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## RESEARCH AND DEVELOPMENT OF MULTIPLE SOURCE COMPREHENSION ASSESSMENT

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Literacy demands of 21st-century society require that we move beyond simpler views of reading comprehension in our theories, research, and assessment (Goldman, in press; Goldman et al., 2010, 2012; Lawless, Goldman, Gomez, Manning, & Braasch, in press; Lee & Spratley, 2010; Moje, 2008). For example, electronic technologies make information ubiquitous and increase the likelihood that “the public” of all ages finds itself attempting to bring together multiple sources of information in the course of their personal, academic, and professional lives (Britt, Rouet, & Braasch, Chapter 11, this volume; Coiro, 2009; Coiro & Dobler, 2007; Goldman, 2004; Goldman et al., 2012; Wiley et al., 2009). To “bring together” information from multiple text sources, readers need to go beyond decoding and comprehension processes associated with word—and sentence—level processes, often referred to as simple views of reading (cf. Andrews & Reynolds, Chapter 5, this volume; Landi, Chapter 2, this volume; Oakhill, Cain, McCarthy, & Nightingale, Chapter 7, this volume; Van Dyke & Shankweiler, Chapter 8, this volume). They have to move to interpretive levels and decide what the text *means* in the context of their purpose or goal. They need to decide what information is relevant; if it fits together coherently; if there are gaps or inconsistencies; and if it contradicts previously acquired knowledge. If such issues arise, readers need to decide what to do about them. The decisions and what to do about them often depend on information *about* the text, such as who wrote it, when, and for what purpose. (See, for discussion, Bråten, Strømso, & Britt, 2009; Britt et al., this volume; Britt & Rouet, 2011, 2012; Goldman et al., 2012; Strømso, Bråten, & Britt, 2010.) These interconnections between reading and reasoning are evident in the following hypothetical example.

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1 A news story hits the networks about an earthquake in China. There has  
 2 been an intense tremor and major damage to certain areas of the country.  
 3 Concerned for the welfare of family and friends who live in China, you  
 4 search the Internet to get additional information, entering *China earth-*  
 5 *quake*. Your search returns several sources of information: Newspapers  
 6 releasing flash updates, twitter feeds from individuals in the immediate  
 7 vicinity, video of the quake captured on cell phones, and links to stories  
 8 published after prior earthquakes of like magnitude and occurring in  
 9 similar geographic areas. Across these “texts” a reader must sort out the  
 10 relevant details. Where was the epicenter? What is the population in that  
 11 area? What kind of damage can such a quake do? What is the early  
 12 damage assessment? Are there human injuries? What happens in the after-  
 13 math of such a disaster? This information, of course, also needs to be in-  
 14 tegrated with one’s prior knowledge of major earthquakes, such as those  
 15 that have occurred in California, Haiti, and Japan. In addition you have  
 16 to consider the type of source and its author to decide on its reliability  
 17 and trustworthiness. If the author was someone from the U.S. Geographic  
 18 Survey, you might be more inclined to accept the claims after a superficial  
 19 reading of the article than if the author was someone who stood to gain  
 20 financially from disaster relief efforts. In the latter case, you might actually  
 21 read the article very closely before deciding on the validity of the  
 22 information.

23  
 24 The general point is that how people read texts depends on how they reason  
 25 *about* the information; and how people reason about the information depends  
 26 on how people read texts. Reading and reasoning are necessary to arrive at  
 27 interpretations of the information.

28 Although going beyond what text says to interpretations of what text  
 29 means requires entertaining complex conceptualizations of reading compre-  
 30 hension, simpler views have dominated approaches to reading comprehension  
 31 theories, instruction, and assessment. One might ask why. One response is  
 32 found in Charles Perfetti’s 2009 keynote address introducing the U.S.  
 33 Department of Education Institute of Education Sciences’ Reading for  
 34 Understanding Initiative. During this talk, Perfetti referred to the “concep-  
 35 tual muddle” that results when reading comprehension takes on other aspects  
 36 of cognition:

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 38 We can expect the comprehension of written language to approximate  
 39 the comprehension of spoken language. When that happens, then reading  
 40 comprehension has developed, for practical purposes, to its limiting or  
 41 asymptotic level. . . . All other limitations are imposed by linguistic abili-  
 42 ties, relevant knowledge, and general intelligence. *If we make things more*  
 43 *complex than this, we push onto the concept of reading comprehension all these*

*other important aspects of cognition, with the muddle that results from conceptual conflation.*

(Perfetti, Landi, & Oakhill, 2005; emphasis added)

The challenge then, in moving beyond simple views is maintaining clarity regarding the construct. In this chapter, we illustrate our efforts to maintain conceptual clarity for the construct multiple source comprehension by using the Evidence Centered Design approach to assessment development (ECD; Mislevy, Steinberg, & Almond, 2003).

ECD is particularly appealing as an approach to assessment of complex comprehension as reflected in multiple source comprehension because it *begins* with the definition of the construct in terms of knowledge, skills, and competencies. Assessment tasks are developed based on explicit statements, called claims, about the knowledge and skills that constitute the construct *and* the work that would provide evidence of students' competence with respect to the claims. As such, the ECD process makes clear what students should know and be able to do and what would be taken as evidence that they know and can do it (Pellegrino, Chudowsky, & Glaser, 2001). ECD can be contrasted with a commonly used technique in cognitive science, rational cognitive task analysis (Clark & Estes, 1996). Task analysis *begins* with the task and asks what knowledge and skills a student would need to successfully complete the *task*. However, the relation of tasks to constructs is not a central concern.

