how the accuracy (or lack thereof) of fictional content has benefits and costs for the student. We then draw on theories from cognitive psychology to discuss how the cognitive processing of fictional material may differ in important ways from that of non-fiction material. The remainder of the paper describes our approaches to studying learning from fiction and integrates our work with other related research to explore the various factors that influence what is learned from fictional sources. Throughout the review, open questions for future research are noted, as well as implications for educational practice.

Reasons for Using Fictional Materials in the Classroom

There are numerous reasons why teachers use fictional materials in the classroom, including helping students to visualize course content (e.g., Marcus *et al*. 2006), stimulating discussion (e.g., Collett *et al*. 2010; Rose 2003; Saldana 2008; Smith 2009), and teaching perspective-taking (e.g., Mar and Oatley 2008; Marcus and Monaghan 2009; Marcus 2005). One of the main reasons is to promote student interest in course content (e.g., Daisey 1994; Kennedy *et al*. 2011; Ventura and Onsman 2009). Interest can be an important factor in determining learning—greater interest leads to increased time spent studying, longer retention of studied material, and better grades (Silvia 2006). However, interest can also be harmful if it focuses the learners' attention on interesting but unimportant content or otherwise leads the reader to think about a text in the wrong way (e.g., Garner *et al*. 1989; Harp and Mayer 1998; Peshkam *et al*. 2011; Sanchez and Wiley 2006). In addition, using fiction does not *guarantee* that students will become more interested, especially since fictional materials vary greatly in quality, coherence, complexity, and other aspects that may affect the amount of interest that is evoked (Green and Brock 2000; Sadoski 2001; Silvia 2006). There will also be large individual differences in how interesting any given piece of fiction is perceived as being (e.g., Silvia 2005, Experiment 2; Silvia and Berg 2011; Silvia 2006); for example, *War and Peace* is a critically acclaimed novel that reliably evokes mind-wandering in undergraduates (Schooler *et al*. 2005).

Fiction can also be a useful tool for teaching students how to be critical consumers of information, a goal of educators across disciplines. Fictional sources often contain factual errors and inaccuracies (as discussed in the next section); they can also present biased viewpoints and omit important information. By having students critically evaluate sources of information, educators hope to inculcate media literacy (e.g., Barnett and Kafka 2007; Nokes 2008; Stevens 2003). For example, a history teacher might have students critique the film *JFK* as an exercise to teach them how to analyze secondary source documents. Through such activities, students learn that sources of information must be subjected to scrutiny rather than accepted at face value.

One final reason that educators use fiction is to teach students course content, and this educational objective will be the primary focus of this article. As will be discussed in the next section, fictional sources often contain a lot of accurate information, and educators often embrace its use in the classroom when that content mirrors what students need to learn

(e.g., Dubeck *et al*. 2004; Janit *et al*. 2011; Roser and Keehn 2002; Short 1997). Fiction has the potential to be an effective teaching tool: Studies have shown that students learn more from fictional sources than they do from expository textbooks when the two sources cover the same material (e.g., Schaffer 1927; Smith 1993). As will be discussed below, the efficacy of fiction as a learning tool is likely due to many factors, such as increased interest and, consequently, increased time on task (Silvia 2006), as well as the organizational mnemonic or schema provided by narratives (Rubin 1995).

Differences between Fictional and Non-Fictional Sources

The content of fiction: a double-edged sword

Although some fiction is completely divorced from reality, most of it contains a blend of true and false information. Fictional stories are often based in the real world and make reference to actual people, places, and events. Indeed, educators who want to incorporate fiction into their courses have numerous options from which to choose. For example, history teachers can select from a broad assortment of high quality feature films (see Marcus 2007; O'Connor 1987)—roughly a third of the films nominated for an Oscar in the Best Picture category during the period of 1981 to 2005 were based on historical events (Niemi 2006). Across academic subjects, a wide variety of novels, films, comic books, and video games are available to help students understand and learn course content.

Nevertheless, there is a potential downside to learning from fiction. Unlike non-fiction sources that are generally held to a high standard of accuracy, fiction, by its very nature, contains false information. Although much of this false information is trivial, sometimes works of fiction contain major errors or inaccuracies that contradict the true state of the world. For example, the film *U-571* depicts American sailors capturing an Enigma code machine from a disabled German submarine—a feat that enabled the Allies to break the Nazi code and turn the tide of WWII. In fact, it was the *British* navy that captured almost all of the Enigma materials from the Germans and broke the code. Predictably, the film sparked outrage in the UK upon release (Grove 2000). If students are learning content from fiction, then there is a risk that they will acquire false knowledge about the world. To be sure, educators sometimes select inaccurate works of fiction on purpose, so that students can learn how to critique secondary sources of information (as described above). Nevertheless, many studies have found that students have a difficult time questioning fiction even though they know that it contains errors and inaccuracies, and instead take fictional content at face value (e.g., Gerrig and Prentice 1991; Marcus *et al*. 2006).

