

Reading Comprehension

Reading comprehension is an important skill for navigating the textual world around us. It is a dynamic process that involves making predictions, summarizing the main idea, questioning one's predictions, and clarifying unclear concepts. This handout will help you understand how reading involves using these reading strategies. The strategies will be incorporated into a sequence that involves pre-reading, during-reading, and post-reading phases.

Before you start, find a place where you can think aloud to yourself. While you read, speak your thoughts aloud so you can externalize what you are thinking. After you have organized your thoughts verbally, write them down.

Pre-Reading Phase

Predictions

Reading involves making predictions about the “big picture.” A prediction is a mental model that you can create before you start reading. This model can help you focus your attention on anticipating the key points in the text. Think about how the information is organized in a piece of text. Are there titles or charts or sub-sections that influence this organization?

You can also think about how genre influences the organization of a text. A genre is a type/category of writing that has a particular form (similar to genres of movies—e.g., horror, romance, comedy, etc.). For example, you can recognize that a scientific article is a scientific article by how it has a few distinctive features: an abstract, a methods section, a findings section, and so on. There are also features of the writing that can help you to identify the piece as a scientific article, such as use of the passive voice, which is common in scientific writing. Think about the genre of the text that you are reading: how do you think genre may influence how the main points will be organized?

Once you have thought about how your text is structured and about where you might be able to find the main points, make a prediction about what the text will do or say and how it might help you in your own research.

Vocabulary

Reviewing key words before reading can help you avoid getting bogged down by unfamiliar vocabulary. Skim the text, make a list of key words you aren't familiar with, and look up their definitions. Once you've gathered this information, revise and clarify your predictions by thinking about how these words will relate to your predictions. As a rule of thumb, if you have a list of more than twenty key words, you may need to re-read the passage a few times to become familiar with the key words and the core meaning of the text.

You may find it helpful to separate what you currently know and what you are predicting with a K-W-L (Know-Want-Learn) chart (Ogle 564-570). The “K” and “W” sections of the chart are completed prior to reading a text; the “L” column is completed once you’ve finished reading.

K	W	L
What I know	What I want to know	What I learned

During-Reading Phase

At this point, your brain has made a mental model of the text and reviewed the key words, which frees up your brain to focus now on identifying the most important parts of the text. It will also be helpful to annotate the text you are reading. Remember, the goal of annotation is to provide you with a map you can reference when you go back to the text. Try not to over-annotate—if you are highlighting or underlining too much of the text, the annotations lose their meaning, and they won’t help you later on (as you won’t know where to focus your attention). Focus on underlining or highlighting the key words and ideas and any transition words that indicate the argument is shifting. Make notes in the margins with your own thoughts about the text. Write down any questions you have about the text in the margins to reflect on how well you understand the text. In only one or two sentences, jot down simple summaries of each main paragraph.

Post-Reading Reflection

Reflect on how this reading process has influenced the way you understand this piece. This step will help you consciously identify your strengths and weaknesses as a reader and to strategically plan out how you may approach reading a text next time.

Ask yourself: What ideas in the text surprised you? What ideas were you not surprised by? What did you agree with or disagree with? What parts of this sequence were challenging for you? What strategies helped or didn't help? If you have to read similar texts in the future, what would you do? You can also fill out the “L” section in your K-W-L chart to take note of the new information you learned from reading the piece.

Activity 1: Research Paper

Read the excerpt below. Practice going through the pre-reading, during-reading, and post-reading phases and try to identify the main idea.

Learning about Life

For 300 years, the models and metaphors of Newtonian physics have dominated the world of science. Newton offered an image of the universe as a machine, a clockwork mechanism. Newton's universe is ruled by linear cause and effect--one gear turns, which makes

a second gear turn, which makes a third gear turn, and so on. This cause-effect relationship is captured in Newton's $F=ma$ formula: force gives rise to acceleration, cause gives rise to effect.

These Newtonian images have spread beyond the community of scientists, deeply influencing work in the social sciences, the humanities, and the arts. Newtonian metaphors have formed the foundation for how people think about science--and, more generally, how they make sense of the world around them.