We provide an overview of ECD and then instantiate it in the context of our efforts to develop assessments of multiple source comprehension in early adolescent students, roughly 10–14 years old. We designed the assessments to serve a formative function by providing teachers with information about their students' knowledge and skills for engaging in deep understanding of multiple information sources. Engaging in the ECD process took us from a very broad definition of multiple source comprehension to specific operational definitions of two subcomponents of the broader construct: (1) selection of sources useful to answering an inquiry question; and (2) information integration from a set of constrained sources to answer an inquiry question.

### Evidence Centered Design: A Brief Overview

The ECD process begins with specifying the knowledge and skills that define competence in the domain, much like models of expert performance in other areas of cognitive sciences. The domain model is the basis for developing the student model, i.e., the knowledge and skills that would define student, as opposed to expert, competence. The student model is expressed as a series of claim statements regarding student performance. They begin with the stem *The student can . . . <show, differentiate, determine>*. Claim statements cannot use verbs like *understand, think about, comprehend*. For each claim statement, there is at least

one corresponding evidence statement, using the stem *The work provides information that the student <differentiates, shows, identifies>*. The task model defines the characteristics of the activities in which students will engage and thereby generate observations that fulfill the terms of the evidence statements. It includes the specification of the work product or performance that serves as the vehicle for collecting observations. The evidence model sits between the student and task models and describes how the observations in the work product or performance are scored, evaluated, and interpreted with respect to the claim statements in the student model. Using the ECD approach for assessment development is an iterative process wherein the results of initial tests are used to refine and elaborate domain, task, and evidence models.

## Multiple Source Reading Comprehension: Domain and Student Models

We developed the construct of multiple source reading comprehension for the functional goal of answering inquiry questions using more than a single text-based resource (Goldman et al., 2010; Lawless et al., in press). We postulated a domain model drawing on extant research and theory in library and information sciences, discourse comprehension, and literacy practices within the disciplines (e.g., Goldman, 2004; Lee & Spratley, 2010; Moje & O'Brien, 2001; Shanahan & Shanahan, 2008; Stadler & Bromme, 2007).

### *The Domain Model*

The domain model includes six components: interpreting the task; gathering resources; sourcing and selecting resources; analyzing, synthesizing, and integrating information within and across sources; applying information to accomplish the task; and evaluating processes and products. We arrived at these components and their description by repeatedly asking the ECD question: *What do we mean by multiple source reading comprehension, as informed by extant research and theories?* (Goldman et al., 2011).

*Interpreting the task* reflects the need to understand the objectives and boundaries of the task, including the kind of question or problem that is posed, the various subproblems that might be involved, and generally the kinds of sources that might be helpful to accomplish the task.

*Gathering resources* refers to finding, identifying, and locating information to address the task.

*Sourcing and selecting* involves whittling down gathered resources to find the most useful sources for the task. Task relevance and reliability are two critical aspects of sourcing and selecting. Decisions about relevance depend on topical relationships between the task and the information source (Braasch et al., 2009). Individuals with prior knowledge of the inquiry topic are likely to be in a better

position to make efficient sourcing and selection decisions than individuals with little knowledge of the task domain. Reliability is influenced by who created the piece, why, and when (Braasch et al., 2009; Bråten et al., 2009; Strømsø et al., 2010; Wiley et al., 2009; Wineburg, 1991; Zhang & Duke, 2011). How those dimensions are weighted depends on readers' knowledge of the content area and the field more generally. Evaluation of the results of sourcing and selecting might lead to decisions to go back and gather more resources, perhaps with more refined search criteria.

*Analysis, synthesis, and integration* are closer to traditional conceptions of reading comprehension than are many of the other components of multiple source reading comprehension. They involve basic reading processes for figuring out what the text says, including word recognition, lexical access, parsing, and extracting meaning elements. These processes contribute to the formation of a textbase-level representation—essentially the ideas that are directly and explicitly communicated through the words and their organization in the text (Goldman, Varma, & Coté, 1996; Kintsch, 1988, 1998; van den Broek, Risden, & Husebye-Hartman, 1995; van Dijk & Kintsch, 1983). Theories of single text comprehension also posit that readers create a situation model level of the text that reflects the reader's interpretation of the world referred to by the text. The situation model representation synthesizes information within the text and with prior knowledge. Thus, even single text comprehension involves synthesis in terms of making inferences that are activated by the explicit text and that connect parts of the explicit text ~~and~~ or the explicit text with prior knowledge (Goldman, Graesser, & van den Broek, 1999; Graesser, Singer, & Trabasso, 1994; Kintsch, 1998; McNamara & Kintsch, 1996; Wiley et al., 2009; Zwaan & Radvansky, 1998). These inferences can reflect a variety of types of reasoning, including associative, causal, and other logical relations. In the context of an inquiry task, analysis involves determining the relevance of information to the inquiry question. This is because even though a text as a whole may be topically related to the inquiry, not all of the information in the text may be useful for addressing the inquiry task. Readers have to critically evaluate what is and is not relevant to their inquiry task and integrate that information so it addresses the task.