The structure of fiction

Beyond differences in content, fictional and non-fictional sources differ in form (Coté *et al*. 1998; Van den Broek *et al*. 2002). Fictional sources such as novels and movies tend to have narrative structures: They tell stories, using a structure that is familiar even to young children. In contrast, textbooks tend to be expository in form, directly stating and conveying information to the reader in a logical structure. Much work has shown that narratives and expository texts naturally afford different kinds of processing and that people approach them differently (e.g., Zwaan 1994), as captured in a framework called material-appropriate processing (MAP; Einstein *et al*. 1990; McDaniel *et al*. 1995; McDaniel and Butler 2010; McDaniel and Einstein 1989). That is, when people read narratives, they naturally link

across pieces of the text (relational processing), whereas expository texts encourage readers to focus on individual items without connecting them to one another (item-specific processing). Evidence for this distinction comes from studies that manipulate the strategy used to process different materials, using the logic that strategies should only boost learning if they do not duplicate processing already afforded by a particular text. For example, consider the task of re-ordering a set of mixed-up sentences; this task requires relational processing because the only way to figure out the proper order of the sentences is to compare them in relation to one another. Re-ordering sentences helps students learn an expository text (which does not naturally encourage relational processing) but not a fairy tale (which already affords relational processing; Einstein *et al*. 1990). In contrast, learning the fairy tale is aided by the addition of a task that taps item-specific processing and directs attention to individual propositions, such as having to fill in letters that have been deleted. Returning to our focus on educational implications, the point is that the material-appropriate processing framework suggests that students may naturally learn different types of information from short stories, novels, and films than from standard textbooks. Stories will encourage the learner to connect information together, but this benefit may come at the expense of remembering specific details.

The phenomenological experience associated with fiction

One could argue that a primary goal of good fiction is to immerse readers or viewers in a fictional world, such that they feel like they are part of the story. When learners are absorbed in a narrative context through mental imagery, emotional involvement, and attention, they are said to be *transported* (Gerrig 1993; Green *et al.* 2004). Behaviorally, transportation is measured by self-reports on scale items such as "*While I was reading the narrative*, *I could easily picture the events in it taking place*" and "*After finishing the narrative*, *I found it easy to put out of my mind*" (Green and Brock 2000). Critical for present purposes is that increased transportation into a narrative is associated with decreased ability to critically evaluate information (Gerrig and Rapp 2004). For example, participants in one study were told to circle parts of a narrative (about a murder in a mall) that did not make sense to them or contradicted known facts; highly transported readers marked much less of the text than did readers who found the text less engaging (Green and Brock 2000, Experiment 2; Green *et al.* 2004, 2006). Transportation may also reduce the reader's access to pre-existing stored knowledge. Evidence for this claim comes from a study where participants read passages about well-known people and events (Gerrig 1989). Readers were slower to verify well-known statements like "*George Washington was the first president of the United States*" after reading narratives that suggested obstacles to the known outcomes (in this case, suggesting that Washington wanted to retire and that John Adams was considered as a candidate). Overall, the point is that interest (presumably reflected in greater transportation) may affect what readers learn from fictional sources. Transported readers may enjoy themselves more, but may be less able to bring relevant knowledge to bear and hence less able to critically evaluate content.

The "fiction" label

Does learning change simply because material has been labeled as fictional? Precisely answering this question requires holding the materials constant, except for the label as "fiction" vs. "non-fiction." Few studies take this approach, probably because it is rather artificial given the content differences described above; however, it is necessary if the goal is to assess the effects of the fictional label separately from content and form factors. The

Green and Brock (2000) study described earlier suggests that students may not pay much attention to such labels. Participants who read the "murder in the mall" passage often failed to remember if it had been described as a story or a newspaper account, and regardless, source had no impact on transportation. Similarly, learning manipulations in material-appropriate processing experiments do not have different effects on fairy tales and newspaper articles when the materials are held constant and differ only in their labels (McDaniel *et al*. 1994). In contrast, other evidence suggests that readers may be less likely to integrate material labeled as fictional with other related general knowledge (e.g., Lewis and Anderson 1976; Peterson and Potts 1982; Potts *et al*. 1989).

Summary: differences between fiction and non-fiction

In short, fiction is likely to contain different information than non-fictional sources, including errors about the world. Readers may also be more likely to process fiction at face value, both due to being transported into a narrative and because fiction's narrative structure encourages relational processing rather than analyzing individual elements.

Our Approaches to Understanding Learning from Fiction

There are many different ways to answer the questions being asked in this paper about how fictional sources influence learning. The methods range from tightly controlled laboratory experiments to classroom studies, with dependent measures ranging from the accessibility of related knowledge (i.e., reaction time measures; Lewis and Anderson 1976; Peterson and Potts 1982; Potts *et al*. 1989) to self-reported student preferences (Brabham *et al*. 2000; Haynes and Richgels 1992; Robinson *et al*. 1997). Although this review touches on much of this work, the emphasis is on our own work, which uses experimental paradigms to examine learning from short stories and popular feature films.

Learning from fictional texts

To capture learning from fiction in the lab, we use a set of short stories (approximately 1,400 words apiece) which contain developed characters, dialogue, and plot, but that critically also contain a number of references to general knowledge (Marsh 2004). Students read stories about diverse topics such as a summer job at a planetarium or a world tour; embedded within these tales are references to both well-known and more obscure facts [as defined by the Nelson and Narens (1980) norms]. Depending upon experimental condition, a given item appears in the story in a correct, neutral, or misleading frame (assignment of items to conditions is counterbalanced across participants). A correct frame states the accurate fact, a neutral frame contains a general reference to the item without stating it by name, and a misleading frame makes a plausible but incorrect reference. For example, if a correct item referred to "*paddling across the largest ocean*, *the Pacific*," the neutral reference would simply allude to "*paddling across the largest ocean*," and the misleading reference would state "*paddling across the largest ocean*, *the Atlantic*" (Table 1 contains additional examples). After a brief delay, participants complete a general knowledge test, which contains questions that can be answered with information from the stories (e.g., "*What is the largest ocean on Earth*?"). Students' ability to answer questions about previously neutral items provides a baseline measure of what they knew before the experiment (and yields similar results as another control where students do not read the critical stories; Marsh *et al*. 2003).

