

Trekkies may recall an episode of the original *Star Trek* where Scotty relishes the thought of spending time off duty reading engineering journals. “Captain, I *am* relaxing,” he remarks to a skeptical Kirk. Ah, how nice it would be to live life as a character in a sci-fi, make-believe TV world. Except perhaps for a lucky few, reading technical specs, a complex procedure, or a mathematical proof is a demanding task. Reading a novel for relaxation or entertainment and reading seriously detailed content to learn, dis-

pendencies requires considerable concentration, effort, patience, and tenacity to meet a goal of correct understanding.

My own early experiences with mathematics journal articles were horri-

review of articles. Initially students were required to answer questions about details in an article to force them into its depth. Unfortunately, this activity did not result in an understanding of the

## How to improve technical reading skills

fy. If the titles, vocabulary, or notation didn’t intimidate me, the bibliography—often with foreign language titles—did. To help my undergraduate math majors learn techniques and strategies for reading technical material,

writer’s main mission. Consequently, I required students to outline articles in a traditional format: roman numerals for major points, capital letters for sub-points, etc. I hoped this would highlight the structure of the author’s logic and argument along with the major point of the article. To ascertain its effectiveness, I had students write summarizations of the articles. Usually these were too general in a mathematical sense, so the next exercise was to require student question formulation on mathematical points. I also had them review the article for future class usage. I was hopeful this “sinus rhythm” between detail and generality would eventually produce a reasonable, balanced understanding at their ability levels.

### Back up reading insights

A search through resources reinforced what my teaching instincts had told me. Serendipity led me to some excellent articles and essays on the topic. All of them are short and well written. Any serious reader of technical literature or journal articles would benefit from the methodology, philosophy, practices, and protocols advocated by these professionals. Here is a brief tour through several of them.

The roots of effective technical reading methodology are traced back to Mortimer J. Adler’s *How to Read a Book* in a short article by Steven McConnell, editor of *IEEE Software* in 1998. McConnell described Adler’s methodology for inspectional reading (title, table of contents, preface, index, chapter introductions, opening chapter, and closing chapter). He relates his transformation of Adler’s list of general questions into a more specific set he used to categorize manuscripts and assign them to reviewers. For example, McConnell translated Adler’s “What is this about?” into “What is the article’s alphanumeric CR code?” (*IEEE Software* classification scheme for submitted articles.) He translated “What of it?” into “What genre is it?” (such as a how to or a case study).



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cover, research, or construct are totally different activities.

In an age of instant gratification, we sometimes forget that learning doesn’t always happen instantaneously. As a result, students may labor under the misconception that this ability will erupt spontaneously sometime during their education. Seasoned professionals, educators, engineers, and researchers know otherwise. Reading to interpret technical specifications, dissect a proof, or comprehend complex system interde-

I have introduced a series of journal article reading assignments into my upper division courses. Based on my own experience of having no formal introduction to journal reading and my idea that a graduated, structured approach would alleviate student intimidation, I designed the assignments to mentor students in effective reading practices, the key elements being outlining, summarization, question formulation/response and critical

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Relying on reviewer comments, McConnell would then utilize Adler's proposed questions to determine whether the article was appropriate for publication in the magazine. McConnell revealed the liberation he felt when he recognized that Adler's approach provided legitimate structure to his previously haphazard methodology. He delineated inspectional and analytic reading by the time limit imposed on the activity, with inspectional reading referring to the maximization of understanding under a time constraint and analytic reading referring to the maximization of understanding with no time constraint.

Arthur M. Hobbs of Texas A&M University refers to inspectional reading as class 2 reading, which involves concentration on a paper's structure and main points. Both are essential to Adler's definition of inspectional reading, lacking only reference to the time constraint. Hobbs describes his personal format for summarizing class 2 readings of research papers in his essay, *Reading Research Papers*. His motivation to develop a personal style of summary and organization stemmed from a desire to retain and recall the source and overall view of numerous papers in his field. This type of reading Adler regards as *syntactical* reading, which refers to the extraction of information from many books or articles on the same topic over time and its synthesis into knowledge that is not obviously gleaned from individual sources. The structure he developed is easily adaptable to a reader's personal preferences. Hobbs details his utilization of three-hole punched notebook paper with author name, article title, journal name, date of reading, reason for reading, and depth of reading at the bottom of the page to facilitate easier flip-through access of his binder of logs. He explains the benefits of listing definitions, citing theorems and key proof ideas on a single page instead of haphazardly in the margins of the paper.