In multiple source comprehension synthesis and integration operate across sources as well as within single sources and involve at least two additional levels of representation. First, the source level represents information about the sources (e.g., author(s), date of publication, publication venue). Second, the integrated model level reflects as complete a model as the comprehender can get of how the information in the multiple sources fits together with respect to the inquiry task. The integrated model or the integrated mental model (Britt & Rouet, 2012; Britt, et al., this volume) reflects bringing together situation model and textbase levels from individual sources and is akin to the documents model as discussed by Perfetti, Britt, Rouet, and their colleagues (Britt, Perfetti, Sandak,

1 & Rouet, 1999; Goldman, 2004; Perfetti, Britt, & Georgi, 1995; Perfetti,  
 2 Rouet, & Britt, 1999; Rouet, 2006). Synthesis across multiple texts involves  
 3 inferential reasoning processes that include comparison and contrast of informa-  
 4 tion to determine whether and how information is related (e.g., complementary,  
 5 overlapping, or redundant) or unrelated. And if it is related, whether it is con-  
 6 sistent or inconsistent and the type of logical relations that apply. Cross-text  
 7 synthesis is important in history for corroboration and in science for establishing  
 8 the reliability of results. Inconsistencies can be of a variety of types with differ-  
 9 ent implications for reading behaviors and interpretations. For instance, to  
 10 return to the earthquake example, one newsfeed might indicate that there were  
 11 no fatalities but another might report that several people had died. The contra-  
 12 diction between the two articles might lead readers to evaluate the evidence for  
 13 the contradictory assertions in the two articles and potentially seek additional  
 14 information to clarify. Integration involves organizing the outcomes of analysis  
 15 and synthesis processes to form the integrated model.

16 Synthesis, as well as integration, are likely to be more difficult in multiple  
 17 source situations than if the same content was included in a single source  
 18 because the writer of a single source that contained conflicting information  
 19 would very likely indicate this conflict through the use of rhetorical devices and  
 20 signals (e.g., *On the other hand*, *An alternative view*, *In contrast* . . .). In multiple text  
 21 situations, readers must supply these relational indicators. Furthermore, multiple  
 22 text situations provide more opportunities for connections and readers need to  
 23 figure out which are germane in the inquiry context and which are not.

24 *Application* involves organizing the information that has been synthesized and  
 25 integrated so that it complies with the task requirements. This phase involves  
 26 knowledge of the forms of communication that are appropriate for accomplish-  
 27 ing different purposes and the conventions that govern how they are organized.  
 28 As such, application often involves reading *and* writing skills. However, we  
 29 include it in our model of multiple source comprehension because the process  
 30 of applying the information to accomplish the task constraints may well lead to  
 31 deeper levels of understanding of the information and perhaps reinterpretation  
 32 of information and sources that readers thought they already understood  
 33 sufficiently.

34 *Evaluation* operates within each component and also coordinates movement  
 35 from one component to another, depending on the outcome of attempts within  
 36 each component. Within each component evaluation regulates processing (e.g.,  
 37 deciding whether a particular source has enough relevant information in it to be  
 38 useful). The components are also interdependent in that readers may have to  
 39 revisit task interpretation based on the information in the sources that are found.  
 40 There may be points or issues that readers determine simply cannot be addressed  
 41 because the relevant data is simply not available. Or the reader may decide to  
 42 search further for the relevant data even if it is not in the sources thus far con-  
 43 sidered. Thus, evaluation is at work when readers decide that the sources they

have selected are insufficient to accomplish the task or when they decide that information from one source matches up with information from another. Evaluation as conceptualized in this domain model is consistent with discussions of the metacognitive aspects of reading multiple sources (Azevedo & Cromley, 2004; Coiro & Dobler, 2007; Stadler & Bromme, 2007, 2008).

From this domain model we developed student, task, and evidence models for two components: sourcing and selecting; and analysis, synthesis, and integration. In the remainder of this chapter we focus on the analysis, synthesis, and integration component. Information on the sourcing and selecting component is available in Braasch et al. (2009), Goldman et al. (2012), and Lawless et al. (in press). We illustrate how we operationally defined the analysis, synthesis, integration component for multiple source reading comprehension through the claim–evidence statements in the student model and the assessment situation specification in the task model. The scoring and analytic strategies used to evaluate student work products reflect our instantiation of the evidence model.

### ***Student Model for Analysis, Synthesis, and Integration***

The student model comprises claim–evidence statements for the constructs analysis, synthesis, and integration as we operationalized them for this multiple source reading comprehension assessment. The claim–evidence statements indicate what students know and can do based on the evidence in work they produce. Abridged versions of the specification of these three constructs and claim–evidence statements for them are provided in Table 12.1. As with the components of the domain model we arrived at these descriptions by repeatedly answering the question “What is meant by <subcomponent>?” (Mislevy et al., 2003) for analysis, synthesis, and integration. The answers are described (column 1) and then expressed in claim–evidence statements (columns 2 and 3). The claim–evidence statements specify the skills involved in multiple source comprehension with respect to inferences about what students can do (the claims) based on specific features of work products (evidence).

Specifically, the analysis subcomponent involves skills for (1) determining task relevance of information in a text, and (2) identifying the claim(s) and evidence supporting it (them) within a text. “Reading” the claim–evidence statement for the first skill in Table 12.1, we would make the claim that a student can show what parts of a text are useful for a task (claim statement) if that student produces a work product that differentiates between useful and less useful parts of a text. As discussed below, the Evidence Model specifies how this differentiation translates into observables, given a particular assessment situation. The descriptors for synthesis shown in Table 12.1 refer to skills for (1) comparing claims across sources and (2) evidence across sources. The descriptors for the integration subcomponent show that it involves (1) organizing claims and evidence from different sources so that they can be used to address the inquiry task.



