An Inquiry Into How Experienced Readers of Science Read

Uncovering Disciplinary Ways of Reading

Reading Process Analysis with *Friction at the Atomic Scale* by Jacqueline Krim

Successful readers of science ***read to fine-tune*** *their understanding of a scientific phenomenon. They may, secondarily, read to understand* ***how this phenomenon is important*** *either in a theoretical or a practical sense. They attend to* ***precise definitions*** *of words, which stand for complex scientific objects and processes. They rely on* ***images*** *both from the text and from their own minds to comprehend scientific phenomenon. They* ***expect*** *definitions of phenomena to* ***change*** *with more and better scientific experimentation and explanation; they therefore* ***expect*** *their own incomplete understandings and* ***misconceptions*** *to be challenged. Science (and therefore scientific reading) is* ***a search for the truth,*** *with the accompanying understanding that truth is* ***more closely approximated over time,*** *depending on the adequacy of our theories and experimental apparatus and procedures.* ***Scientific readers read to imagine and understand what must be true,*** *even if it challenges what they formerly believed to be true. To accept something as true, scientific readers must be convinced that the* ***experiments and explanations*** *given* ***in fact demonstrate what is claimed.***

Experienced readers of science will FOCUS their attention on:

- Illustrations and captions and the connections to these illustrations in the text, as they come up
- Descriptions of experiments and results
- Explanations of the phenomenon
- Definitions of words
- Counterintuitive or surprising things which reveal their misconceptions
- Experienced readers of science may also focus their attention while reading on the importance of the science for daily living or in furthering our scientific knowledge.

Experienced readers of science will ASK QUESTIONS as they read primarily about:

- What is new: e.g. What are the new theories about subatomic friction?
- Unfamiliar concepts: e.g. What is sound theory? What is cold welding?

- Distinctions between concepts and definitions: e.g. How does friction differ from adhesion? From wear?
- How things work: e.g. How does the mechanical energy turn into sound energy?
- Experimental procedures and interpretations of results: How did they do it? How does it work? Does that make sense to me? Why must that be true?
- Counterintuitive scientific facts: Do I believe this? How is this different from what I thought before reading this?
- How this phenomenon is important in a practical sense: e.g. What role does friction play in my daily life and how would a better understanding help?
- The author's purpose in the article: e.g. What is the importance of friction to the modern and scientific worlds?

These questions serve the purpose of helping to refine the reader's understanding of the science by helping the reader to form precise definitions and images of objects and their interactions, as well as to understand experiments and what they demonstrate about the topic.

Experienced readers of science will form *IMAGES* in their own minds as well as look to the images provided in science texts in order to picture experiments and explore the properties of scientific phenomena. They will form mental images primarily of:

- Physical objects described
- Physical objects and their interactions
- Analogous objects to those described
- Uses of scientific phenomena in history mentioned
- Experimental apparatus, procedures, and results
- Experienced readers of science may also form images of the author and work situation in which the author's experiments take place and are reported to others, and/or picture the phenomena at work in their own daily lives.

Many of the images successful readers of science rely on come from their experience working with actual physical objects such as the experimental apparatus and materials, or from mental and physical modeling of objects–such as atoms–in interaction. Hands-on experiences in experiments help readers build the kind of bank of images they need to make sense of scientific texts.

Experienced readers of science will make PREDICTIONS about how they will need to approach a science text, as well as what will likely be in the text.

- Approaching the text: predicted the article would be difficult to read; would include names, terms, and concepts that would be hard; that it would include lots of math; and that it would take a long time to read

- From the title, predicted the article would answer the question, "What happens when two molecules are brought together?", that the article would be an exposition of theories of friction at an atomic level

- From knowledge of how science articles usually go, predicted the article would include the history of ideas about friction and how they have changed over time and why

- From knowledge of how science is usually presented, predicted the author would demonstrate why this topic is important (to industry, further science, etc.)

- From knowledge of the journal (*Scientific American*), predicted the article would be a review: How we know what we know now about the topic. What we still need to know and why. "Here's the situation."