Table 1 Sample story excerpts with the correct, neutral, and misleading references used to complete them

	Story reference			Final question
	Correct	Neutral	Misleading	
The whole basement was taken over by the project, and signs reading "KEEP OUT" and "TOP SECRET" hung all over the place. "You'd think they were developing the atomic bomb down there!" joked Billy's Mom, making reference to the World War II _____ Project	Manhattan	Bomb	Los Alamos	What was the name of the project that developed the atomic bomb during WWII?
My first day in the new position turned out to be a big one. It was also the first day of a new show at the planetarium…First I had to go through all the regular astronomical facts, starting with how our solar system works, and explaining _____ is the largest planet	Jupiter	What	Saturn	What is the name of the largest planet?

The *final column* shows the corresponding final general knowledge questions. Adapted from Marsh (2004)

Typically, three main results are found: Fig. 1 shows the results from the questions about the well-known facts. First, consistent with the larger literature, fiction can be an effective vehicle for learning (accurate) content. As the left panel of Fig. 1 shows, participants benefit from reading correct facts in the stories in that they correctly answer more general knowledge questions after reading the correct answers in the stories than after reading neutral

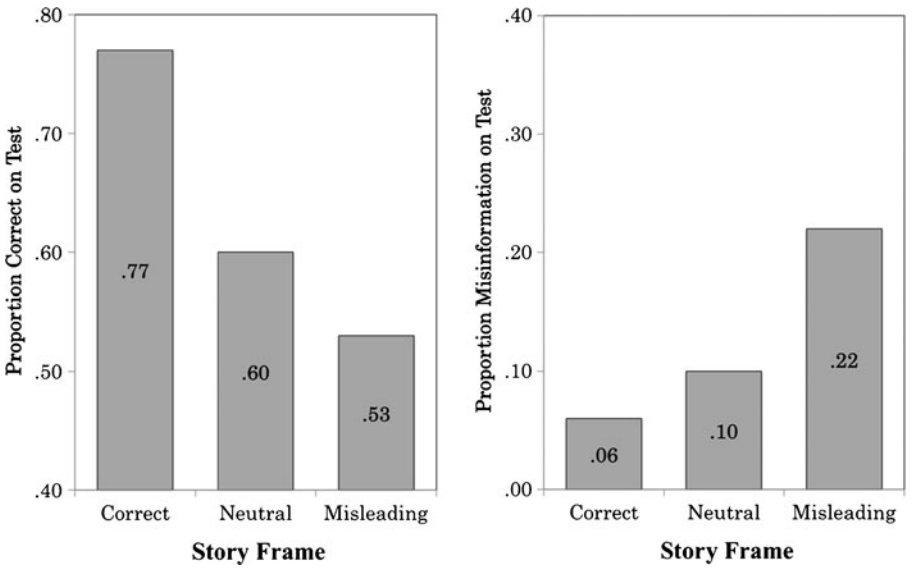

Fig. 1 Proportion of general knowledge questions answered correctly (*left panel*) versus with misinformation (*right panel*) as a function of story sentence frame. Adapted from Marsh *et al*. (2003, Experiment 2)

references. Second, participants are strongly affected by exposure to misinformation in the stories. They experience a cost to their correct answers such that reading misleading information reduces participants' ability to correctly answer general knowledge questions, as compared to their expected performance (as measured by performance on the neutral items). Third, they are also highly suggestible, producing many more story errors (or misinformation) as answers on the general knowledge test (as shown in the right panel of Fig. 1). As will be described below, these main findings have been consistently obtained across many experiments (e.g., Butler *et al*. 2012; Eslick *et al*. 2011; Fazio and Marsh 2008a, b; Marsh and Fazio 2006, 2007; Umanath and Marsh 2012).

Learning from fictional films

A second paradigm investigates learning from popular feature films, with a focus on how watching films affects learning of new information from associated non-fiction texts. A study by Butler *et al*. (2009) provides an example of the paradigm. Participants read texts about various historical topics and watched clips from popular films during an initial learning session (the order of reading versus viewing was counterbalanced across subjects and topics). Critically, each film clip contained one piece of correct information that was consistent with the associated text and one piece of misinformation that was inconsistent with and directly contradicted the text.

For instance, participants learned about the life of Wolfgang Amadeus Mozart; they read a few historically accurate paragraphs of text about Mozart and watched a clip from the film *Amadeus.* Both the film clip and the text accurately stated that Mozart had performed as a musician in royal courts throughout Europe before the age of 10—a consistent item. The film clip also inaccurately depicted Mozart as behaving in an immature and eccentric manner, an error that was contradicted by the text which stated that Mozart was described as respectful and polite in court despite his youth. The pairing of incorrect information in the film and the correct information in the text represents an inconsistent item (Table 2 contains additional examples). Some of the films were not shown to participants in order to create a

Table 2 The critical information used to create the consistent and inconsistent items for the topic "The Satsuma Rebellion"

	Item type	
	Consistent	Inconsistent
Information in text	The Imperial Japanese army was made up of peasants with little fighting experience that had been conscripted into military service	The Emperor Meiji hired French military advisors to train the Imperial Japanese army to put down the Satsuma rebellion
Information in film	[Same as text]	The Emperor Meiji hired American military advisors to train the Imperial Japanese army to put down the Satsuma rebellion
Final test question	Who were the soldiers in the Imperial Japanese army that were being trained to put down the Satsuma Rebellion?	From what country did Emperor Meiji hire military advisors to train the Imperial Japanese army?