**TABLE 12.1** Unpacking the analysis/synthesis/integration component of multiple source comprehension (abridged version) and the evidence model

Subcomponent	Evidence model	
	Student model	Evidence from essay
	<i>Claim statement</i> The student can . . .	<i>Evidence statement</i> The work provides information that . . .
<i>Analysis</i>	<ol style="list-style-type: none"> <li>show that, how or why, when or where part of text is useful for task.</li> <li>differentiate between claims and their supporting information.</li> </ol>	<ol style="list-style-type: none"> <li>the student differentiates parts of text useful for task from those not useful.</li> <li>the student identifies the distinct claims and evidence from them.</li> </ol>
<i>Synthesis</i>	<ol style="list-style-type: none"> <li>determine which claims agree, disagree, or complement one another.</li> <li>determine which evidence is consistent, which inconsistent across sources.</li> </ol>	<ol style="list-style-type: none"> <li>the student selects claims that agree or complement one another to address the inquiry question.</li> <li>the student detects inconsistencies across evidence and provides explanations of why they are inconsistent.</li> </ol>
<i>Integration</i>	<ol style="list-style-type: none"> <li>take claims from different sources and combine them into one claim or set of claims.</li> <li>connect evidence to appropriate claims regardless of original text source.</li> </ol>	<ol style="list-style-type: none"> <li>the student combines consistent claims into one claim or argument that addresses inquiry task.</li> <li>the student provides evidence to support claims.</li> </ol>
	<ol style="list-style-type: none"> <li>Determine relevance of information to task.</li> <li>Identify claim(s) and evidence in each text.</li> </ol>	<ol style="list-style-type: none"> <li>Proportion of essay reflecting textbase, especially elements central to inquiry question.</li> <li>Mean number of texts reflected in essay content.</li> </ol>



As specified in (2), this may sometimes involve using evidence presented in support of one claim to support a different claim.

### **The Task Model**

The claim–evidence statements in and of themselves tell us little about the topics, inquiry questions, and kinds of texts (genres and complexity levels) in which students produce work products. That is the job of the task model. It describes the assessment situation in terms of the conditions for collecting observations so that the work products are capable of providing the evidence specified in the evidence statements in the student model. These “conditions” include the topic, type of response, type and number of texts, task instructions, timing, and so on. The task model we developed reflects our selection of a particular form of analysis, synthesis, and integration that pilot testing indicated would be developmentally appropriate for students in the grade band 5–8, age 10–14.

In developing the task model, we realized there were a number of different types of synthesis situations. Consider just three types:

1. Synthesizing different text genres to answer an inquiry question (e.g., primary versus secondary documents in history; newspaper accounts of research studies versus peer-reviewed journal reports of experiments);
2. Synthesizing/comparing multiple texts that agree with one another versus contradict one another (e.g., two editorials that take similar positions as compared to two that take opposite sides on a topic such as immigration policies of the U.S.);
3. Synthesis of texts that each contribute a piece of the answer, but do not provide a complete solution to the inquiry task on their own (e.g., an economic analysis in one text and a political analysis in another of fluctuations in the cost of gasoline).

To create assessment situations for each of these requires three different task models. We formulated the task model for the third type of analysis/synthesis/integration, in part because it reflected a beginning level of analysis and synthesis: to answer the inquiry question completely, relevant information would have to be selected from several texts (analysis), claims and supporting information compared and coordinated across texts (synthesis), and organized logically to address the inquiry question (integration). This assessment situation would therefore be able to provide evidence for only the first skill shown in Table 12.1 for each of the subcomponents.

The inquiry task was specified as using the information in a set of texts that were provided to write an essay in response to the question *Why were the civil rights events of 1955–1965 more successful than previous civil rights events?* The text

1 set contained three texts that presented complementary information regarding  
2 the historical event. One described the federal laws (LAW) that were passed  
3 between 1860 and 1955 and reasons they had limited impact on the rights of  
4 African Americans. The second described direct action efforts (DA) that prior to  
5 1955 had consisted of largely local, small-scale events. The third text described  
6 the advent of television (TV) as a common household item that brought the  
7 news of the day into people’s homes in ways that had not been possible previ-  
8 ously. Intentionally, the genre of each of the texts is similar to “textbook” so  
9 that we could look at analysis, synthesis, and integration independent of issues  
10 of sourcing. Each text contained claims about the role of laws, direct action, or  
11 the advent of television along with evidence to support the claims in the form  
12 of generalizations with specific example events. For example, from the DA text:  
13 generalization: *Small groups fought for change in their own communities*; specific  
14 events: *In the 1930s, Blacks boycotted the Woolworth’s drug stores in Chicago. They*  
15 *refused to buy anything there because Woolworth’s would not hire Blacks.* The three  
16 texts are provided in Table 12.2. The three texts as a set met the parameter in  
17 the task model of providing information that was sufficient for students with  
18 little or no prior knowledge to demonstrate analysis, synthesis, and integration  
19 in an essay answering the inquiry question. Additional parameters in the task  
20 model set conditions on length of the texts, readability, and degree and type of  
21 content overlap among the texts in the text set (e.g., surface overlap of some  
22 words, repetition of events) (see Goldman et al., 2012, for details).