In recent years, a new set of models and metaphors have begun to spread through the scientific community, and gradually into the culture at large. Many of these new ideas come not from physics, but from biology. In a growing number of disciplines, researchers are now viewing the systems they study less like clockwork mechanisms, and more like complex ecosystems. Increasingly, ideas from ecology, ethology, and evolution are spreading beyond their disciplinary boundaries. Ideas like self-organization and emergence are affecting the direction and nature of research in many other fields, from economics to engineering to anthropology. In general, there is a pronounced shift toward decentralized models, in which patterns are determined not by some centralized authority, but by local interactions about decentralized components. The growing interest in the field of Artificial Life is both a reflection of and a contributor to this broader intellectual shift.

Biology-inspired models and metaphors will have their greatest influence when they spread outside of the scientific community and into the general culture. For children growing up in the world today, learning about living systems is taking on a new urgency. The point is not just to understand the biological world (though that, of course, is a worthy endeavor). Rather, decentralized models of living systems provide a basis for understanding many other systems and phenomena in the world. As these ideas seep out of the scientific community, they are likely to cause deep changes in how children (and adults too) make sense of the world. This paper explores ways to help make that happen.

~Mitchel Resnick, "Learning about Life," *Artificial Life*, 1993.

Sample Answer for Activity 1

1. Pre-Reading:

- a. Prediction 1: The title indicates it will be about living things.
- b. Key words:
 - i. Newtonian physics/Newton's universe: assumption that change can only be caused by one object acting upon another
 - ii. cause and effect relationship: the idea that one event causes another to happen
 - iii. self-organization: a process where local interactions within a system create order
 - iv. emergence: when local interactions cause a system to acquire new properties as a wider whole
 - v. decentralized models: a system where local interactions can work together to accomplish global goals
 - vi. living systems: self-organizing systems that interact with their environment
 - vii. phenomena: an observable fact or event
- c. Prediction 2: "Life" refers to systems that are able to interact with their environment. The concepts of cause and effect relationships will somehow be

related to how systems work. The behavior of self-organizing systems will also be addressed.

2. **During-Reading:**

- a. Paragraph 1: The idea of cause and effect has been popular in the sciences for a long time.
- b. Paragraph 2: This is also a popular model that other disciplines use to study the world around them.
- c. Paragraph 3: Ideas from biology, such as self-organization and emergence, have influenced the scientific community to pay more attention to decentralized models instead.
- d. Paragraph 4: This idea will become popular outside of the scientific community, and this paper will talk about possible ways to help this change along.
- e. Clarification 1: Cause-and-effect models of the world were popular; now decentralized models are popular.
- f. Clarification 2: Self-organizing models are an example of decentralized models.
- g. Summary: Decentralized models are getting more popular than cause-and-effect models in the scientific community.

3. **Post-Reading:** The organization of this paper was clear; each paragraph had one argument each. Each point built on the previous one.

- a. I was surprised by the idea that scientists have been modeling the relationship between objects in a cause-and-effect way. I hadn't thought about how there are different ways to think about this.
- b. I wonder how this paper will talk about how these models can influence how non-scientific audiences conceptualize the world around them.

Activity 2: Scientific Abstract

Read the scientific abstract below. Practice going through the pre-reading, during-reading, and post-reading phases and try to identify the reason for this study, its results, and the significance of those results.

Rules for Biologically Inspired Adaptive Network Design

Transport networks are ubiquitous in both social and biological systems. Robust network performance involves a complex trade-off involving cost, transport efficiency, and fault tolerance. Biological networks have been honed by many cycles of evolutionary selection pressure and are likely to yield reasonable solutions to such combinatorial optimization problems. Furthermore, they develop without centralized control and may represent a readily scalable solution for growing networks in general. We show that the slime mold *Physarum polycephalum* forms networks with comparable efficiency, fault tolerance, and cost to those of real-world infrastructure networks—in this case, the Tokyo rail system. The core mechanisms needed for adaptive network formation can be captured in a biologically inspired mathematical model that may be useful to guide network construction in other domains.