The information described in the history text was either consistently or inconsistently depicted in the clip from the film, *The Last Samurai* (2003). The correct answer to the final test question was the information described in the text. Adapted from Butler *et al*. (2009)

control condition in which only the text was read. In addition, participants were told that the film clips merely illustrated the text material and that they would be tested on the content in the texts. One week after the initial learning session, participants took a short answer test on the information presented in the texts.

Figure 2 depicts the typical pattern of results. As the left panel shows, when the film portrayed historically accurate information, participants were significantly more likely to produce the correct response on the short answer test when they had read the text and viewed the film than when they had only read the text. However, as the right panel shows, participants who read the text and viewed the film often produced the film inaccuracies on the short answer test (i.e., relative to when they had only read the text). Furthermore, this effect occurred even though participants were instructed to answer based on their memory for the texts (and the information in the text directly contradicted the film). Thus, viewing popular films that contain both correct and incorrect information can have both positive and negative consequences for learning (see also Umanath *et al*. 2012).

In the following sections, we explore the factors that affect what people learn from fictional sources in these two paradigms while also integrating findings from the broader literature.

Factors that Affect Learning from Fiction

Educational materials are not used in a vacuum, and thus it is important to consider other factors that might affect learning from fictional sources. Jenkins' (1979) tetrahedral model of experimental variables is used to frame this discussion, as shown in Fig. 3. Just as Jenkins systematically drew attention to the different components of experiments that could influence memory, this section will focus on factors involved in the classroom (and laboratories) that likely affect learning from fiction. Learning is not driven solely by the nature of the to-

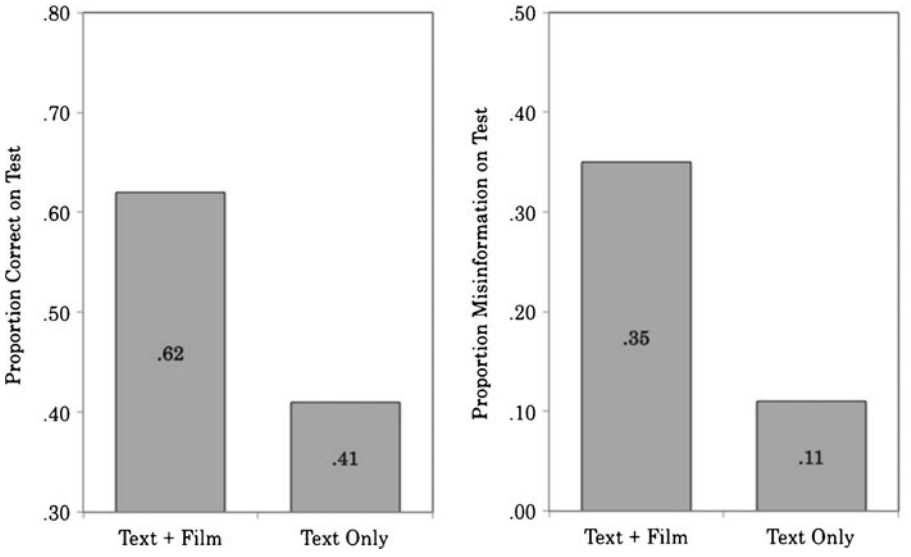

Fig. 2 Proportion of consistent items answered correctly (*left panel*) and proportion of inconsistent items answered with misinformation (*right panel*) on a final test for information in the history texts as a function of exposure to fictional films. Adapted from Butler *et al*. (2009)

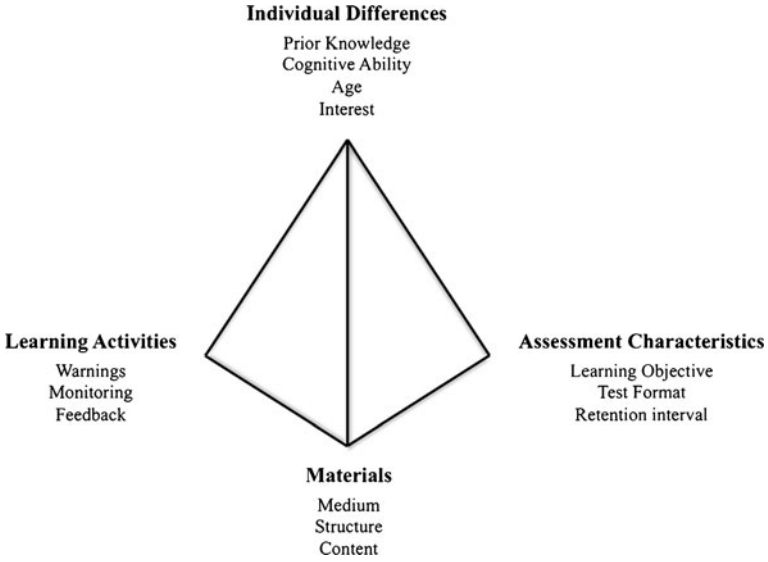

Fig. 3 A tetrahedral model of learning, adapted from Jenkins (1979). Each *vertex* represents a group of factors that may affect how people learn from fictional sources. Examples of specific factors are provided for each grouping, but many other factors exist as well. Each *edge* represents a two-way interaction between groups, each *plane* a three-way interaction, and the *entire tetrahedral* represents a four-way interaction

be-learned materials; it can also be affected by individual differences in the characteristics of students, the particular learning activities proscribed, and how learning is assessed.