23 The task model also captures the administration conditions of the assessment  
24 situation. In the present context we report results from an administration of the  
25 civil rights assessment situation to 211 students in grades 5 (n=70), 6 (n=90),  
26 and 7 (n=51). The assessment task was developed as an online activity pro-  
27 grammed in Flash, with an archival database collecting information on student  
28 responses and interactions within the activity. An introductory audio and ani-  
29 mation sequence contextualized the inquiry question for the students and  
30 modeled how to answer a “why” question by searching for the *main reasons* and  
31 *supporting reasons* across the available texts that addressed the inquiry question.  
32 Students were told that “these reasons all fit together like [pieces of] a puzzle:  
33 when you put the pieces together, you see the whole picture—the answer to  
34 the question!” As a reminder, the written inquiry question was visible across the  
35 top of the computer screen throughout the duration of the entire task. All  
36 instructions were provided in both text and audio formats.

37 Students were told they would have three texts to use to answer the inquiry  
38 question in a written essay. The activity was divided into two phases: reading  
39 and writing. To increase the probability that students read the three texts in  
40 their entirety before writing their responses, the students were first asked to read  
41 the three passages (Step 1: reading) for the main and supporting reasons and  
42 could not go on to writing until they had met the minimum “screen time” for  
43 each text (2 minutes per text). By clicking on the titles of each of the three texts

**TABLE 12.2** Three texts in the text set for the civil rights inquiry question *Why was the civil rights events of 1955–1965 more successful than previous civil rights events?*

**Legal Rights as a Force for Change**

Early civil rights battles were fought in the courtroom in order to change federal law. A law is a rule that is created by an authority figure to protect people, their property and their rights. While many of these battles were successful and created new laws that supported the civil rights of black people, they had little impact on how black people were treated. People had to decide to obey the new laws. But many people did not want to obey them. People not wanting to obey new laws is something that is quite common. Cell phone use while driving is a good example. There are now laws against it but people don't see why they have to obey that law and still talk or text on their phones while driving a car.

This same thing happened with civil rights laws, some of which date back to the civil war. For example the Civil Rights Act of 1875 created a federal law that gave black people the right to use the same public places as white people, including public restrooms, water fountains, and restaurants. But many people in the Southern states like Alabama, Mississippi, and Georgia did not want black people to use the same facilities as white people. Some lawbreakers in these states created new laws that pretended to obey the federal law. They were called "separate but equal" laws. Separate drinking fountains and bathrooms were designated for use by blacks, but they were often in poor working condition compared to those designated for whites. Schools that whites attended had better books and buildings than schools that black students had to go to. All people could ride the same city bus but blacks had to sit in the back while whites could sit wherever they wanted. So while the Civil Rights Act of 1875 changed the federal law, it did not really improve the lives of blacks in many U.S. cities and towns.

In the end, it became clear that making and changing federal law alone was not enough to make real improvements in the treatment and lives of black Americans. Something would need to happen to change public opinion so that the American people would be more aware of these civil rights laws and understand why these laws were necessary for the good of everyone.

**Taking Action and Working Together for Change**

Throughout history, people have had to fight for their rights. One way of doing this is through direct action. Direct action is a strategy for change where groups of individuals do things that call attention to problems that need to be fixed. Direct action was one way black people fought for their civil rights and were able to make a difference in how they were treated.

Early direct action efforts were small, and made local changes. Small groups fought for change in their own communities. In the 1930s, blacks boycotted the Woolworth's drug stores in Chicago. They refused to buy anything there because Woolworth's would not hire blacks. The boycott lasted 4 months and ended when Woolworth's finally hired 21 black workers. The Baton Rouge Bus Boycott of 1953 was another example. Blacks refused to use the public buses because they were forced to ride in the back. The boycott lasted just 4 days, and ended after the bus company agreed to let blacks share the *middle* section of the bus with whites, but not the front. These small victories showed how it was possible for people to come together and make a change within their communities. But many more people in the country still needed help.

Later direct action events were much bigger, highly organized, and made national changes. Led by the civil rights organizations, many of these efforts won some big civil rights victories. For example, the National Association for the Advancement of Colored People (NAACP), Dr. Martin Luther King Jr., and the Montgomery Improvement Association (MIA) all worked together to plan and run the Montgomery Bus Boycott (1955–1956). Having all of these groups work together was important because it meant that people in different places could communicate with each other and plan much bigger direct action events that lasted longer. The Montgomery Bus Boycott lasted more than a year and more than 20,000 people participated. As a result, laws changed so that everyone could sit wherever they wanted on the buses. The 1963 March on Washington was another large direct action event planned by many of the major civil rights organizations. At this gathering of over 200,000 people, Dr. Martin Luther King, Jr. delivered his famous "I Have a Dream" speech. This event was also televised live as it happened. People all over the country watched it on television. Many people, including the President of the U.S., began to push for equal rights for all American citizens because of the March on Washington.

All of these direct action events were successful because of the way people and organizations worked together. The early, smaller efforts made local changes. The later, larger and more organized events brought civil rights issues to the attention of people across the nation and helped obtain equal rights for all U.S. citizens.