~ Tero et al., "Rules for Biologically Inspired Adaptive Network Design," *Science*, 2010

Sample Answer for Activity 2

1. Pre-Reading:

- a. Prediction: This study will talk about how the design of a network can be inspired by biology.
- b. Key words:
 - i. biologically inspired: inspired by biological systems
 - ii. adaptive: capable of changing
 - iii. ubiquitous: common
 - iv. trade-off: a situation where the amount of one thing must be decreased for a second thing to be increased
 - v. evolutionary selection pressure: a factor that causes change in a population
 - vi. optimization problem: a problem of finding the best solution out of all possible solutions
 - vii. centralized control: a type of model where one part controls the behavior of the other parts
 - viii. scalable: capable of being changed in size
 - ix. slime mold: a blob-like organism
 - x. mathematical model: an abstract model that uses math to explain the behavior of a system

2. During-Reading:

- a. Summary: This study talks about how transport networks can take inspiration from biological models. We can take inspiration from biological models because they have been shaped by evolutionary pressures to be efficient and because they change over time, just like transport networks. The researchers compared the efficiency of the Tokyo rail system to the network that a slime mold made, and they found that the slime mold model is similar in efficiency to the Tokyo rail system. This finding shows how biological models can help us guide network construction in other domains, too.
- b. Notes: The first two sentences describe transport networks. The third and fourth describe how biological models can influence network design. The fifth sentence shows what the researchers did and what they found. The last sentence describes the implications of their research.
- c. Prediction: The abstract of a research paper will often follow this structure in stating what the paper will be about.

3. Post-Reading:

- a. I was surprised to hear that a slime mold could make a network that was just as efficient as Tokyo's transportation system. I wonder how they managed to do this in the paper. It helped for me to look up many of the words and to use them in context, and then to look at the relationship of each sentence to the whole.
- b. I expect the rest of the paper to list out the rationale, methods, results, and implications of their research in a way that is similar to the way it was summarized in the abstract.

Activity 3: Novel Excerpt

Read the excerpt below. Practice going through the pre-reading, during-reading, and post-reading phases and form a prediction of what will happen later in this story.

Excerpt from Pride and Prejudice

It is a truth universally acknowledged, that a single man in possession of a good fortune, must be in want of a wife.

However little known the feelings or views of such a man may be on his first entering a neighbourhood, this truth is so well fixed in the minds of the surrounding families, that he is considered as the rightful property of some one or other of their daughters.

“My dear Mr. Bennet,” said his lady to him one day, “have you heard that Netherfield Park is let at last?”

Mr. Bennet replied that he had not.

“But it is,” returned she; “for Mrs. Long has just been here, and she told me all about it.”

Mr. Bennet made no answer.

“Do not you want to know who has taken it?” cried his wife impatiently.

“You want to tell me, and I have no objection to hearing it.”

This was invitation enough.

“Why, my dear, you must know, Mrs. Long says that Netherfield is taken by a young man of large fortune from the north of England; that he came down on Monday in a chaise and four to see the place, and was so much delighted with it that he agreed with Mr. Morris immediately; that he is to take possession before Michaelmas, and some of his servants are to be in the house by the end of next week.”

“What is his name?”

“Bingley.”

“Is he married or single?”

“Oh! single, my dear, to be sure! A single man of large fortune; four or five thousand a year. What a fine thing for our girls!”

“How so? how can it affect them?”

“My dear Mr. Bennet,” replied his wife, “how can you be so tiresome! You must know that I am thinking of his marrying one of them.”

~Jane Austen, *Pride and Prejudice*, 1813.

Sample Answer for Activity 3

1. Pre-Reading:

- a. Prediction: The title may be referring to qualities of having pride and prejudice against others.
- b. Key words:
 - i. prejudice: the state of being judgmental
 - ii. let: to offer or grant for rent or lease
 - iii. chaise: horse-drawn carriage
 - iv. Michaelmas: a Christian holiday

2. During-Reading:

- a. Summary: Mr. and Mrs. Bennet are talking about Mr. Bingley, and they are planning to have one of their daughters married to him.
- b. Key words and phrases: "is he married or single?"; "I am thinking of his marrying one of them."
- c. Prediction: This story will be about marriage. Some of the characters, such as Mr. Bingley or the Bennets, may act prideful and prejudiced as this story unfolds. Mr. Bingley may get married at one point in this book.

3. Post-Reading:

- a. This book was written in 1813; the cultural expectations around marriage have changed since then. I liked how succinctly the author sums up what this book was going to be about in the first sentence, and the dialogue revealed a lot of detail about the personalities of the family members.
- b. Most of the action and explanations takes place in the dialogue. It will be helpful to pay attention to the dialogue to figure out what's going on in this book.

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