Individual differences

Individual differences refer to the personal characteristics that a learner may bring to the classroom. The focus here will be on the effects of three specific individual differences that could affect learning from fiction (the learner's age, prior knowledge, and need for cognition) before noting some directions for future research and making concluding comments about the generality of effects across individuals.

Age

It is popular to use fictional materials when teaching students in the younger grades, and consequently much work focuses on suggestions for specific curricula (Daisey 1994; Palmer and Burroughs 2002; Rice 2002; Royce and Wiley 1996), implicitly assuming that children do learn from fictional sources. Experimental studies are generally supportive of this conclusion, having demonstrated that children as young as 15 months of age can learn the names of novel objects from picture-books (Ganea *et al*. 2008) and children as young as 4 years of age can integrate across story facts to infer new knowledge (Bauer and San Souci 2010). There may be conditions that make children's learning more or less likely (e.g., the similarity of the fictional source to real life), but it seems clear that children can learn something from stories, similar to how they learn from other types of materials.

Children's ability to learn from fictional sources raises the possibility that they may also learn erroneous content. A number of papers have described errors in children's books, highlighting this potential danger (e.g., Owens 2003; Rice 2002; Royce and Wiley 1996; Trundle *et al*. 2008).

There are several reports of storybooks misleading children (e.g., Mayer 1995; Rice 2002), although these are more proof-of-concept than complete reports of data [see also Brophy and VanSledright (1997) for discussion of these issues in an actual fifth grade classroom].

To test these ideas using traditional experimental methods, we modified the paradigm described earlier and had children listen to analogs of books-on-tape (accompanied by pictures) that contained correct, neutral, or misleading references to real concepts (Fazio and Marsh 2008a). For example, depending upon experimental condition, a story about a skunk correctly referred to "*autumn as another word for fall*" or misleadingly referred to "*autumn as another word for spring*." In the neutral condition, a reference was made to autumn without mention of a synonym. Of critical interest was children's later ability to answer short answer questions (e.g., *"What is another word for autumn*?"). Surprisingly, older children (7-year-olds) were more likely to answer general knowledge questions with the story errors than were younger children (5- to 6-year-olds). This same pattern of data (with older children being more suggestible than younger ones) was also obtained on a multiple-choice test that directly pitted the correct and misleading answers against each other (Goswick *et al*. 2012). One possible explanation is that age-related increases in episodic memory also support better memory for story errors (Howe 1991).

Prior knowledge

Learners enter the classroom with very different knowledge, and one might expect personal knowledge to dramatically change what was learned from fictional sources, given the role of knowledge in supporting new learning (Anderson 1981; Ausubel and Blake 1958; Chiesi *et al*. 1979; Dooling and Mullet 1973; Kole and Healy 2007; Rapp 2008). However, at least in our paradigms, prior knowledge does *not* protect the learner from learning errors embedded in fiction. First, consider again the data presented in the left panel of Fig. 1, which shows learners' ability to correctly answer general knowledge questions after reading correct, neutral, and misleading references. Critically, reading misinformation *reduced* correct performance below that observed in the neutral condition, the baseline measure of prior knowledge. That is, learners came into the experiment being able to correctly answer about 60 % of questions, and this rate dropped to 53 % after reading misinformation. If students only learned misinformation in cases where they had no contradictory stored knowledge, there would be no difference between these two values.

As described earlier, we used two groups of facts, one judged to be well-known to our participants, meaning that students in the Nelson and Narens (1980) norming study were able to answer short-answer questions about these facts 70 % of the time (and recognition of the facts would be expected to be higher), and the other judged to be more obscure (produced on average by 15 % of norming participants). The patterns remained the same regardless of how likely students were to know the facts prior to the experiment: Reading correct information helped students to answer later general knowledge questions, but reading misinformation interfered with ability to retrieve pre-existing knowledge and increased the likelihood that students answered questions with the specific story errors. The data in Fig. 1 are limited to facts judged as more likely to be known by participants, as estimated using the Nelson and Narens (1980) norms. In more recent work, we measured what each individual learner knew 2 weeks prior to reading the stories and showed that the misinformation effect was just as robust for facts for which students had demonstrated correct knowledge 2 weeks earlier as for ones for which they had no prior knowledge (Fazio *et al*. 2012).

A similar phenomenon was observed in the movie paradigm. In a text-film condition, students read the correct historical text prior to watching the movie that contained

misinformation. In other words, reading the text meant that students had the prior knowledge necessary to notice and reject the historical inaccuracy portrayed in the film. Even so, watching the film often led students to make the critical error on a later general knowledge test (Butler *et al*. 2009; Umanath *et al*. 2012). More generally, these results are consistent with a larger literature that suggests learners are not always good at retrieving and applying relevant prior knowledge (e.g., Bottoms *et al*. 2010; Shafto and MacKay 2000, 2010). It is unclear how much this problem is specific to fiction; some data do suggest that readers' prior knowledge may matter more when reading expository texts than when reading narratives (Wolfe and Mienko 2007; see also Wolfe 2005).