**The Rise of Television**

For many of us it is hard to imagine a world without television, but in the early 1950s, only 1 in 10 U.S. households had a television set. By the end of the 1950s, the number of American homes with a television jumped to nearly 90%. Television had an advantage over other forms of mass media like radio. People getting their news from the radio could only listen about the event, but with a television people could see *and* listen. As a result, many people felt more connected to television events. Television provided people with a way to experience important news events as they occurred. Events all over the world were broadcast into people's living rooms. People were introduced to a whole variety of things that, prior to television, they could only imagine. Everyone watching television news or shows shared a common experience. Rich and poor people of all colors experienced televised events at the same time. In 1959, for example, Americans all over the country watched the televised event of the very first time an American was sent into outer space.

Television also helped shape public opinion by giving people the change to see the world through the eyes of others. People began to understand more about political issues because they could actually see, on television, the problems other people had to face. In a sense, people could actually experience those faraway events for themselves. For example, people watching television in the northern United States could see for themselves the unfair living conditions endured by blacks living in the South. They also saw how blacks struggled against those conditions. In the 1950s and 1960s, television viewers saw news broadcasts of angry white mobs trying to keep black students out of white schools, attacks by police and dogs on children and civil rights protesters, and bus boycotts. It was one thing to hear on the radio that protesters were being sprayed by fire hoses but seeing it on television made a more powerful impression. Viewers witnessed with their own eyes that the protesters could not even stand up against the force of the water as it was sprayed on them.

Because these television broadcasts were national, a lot more people became aware of the poor treatment of blacks in the South. This helped change public opinion and resulted in many people deciding to join in the fight for equal rights for all U.S. citizens. It also demonstrates the important role television has played in the shaping of society as we know it today.

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(whose placement order on the screen was randomized), students were able to view and read each text, at any pace and order of texts. Students spent approximately 10–15 minutes reading all three of the texts. Students then proceeded to Step 2: writing. To write their essay, they were told to use the three texts (still available to them) for reference while typing out their responses. Note that although the texts were available, they could not scroll over text and cut and paste it. (See Goldman et al., 2012, for further information and screen shots of the software application.) Students spent approximately 15–30 minutes on the writing portion of the task.

### ***The Evidence Model***

The evidence model specifies how the observations, in this case the contents of the essays, are to be evaluated with respect to the claim–evidence statements in the student model. Our a priori evidence model is provided in column 4, Table 12.1. We anticipated that evidence of the information relevance skill (analysis) would be reflected in selective inclusion of main reasons and key supporting evidence or details from the LAW and DA text regarding why actions prior to 1955 were less successful than those occurring between 1955 and 1965. We also expected inclusion of information about the role of television in raising awareness of civil rights issues. The key evidence for synthesis was inclusion of information from more than a single text source. For integration it was inferences that connected claims and/or evidence across texts. Column 5 of Table 12.1 provides the dependent measure(s) used as indicators of the various types of evidence described in column 4.

To enable us to systematically map essay contents to an integrated model that could be constructed from the three texts to address the inquiry question, we developed the schematic shown in Figure 12.1. Content from each of the texts is represented as a series of vertically organized content nodes, starting at the top with the overall main reason from each text. These are claim nodes in Figure 12.1 and are labeled CL1, CL2, and CL3 for LAW, DA, and TV texts respectively. Beneath each claim are the evidence nodes (EV#) supporting the claims. At the third level are nodes reflecting details of specific events (DET) that illustrate the more general evidence statements. Connections between nodes that were provided in the texts themselves (labeled R) are shown in Figure 12.1 as solid lines. Inferred, between-text connections (labeled IREN##) are indicated with dotted lines. There were also unanticipated cross-text inferential connections present in students' essays. These are shown as ISYN in Figure 12.1. We indexed specific sentences from the texts to each node and link. The integrated model served as a template for scoring the information contained in student essays.

According to the integrated model in Figure 12.1, an essay that provided a complete answer to the inquiry question would make three claims: the spread

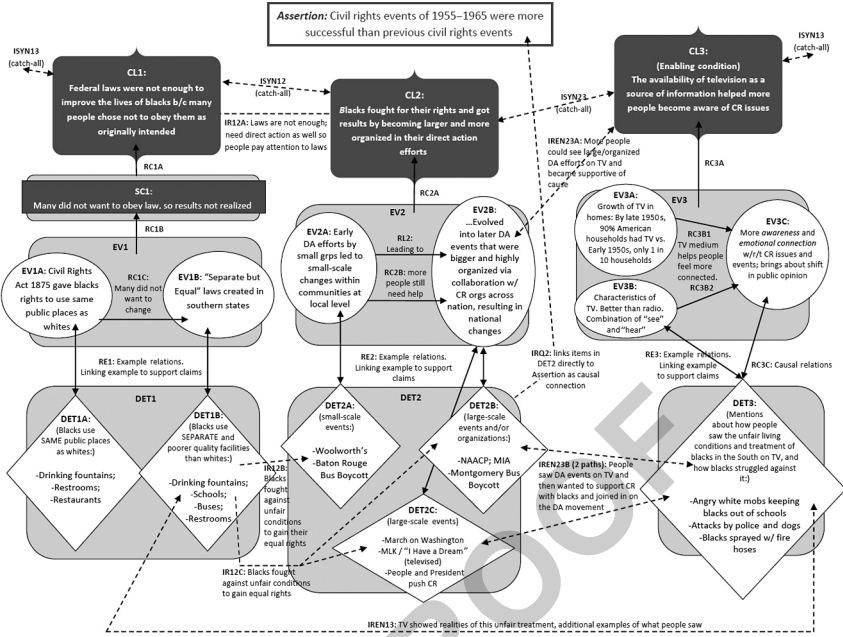


FIGURE 12.1 Integrated model for inquiry question *Why were the civil rights events of 1955–1965 more successful than previous civil rights events?*

of television was a key enabling condition in the success of the civil rights movement in the 1955–1965 period (CL3) because (IREN23) it made more people aware of direct action efforts (CL2) and the inadequacy of federal laws to extend civil rights to African Americans (CL1). With respect to the student model, the “best” essay would be able to provide evidence of synthesis and integration in terms of inferences connecting elements across texts, indicated by IREN and ISYN links.