In fact, students in my College Geometry course (fall 2004) were assigned the task of producing a Hobbs' summary for a mathematics journal article that they were to read. It was one of the more effective reading assignments since it provided a standard structure for them to easily follow, yet permitted some flexibility in their individual summaries.

Shai Simonson and Fernando Gouveau take a distinctively unique

approach to illustrating common mistakes when reading difficult material. Reading linearly, reading passively, or reading too fast may lull a reader into a false sense of mastery on a topic. In their paper, *How to Read Mathematics* (found on the web), Simonson and Gouveau interweave suggested reading protocols into a dialogue between a Reader and a Professional Mentor (who is actually the Reader thinking out loud). They illustrate sound reading practices in the context of a passage on probability. Maxims such as "Don't miss the big picture," "Don't be a passive reader," or "Don't read too fast" are refreshingly reiterated. Though titled for mathematicians, the paper offers reading strategies that any technical reader could adapt and utilize. Linear reading can be conquered with conscious rereading as well as constant cross referencing to vocabulary, notation, and earlier points. Passive reading is eliminated when the reader creates an original example or application, however simple it might be. Working through omitted "obvious" details disciplines a reader to slow down. Difficult reads take time. Thirty minutes may be quite reasonable to digest up to three lines of a mathematical or technical article. Pausing for regular breaks between paragraphs allows the brain to digest details and make connections.

### Final considerations

To become a better technical reader, first consider how you do your reading now. Identify the conditions that would help you to focus on the task without distraction. For example, some people may prefer classical music playing quietly in the background. Others may need absolute quiet, with no noise and no distractions. Does a comfortable chair help or would a hard chair be better? Do you snack while you read? Does a particular location suit you: a library study carrel, your own cubicle, or Starbucks? As much as possible, choose a time of day or night when you are alert. Once identified, all these physical conditions should be chosen to optimize your concentration.

Now you need to select a methodology that fits your style of learning. Having read this article, as well as the articles referred to here, be cognizant of which method works best for you: asking directed questions, outlining, or creating a summary sheet.

You could even devise your own hybrid system. If you don't know what to use, try various approaches on different parts or pages of the same article and judge their effectiveness. Do something at the inspectional level of reading so you don't lose the big picture. It may even pay to make a laminated bookmark of maxims to practice or errors to avoid. The approach you select may even be dictated by the nature of the technical reading you are doing. One author's style may be conducive to outlining, while another may be better suited to questions or a summary.

Lastly, effective, efficient reading not only empowers the reader, it also mobilizes the inner writer to better clarity of expression. I don't think anyone could argue against the importance of this added benefit.

### Read more about it

- A.M. Hobbs, *Texas A&M University*. 1996. Dept. Mathematics, Texas A&M University. 14 Aug. 2004 [Online]. Available: <http://www.math.tamu.edu/~arthur.hobbs/>
- S. McConnell, "How to read a technical article," *IEEE Software*, Nov. 1998.
- A. Reiter, "Helping undergraduates learn to read." Mathematical Association of America: Teaching and Learning Exchange. 30 Apr. 2004 [Online]. Available: [http://www.maa.org/t\\_and\\_l/exchange](http://www.maa.org/t_and_l/exchange)
- S. Simonson and F. Gouveau. "How to read mathematics." Dept. Computer Science, Stonehill College. 14 Aug. 2004 [Online]. Available: [http://www.stonehill.edu/compsci/History\\_Math/math-read.htm](http://www.stonehill.edu/compsci/History_Math/math-read.htm)

Note: For any math students reading this article, I highly recommend Ashley Reiter's *A Few Mathematical Study Skills...Reading Theorems and A Few Mathematical Study Skills...Reading Definitions*.

### About the author

With an M.S. in mathematics (1977) from Notre Dame and nine years' experience in programming and software technical support, Mrs. Lindquist became a mathematics instructor at the College (now University) of St. Francis in Joliet, Illinois, in 1986. As an assistant professor of mathematics, she especially enjoys teaching linear algebra, abstract algebra, and geometry.