Need for cognition

Need for cognition is defined as "an individual's tendency to engage in and enjoy effortful cognitive endeavors" (Cacioppo *et al*. 1984). People high in need for cognition endorse scale items such as "*I would prefer complex to simple problems*" and "*I find satisfaction in deliberating hard and for long hours*." The question for present purposes is whether people high in need for cognition would be more likely to process fiction critically, resulting in a lower likelihood of learning errors. Only a few studies have examined this issue, and the data are not encouraging. When explicitly instructed to circle parts of a text that seemed false, people high in need for cognition did circle more information, consistent with the idea that these people tend to engage in critical processing (Wheeler *et al*. 1999). However, these participants showed similar effects of story-reading as did participants who were lower in need for cognition; reading increased participants' self-reported beliefs in falsehoods like "*aerobic exercise weakens your heart and lungs*" that had been embedded in the stories.

Summary of work on individual differences

Although the work reviewed here has not revealed strong differences across learners, more work on this topic is needed. Most likely, working memory capacity (which is clearly related to reading comprehension; Daneman and Carpenter 1980), expertise in a domain (as opposed to pre-existing knowledge of individual facts), and conditions such as ADHD (e.g., Lorch *et al*. 1999) or learning disabilities will have consequences for learning specific content from fiction.

Before turning to the next section, we would like to highlight that the general effects described thus far are quite robust in the sense that most participants show both benefits and costs. In our past work, more than 70 % of learners have benefitted from reading correct answers in stories (e.g., Marsh and Fazio 2006) or seeing them depicted in films (e.g., Butler *et al*. 2009). Similarly, more than 75 % of learners later reproduced errors embedded in short stories (e.g., Marsh and Fazio 2006) or in films (e.g., Butler *et al*. 2009). So, although there may be a role for individual differences, clearly these effects are relatively robust across people.

Learning activities

In the classroom, students engage in many different learning activities, such as reading for pleasure, taking notes, critiquing content, and discussing material in small groups. While students are engaged in these activities, they process information on many different levels, ranging from low-level perceptual processes to high-level processes that extract meaning (e.g., Craik and Lockhart 1972; Craik and Tulving 1975). Although much of this processing occurs automatically, it can be directed in different ways depending on the nature of the

learning activity. Critically, the processing that a particular activity induces will determine what information is encoded into memory and retained. This section describes some of the factors that influence the processing that occurs during various learning activities, separating those that affect the initial processing of fictional material versus factors that affect how it is reprocessed.

Factors that affect initial processing

Of particular interest are any effects of warning students about the possibility of encountering errors in fiction, since this should encourage students to monitor the content and in turn, decrease suggestibility. In other areas of memory research, studies have found that when a source of information is not credible, people tend to discount what they learn from that source (e.g., Hoffman *et al*. 2001). However, while warning students might make them less susceptible to acquiring the errors in the fictional material, it might reduce the amount of correct information that they learn as well (e.g., Greene *et al*. 1982).

Unfortunately, general warnings do not protect readers or film viewers from reproducing errors contained in fictional sources (Butler *et al*. 2009; Marsh and Fazio 2006). That is, simply telling students to "watch out" or to look for errors is not likely to prevent them from learning misinformation, although it may help readers to avoid reproducing irrelevant details from a text (Peshkam *et al*. 2011). However, Butler *et al*. (2009) found that it was very effective to give participants a specific warning that indicated what piece of information was inaccurate in the film (and provided the correct information) prior to watching the film. Participants who received the specific warning later produced very little misinformation, similar to the level produced in a control condition in which the films were not viewed. If an educator wants or needs to use material containing errors, specific warnings (prior to encoding) can help learners to identify and dismiss the inaccuracies.

One might imagine that the learner would benefit from more active monitoring tasks, since warnings only indirectly induce monitoring (while requiring the learner to keep that goal active in the context of other activities). To investigate this possibility, Marsh and Fazio (2006, Experiment 3) asked some participants to read short stories sentence by sentence with explicit instructions to press an "error" key any time a factual inaccuracy was detected. A control group also read the stories one sentence at a time but without instructions to detect errors. Although participants in the detection group spent significantly more time reading each sentence, they were not particularly effective at identifying errors—only 33 % of the errors were detected (even though the Nelson and Narens norms predicted that participants should have recognized many more of the errors). The detection task significantly reduced the amount of misinformation that was produced on the subsequent general knowledge test relative to the control group; however, the effect was small (about 5 %), and some of the detected errors were still reproduced on the final test even though they had been successfully identified earlier. Similar results have been obtained in other studies, with slightly different methods (e.g., Fazio and Marsh 2008b; Umanath *et al*. 2012; Umanath and Marsh 2012).

The main issue seems to be that it is very difficult for people to identify the inaccuracies in fictional material, regardless of whether these inaccuracies contradict recently studied information or pre-existing general knowledge. Although surprising, these results are consistent with other laboratory demonstrations; for example, consider the Moses Illusion, where readers fail to notice a problem in the question "*How many animals of each kind did Moses take on the ark*?" even though they are later able to successfully identify that the reference should be to Noah, not Moses (e.g., Erickson and Mattson 1981). Returning to the issue of learning from fiction, the problem is not ameliorated by efforts to draw attention to

the specific information that needs to be monitored. For example, one recent study showed that highlighting (in red) correct and misleading references failed to reduce the acquisition of false knowledge and instead increased it (Eslick *et al*. 2011). Presumably, this ironic effect occurred because participants failed to correctly evaluate the statements (and judge them as false), but they spent more time processing the sentences and thus better encoded the errors (for a similar argument involving irrelevant details, see Peshkam *et al*. 2011).