Students’ essays were scored in two passes, the first with respect to the presented texts (textbase coding) and second with respect to the integrated model (Figure 12.1). In the first pass, raters worked from essays that had been parsed into idea units. Each idea unit was “mapped” to the texts and was coded to indicate what text and which sentence it was drawn from, as well as whether it was a direct, verbatim copy of the text information or whether it was a paraphrased version of the text information. This textbase coding allowed us to identify the depth and breadth of content coverage within each text and across the text set included in each student’s essay. As such, we were able to examine if students were extracting the important information from the texts relative to the inquiry question and if they were able to successfully differentiate the relevant from the irrelevant sections of the original texts. The textbase codes thus

1 served as a proxy measure for the analysis component of the student model. In  
 2 addition to the textbase codes, essays were coded for the presence of prior  
 3 knowledge, extratextual inferences, and distortions (misinterpretations) of the  
 4 text base.

5 In the second scoring pass, coders examined student essays for the elements  
 6 (nodes and links) of the integrated model (see Figure 12.1). These data allowed  
 7 us to understand which components of the text set students were “synthesizing”  
 8 in order to develop a coherent response to the inquiry question. Each essay was  
 9 coded by a minimum of two independent coders who obtained an interrater  
 10 reliability of at least 85%, with differences being resolved in conference.

11 During the coding process and through initial analyses examining the depend-  
 12 ent measures shown in Table 12.1, it became clear that simply looking at each  
 13 dependent measure independent of what else was in the essay provided an incom-  
 14 plete picture of performance on the subcomponents. We decided to explore  
 15 cluster analysis as a means of revealing patterns across a set of dependent measures.  
 16 We derived six measures of what was included in the essays as related to the in-  
 17 tegrated model (number of essay statements that were direct copies of statements  
 18 from LAW, DA, or TV; number of essay statements that were paraphrases of  
 19 statements from LAW, DA, or TV) and four additional indicators of essay content:  
 20 essay word count, inferences not related to synthesis, instances of prior knowledge  
 21 use, and the number of distortions of presented content. These variables were  
 22 entered into a two-step cluster analysis as the dependent vector of scores for each  
 23 student. A unique feature of the two-step algorithm is the *automatic selection* of the  
 24 number of clusters versus a prespecified cluster amount that is entered by the  
 25 researcher as is called for by other clustering methods (Norusis, 2010).

26 The analysis yielded three clusters across all students (5th–7th grade). Essays  
 27 within each resulting cluster were examined with respect to the type and pro-  
 28 portion of included content: text-based information, distortions of the text-  
 29 based information, inferences, and prior knowledge. In addition, the amount of  
 30 information that was “copy and pasted” versus transformed was considered.  
 31 Based on the trends in these variables exhibited by each of the different clusters,  
 32 we labeled them *replicators* (20.9%,  $n = 44$ ), *transformers* (31.3%,  $n = 66$ ), and *mini-*  
 33 *malists* (47.8%,  $n = 101$ ). We then looked at indicators of analysis, synthesis, and  
 34 integration for each of these groups.

35 *Replicators* wrote essays for which the majority of content (58%) consisted of  
 36 information that was lifted directly from the texts, untransformed. A smaller  
 37 percentage of their text-based content (22%) was paraphrased, with distortions  
 38 of text-based information (14%) rounding out the major sources of content in  
 39 their written work. These students’ essays contained very few, if any, inferences  
 40 (2%) or prior knowledge (4%). *Replicators* spent the most time on the writing  
 41 task ( $M = 1687$  seconds) and wrote the longest essays ( $M = 196.5$  words).

42 *Transformers’* essays were characterized by a very large proportion (76%) of  
 43 paraphrased text-based content, in contrast to a relatively small amount of



copied-and-pasted content from the texts (10%). These students' essays also contained few distortions of text-based information (6%), almost no instances of prior knowledge (1%), and the highest proportion of inferences (7%). It appears that both the *replicators* and the *transformers* made the inclusion of text-based information a priority in their work, but the *transformers* provided a more sophisticated treatment of this content in their written responses. The *transformers* spent less time writing than the *replicators*, an average of 1294 seconds, and the average word count was 179.8.

*Minimalists*, unlike the *replicators* and *transformers*, provided work that was characterized by larger proportions of non-text-based content (inferences: 5%; prior knowledge: 11%; distortions of information from the texts: 18%). Only 66% of *minimalists'* essays consisted of text-based content, in comparison with essays by the *replicators* (80%) and *transformers* (86%). The *minimalists* spent the least time writing their responses to the inquiry question ( $M = 927$  seconds) and, not surprisingly, produced the shortest essays ( $M = 97.8$  words).