A final factor involves the amount of cognitive resources that students have available for monitoring while reading or viewing a fictional source—the more cognitive resources that students have available, the more effective they should be at detecting errors and inaccuracies. The amount of cognitive resources available for processing can be manipulated in many ways. For example, Fazio and Marsh (2008a) had participants listen to analogs of books-on-tape (using the types of stories presented in Table 1) that were presented quickly or slowly; both versions were understandable to listeners. The impetus for this manipulation was that slowing down the presentation speed should facilitate comprehension of the stories, thus freeing up cognitive resources to monitor the fictional content. However, performance on the subsequent general knowledge test showed an ironic effect—participants who listened to the slower presentation were actually more likely to acquire false knowledge from the stories than participants who listened to the faster presentation. This finding suggests that the greater availability of cognitive resources for monitoring does not necessarily prevent the acquisition of false knowledge. Other studies that have manipulated factors that affect the availability of cognitive resources, such as the reading comprehension level of the story (sixth grade vs. 12th grade; Marsh and Fazio 2006, Experiment 2), have yielded similar results.

Factors that affect reprocessing

Some learning activities involve reprocessing material, meaning that they require learners to process the material again in some manner after the material has already been encoded. Real-world examples of this behavior might include reviewing one's notes, discussing a film with a friend, or reading a critique. Perhaps the simplest form of reprocessing involves re-exposure to the original materials; that is, asking a student to read a story a second time or watch a film again. It might be expected that re-exposure would free up resources for monitoring, since the story would already have been comprehended the first time it was encountered. Marsh *et al*. (2003, Experiment 2) tested this idea, with students reading stories like those in Table 1 once, twice, or not at all. Reading the texts twice increased the amount of correct information that participants acquired relative to reading the text once; however, it also increased the acquisition of incorrect information. Once again, increasing the availability of cognitive resources for monitoring does not necessarily yield a reduction in the acquisition of false knowledge and may actually increase this negative effect.

A more powerful post-encoding intervention involves feedback from the teacher or experimenter, as opposed to depending upon the learner to notice problems in a text or film. In many simple laboratory experiments, telling students the correct answers is an easy and effective way to improve long-term retention (e.g., Butler *et al*. 2007; Butler and Roediger 2008). A similar effect was found when feedback was given after students attempted to detect inaccuracies in films (Umanath *et al*. 2012). In this study, after reading each text and viewing each film, participants were asked to describe the historical inaccuracy in the film. Afterwards, half of the participants received feedback stating the inaccuracy and the correct information, while the other half did not receive feedback. All participants were later tested on the information in the texts, which contained only correct information. Participants in the feedback condition rarely reproduced misinformation from the films.

Critically, attempting to detect the errors did not help if this learning activity was not paired with feedback. Interestingly, feedback was highly effective in reducing the acquisition of false knowledge regardless of whether participants were successful at detecting the inaccuracy in the film.

One final activity that induces reprocessing is retrieval practice, which requires students to retrieve content from memory and typically takes the form of answering test questions, self-quizzing (e.g., using flashcards), or responding to adjunct questions in texts. Although testing is often conceptualized as a neutral event, the act of retrieving information from memory increases the long-term retention of that information (for reviews, see Roediger and Karpicke 2006; Roediger and Butler 2011). The question here is how testing changes what is learned from fictional sources. The best answer comes from Barber *et al*. (2008), who manipulated whether or not participants took a short answer test after reading short stories. One week later, participants were more likely to remember both correct and incorrect information that had been retrieved on the initial test. This finding makes sense—the mnemonic benefits of retrieval practice are blind to the accuracy of story content, and thus whatever is retrieved will be better retained. Of course, it may be possible to structure the retrieval practice in such a way that students will be more likely to detect errors as they re-process the fictional material in memory. For example, combining retrieval practice with feedback (as described above) may be a powerful tool for reducing the acquisition of false knowledge.

Summary of work on learning activities

Activities that depend upon the learner to notice inaccuracies in fiction are not particularly effective; learners do not benefit from general warnings about fictional inaccuracies and show limited benefits when required to make explicit decisions about the accuracy of specific content. Instead, learners benefit from activities that point out the inaccurate content for them, whether in the form of a specific warning given pre-encoding or feedback given post-encoding.

Assessment characteristics

The nature of the final assessment also matters; the conclusions about what a student has learned may change depending upon how learning is assessed (McDaniel and Butler 2010; Roediger 2000). Not surprisingly, teachers assess what students have learned in different ways. Some standard assessments line up with the approaches described here, including fiction's effects on self-reported beliefs (e.g., Prentice *et al*. 1997) and attitudes more generally (e.g., Appel 2008; Green 2006), and answers to general knowledge questions (e.g., Marsh *et al*. 2003; Goswick *et al*. 2012). The laboratory experiments converge with classroom studies that examine fiction's effects on a range of dependent measures, including student preferences and opinions (e.g., Brabham *et al*. 2000). One important future direction will be to investigate assessments that tackle higher-level cognition; drawing on the original Bloom (1956) taxonomy, much of the laboratory work described here has focused on knowledge acquisition as opposed to going beyond the retention of facts and examining higher-level behaviors such as the application, synthesis, and evaluation of facts.

Long-term retention

A major goal of education is long-term retention, with students remembering information over months and years. However, most of the research described in the foregoing review has assessed learning and retention after periods of time that range from a few minutes to a few

weeks. While this time frame is relatively short with respect to education, it is sufficiently long to observe that some effects diminish over time while others grow. For example, the effects of story-reading tend to decrease over longer periods of time, presumably because students forget this information and rely on their general knowledge instead (e.g., Marsh *et al*. 2003). In contrast, both the positive and negative effects of viewing popular history films seem to increase over time (e.g., Umanath *et al*. 2012). One possible explanation for this finding is that students in these studies forgot the information they had read in texts more rapidly than what they had seen in the films, and thus came to rely on their memories of the films more over time. Although certain mediums may produce longer-lasting effects (e.g., films that are rich in visual and auditory information), the medium does not necessarily determine whether the effects will increase or decrease over time. For instance, Appel and Richter (2007) found that the negative effects of exposure to false assertions in a fictional story increased after a delay of 2 weeks relative to an immediate assessment (a sleeper effect, with changes in belief increasing over time; Hovland and Weiss 1951). As these examples suggest, how the effects of learning from fictional materials unfold over time is likely to depend on many different factors. Since the timing of the final assessment is not usually manipulated as an independent variable, more research is clearly needed to investigate both the time course and the long-term effects of fiction on memory.

Furthermore, when considering the long-term effects of learning from fictional materials, it is important to note that students in these studies typically receive just a single, brief exposure to the fictional materials. The durability of these effects would be expected to increase with more exposure, especially if this additional exposure involved repeated engagement with the materials that is spaced out over time (Dempster 1989). Indeed, prior research indicates that there is a strong relationship between the amount of exposure to various types of media (e.g., print and television) and knowledge (e.g., Stanovich and Cunningham 1993). Engaging in learning activities that involve active processing of the fictional materials (e.g., concept mapping and critiquing accuracy of content) rather than passive processing (e.g., reading a text and viewing a film) would also be expected to promote long-term retention of the content, regardless of whether it is true or false. For example, as noted earlier, when students were tested after reading fictional stories, they remembered more correct and incorrect information after a 1-week delay than if they had only read the stories (e.g., Barber *et al*. 2008; Marsh *et al*. 2003, Experiment 3).

Source memory

The last question addressed here is whether students later remember if and when information was learned from fictional sources. Earlier in this paper, we made several references to fiction as a lower credibility source, which might have consequences for people's willingness to rely on it as a source of information about the world (e.g., Smith and Ellsworth 1987; Underwood and Pezdek 1998). One possibility is that readers only rely on fictional sources after forgetting that information was learned in such sources (*source amnesia*; Schacter *et al*. 1984). To test this, we used our short story paradigm with one important modification: After students read short stories containing correct and erroneous references to facts, students made two source judgments. First, they indicated whether they remembered reading each answer in one of the stories, and second they indicated whether they knew each answer prior to entering the experiment. Surprisingly, readers were actually quite good at identifying which answers had been read in the stories, even for misinformation (Marsh *et al*. 2003). Reliance on the stories did not depend upon source amnesia. Instead, readers experienced an illusion of prior knowledge: They believed they had known many of the facts prior to

entering the experiment, including story misinformation that they were unlikely to have known.

A similar source error occurred when students relied on inaccuracies depicted in films to answer general knowledge questions, even though they were instructed to answer based solely on the accurate texts. Students did remember seeing their answers depicted in the films, but they also believed the information had been conveyed in the texts (Butler *et al*. 2009, Experiment 2). The issue is that most sources in real life are *not* mutually exclusive and remembering that something occurred in a particular source does not mean it was not also encountered elsewhere. From an educational standpoint, this means that telling students to avoid a particular source may not be effective if students erroneously believe they have also encountered the information outside of that context.

Summary of work on assessment characteristics

Much of the relevant work does not tackle educationally relevant delays, although the data available do allow predictions about the time-course of learning. Depending on the processing activity, long-term effects are possible, and such learning is likely to be paired with an illusion of prior knowledge.

Conclusions

To summarize, both laboratory research and classroom demonstrations show that students learn from fictional sources. When the content is veridical, learning is similar to that observed with other sources; for example, students learn more when information is repeated, they forget material over time, and they benefit from retrieval practice. However, one problem is that fiction can contain factual inaccuracies, and the same principles of learning apply for errors as for veridical information. Reading errors can slow retrieval of related world knowledge, block access to pre-existing knowledge, and lead to the reproduction of story errors on later tests; more generally, the errors appear to be integrated into the knowledge base (with learners reporting that they "knew" the story errors before entering the experiment). The costs of reading fiction are not due to source amnesia, but rather occur because readers often fail to notice errors embedded in fictional sources, even if they are warned about the errors or actively search for them. The challenge for the educator is to engage the learner, to promote successful detection of the errors, and to provide clear feedback about any errors. These principles of critical reading and error correction are not necessarily specific to the use of fictional sources, but are likely to apply broadly to any materials that contain a mix of truth and errors.

Fiction is a powerful tool for engaging students and teaching veridical content, even if it also has the potential to transmit false knowledge. Fictional sources are frequently encountered in everyday life and may influence learning more than traditional sources (e.g., textbooks) that are unlikely to be encountered outside of formal educational contexts. Consistent with this idea, Stanovich and Cunningham (1993) showed that print exposure (as measured by people's ability to recognize names of authors like Ian Fleming and John Updike) is correlated with people's performance on general knowledge measures tapping science, history, and economics, among other topics. Critically, print exposure predicted knowledge after the analyses controlled for general ability as measured through GPA, reading ability, reasoning skill, and mathematics aptitude. This finding nicely illustrates how interacting with fictional sources may be a primary way that people learn about the

world. Given the long tradition of learning from fictional sources, it is clear that people will continue to learn in this fashion, highlighting the importance of understanding the underlying mechanisms and the factors that enhance the benefits and minimize the costs.

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