Evidence of synthesis and integration skills was differentially reflected in the three clusters. The *transformers* demonstrated the strongest evidence of synthesis: 92% of their essays included content from two or three texts, overall  $M = 2.42$  texts included. In contrast, only 40% of the *minimalists* included content from more than one text ( $M = 1.43$ ). Of the *replicators*, 75% included information from more than one text ( $M = 2.11$ ). Integration, indicated by the presence of inferences that connected content nodes across texts, occurred at very low levels in the *minimalists* and the *replicators* (15% and 16% of essays, respectively). On the other hand, 45% of the *transformers'* essays reflected integration in the form of cross-text inferences. The majority of these inferences connected the details across the LAW and DA texts or made miscellaneous connections at the general level across the TV and DA texts.<sup>1</sup>

Our analyses of skill at determining relevant information (analysis) are interesting in that the evidence level (EV in Figure 12.1) of the integrated model was skipped over by most of the students and claim statements were included at moderate levels but largely for the DA text. Details from each of the texts were the most frequent nodes included in the essays, with the specific patterns quite similar for *replicators* and *transformers*. *Minimalists* included almost no information from the TV or the LAW texts but showed a pattern of content inclusion similar to the other two clusters for the DA text. These patterns are complex and we continue to analyze them but they clearly do not accord with the a priori expectations of the Evidence model. What they do reflect is a not surprising tendency for students in this age range to focus on concrete, single-instance events as exemplars of general claims.

It is interesting to note that higher quantities of time and/or writing did not necessarily produce higher-quality work products. Although the *replicators* wrote lengthier essays, their strategy of copying phrases directly from the texts in formulating their responses was not as effective as the *transformers'* method of



1 paraphrasing (and synthesizing) this information in order convey what they  
2 thought was important to say. The quick-and-short approach adopted by the  
3 *minimalists* is also telling with respect to the quality of their responses, which  
4 reflected less emphasis on the inclusion of text-based information and instead  
5 favored the incorporation of proportionately more instances of prior knowledge  
6 in the construction of their essays.

## 8 Conclusions and Continuing Issues

9  
10 Synthesizing and integrating information stemming from multiple, separate  
11 sources of information are clearly comprehension skills for which systematic  
12 instruction is needed. In our sample of over 200 children in grades 5–7, approx-  
13 imately 30 students demonstrated evidence of inferring connections across in-  
14 formation presented in at least two different texts. Furthermore, these  
15 connections were at the detail level of specific events, with selection biased  
16 toward those details with relatively high semantic overlap across texts. The  
17 inclusion of claim statements in essays was infrequent and when evidence was  
18 used to support claims it tended to be through specific example events rather  
19 than generalizations over several examples. In other words, analysis for relev-  
20 ance favored the instantiations of generalized statements rather than the general-  
21 ized statements, expressed as topic sentences in the texts.

22 The ECD process played a key role in allowing us to make more transparent  
23 precisely what performances constitute complex or deep reading comprehen-  
24 sion, leading to limited but clearly defined constructs for analysis, synthesis, and  
25 integration. It is in fact rather humbling to realize that the grain size at which  
26 we specified these three subcomponents was much more constrained than we  
27 had initially anticipated. This grain size resulted from the ECD process of speci-  
28 fying the knowledge and skills along with the kind of evidence that would indi-  
29 cate that such knowledge and skills were present. While measured at a more  
30 microlevel than anticipated, the assessment process allowed us to identify dis-  
31 tinct profiles and approaches to analysis, synthesis, and integration. The clarity  
32 of the construct assessed provides an excellent basis for designing instruction that  
33 begins where students are and moves them forward along a developmental tra-  
34 jectory. As such, the assessment development process and the resulting assess-  
35 ment situations and task performance examples can be educative for teachers  
36 regarding aspects of multiple source comprehension that might be appropriate  
37 foci for different groups of students.

38 Thus, our initial efforts to assess multiple source comprehension, even with  
39 the limited way in which we operationalized analysis, synthesis, and integration,  
40 indicate clear starting points for efforts to support students' developing complex  
41 comprehension skills. Indeed, in the context of an ongoing collaborative effort,  
42 Project READI, we are developing and researching instructional modules spec-  
43 ific to one of three disciplinary areas (literature, history, or science).<sup>2</sup> The

modules are designed to support multiple source comprehension in service of addressing inquiry questions appropriate for that content area. Instructional routines for engaging students in close reading of text material are a key component of these modules. “Close reading” is framed in terms of criteria for determining relevance of information within a source (analysis), connections within and across sources (synthesis), and practices of argumentation (integration) appropriate to each of the disciplines. Assessment development is also a key part of the modules and we are building on what we have discovered using the ECD process as described herein. The work to date is also making clear how much more there is to do to identify, assess, and instruct multiple source comprehension and better prepare students for the complex literacy demands of the 21st century.

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## Notes

- 1 Preliminary analyses indicated that none of these trends was significantly related to grade; nor was membership in the clusters.
- 2 Project READI (Reading, Evidence, and Argumentation in Disciplinary Instruction) is a collaborative project among researchers from the University of Illinois at Chicago, Northern Illinois University, Northwestern University, WestEd, and Inquirium Ltd. who are working with educational practitioners from schools in the greater Chicago and Bay area in California. Project READI is part of the Reading for Understanding network funded by the Institute of Education Sciences, U.S. Department of Education, through Grant R305F100007 to the University of Illinois at Chicago. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

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