

Flight Simulation for the Brain: Why Army Officers Must Write

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Flight Simulation for the Brain: Why Army Officers Must Write

By MAJ Trent J. Lythgoe, SG 17A

Writing is on the decline in the Army officer corps. Thoughtful, precise writing in staff papers has been replaced by hastily composed emails and PowerPoint© slides filled with bullet statements of incomplete sentences. This deterioration of writing skills is causing a corresponding deterioration of thinking skills. Writing, although valuable as a communication medium, is most valuable as a powerful way of thinking. Writing forces us to order thoughts in a logical and coherent way. It forces us to critically examine our own thinking, which ultimately leads to better thinking, problem solving, and decision making. If the Army wants better thinkers, we should start by educating better writers.

A Crisis in Writing

The decline of writing in the Army is part of a broader writing crisis in America. According to the most recent writing survey of the National Assessment of Education Progress, only 33 percent of eighth-graders and 24 percent of twelfth-graders can write proficiently.¹ Predictably, many American students go to college with poor writing skills. A college writing professor received this email from a prospective student:

i need help, i am writing a essay on writing i work for this company and my boss want me to help improve the workers writing skills can yall help me with some information thank you²

The writing crisis is filtering into the American workforce. According to a 2006 study, 27.8 percent of businesses report that college graduates were “deficient” in written communications. These same businesses ranked written communication as the most important skill for incoming workers with four-year degrees.³ A recent survey of business leaders found that 40 percent of companies either offer or require writing improvement training for employees with writing deficiencies at an estimated cost of \$3.1 billion.⁴

Predictably, the writing crisis is affecting the Army. Like American businesses, the Command and General Staff College has implemented a writing improvement program to help ill-prepared Intermediate Level Education (ILE) students improve their writing skills. Anecdotal evidence of

declining writing skills abounds in the millions of poorly-written emails flying between Army officers each day, many of which resemble the email above.

We cannot put all the blame for the Army's writing woes on America's education system. There has been a precipitous decline in formal writing within the Army itself. Staff studies and decision papers, once a mainstay of staff work, are almost a thing of the past. The old FM 101-5 had an entire appendix on staff studies and decision papers which is absent from its replacement, FM 5-0. All that remains in today's FM 5-0 is an appendix on military briefings. Army Regulation 600-67 *Effective Writing for Army Leaders* was last updated 25 years ago; a reflection of our institutional apathy toward formal writing. Email and PowerPoint slides have usurped formal writing as the preferred written communication mediums, and both are contributing to the problem.

Email is contributing to the writing skills decay. This may seem counter-intuitive since email is a writing medium. Consider, however, that while the average Army officer may send scores of emails every day, few take the time to compose thoughtful, well-written messages. And why should they? Unlike formal staff papers, there are no standards for brevity, grammar, or correctness for emails. Many leaders don't demand well-written emails. The result is officers who practice poor writing day in and day out, which is arguably worse than not writing at all.

The widespread use of PowerPoint is another contributor to the demise of writing. PowerPoint slides are now the preferred medium for transmitting and receiving information in the Army. The problem is that PowerPoint does not require officers to formulate complete ideas, or to put those ideas together in a logical way. Instead, thoughts are reduced to "bullet statements," which is shorthand for incomplete sentences. Many PowerPoint slideshows are cut and pasted from other slideshows. Officers put the slides together without thinking about how the ideas go together. Too many officers spend more time thinking about pictures and fonts than they do thinking about the substantive issues at hand.⁵

Although the demise of writing as a means of communicating ideas is regrettable, there is a far more concerning side effect of this trend. Writing is a form of thinking. As the writing skills of Army officers atrophy, our thinking skills may be doing so as well.

Writing as Thinking

*"Forward, the Light Brigade!"
Was there a man dismay'd?
Not tho' the soldier knew
Someone had blunder'd...
Into the valley of Death
Rode the six hundred.*

~Alfred Tennyson

Writing is a supremely important communication skill for Army officers. One of the most infamous military writing failures occurred at the Battle of Balaclava, leading to the infamous "Charge of the Light Brigade." An unclear written order from the British commander was misunderstood by his cavalry commander. Instead of moving to prevent the opposing Russian force from repositioning their guns, the cavalry instead charged unsupported into the teeth of the Russian defense, suffering heavy casualties with no decisive effect. Even today, written orders remain the centerpiece of battlefield command and control despite exponential technological advance. Army officers must clearly conveying mission, commander's intent, and tasks to be accomplished in written orders.

Additionally, the Army's promotion and command selection processes depend heavily on good writing. Board members rely on rater and senior rater comments from officer evaluation reports to make promotion and command selections. Officers must be able to clearly articulate the leadership potential of subordinates in written form. Major General (Retired) Larry Lust, who sat on several promotion boards, observes, "The board is very good at picking the best *paper*. If officers in the field can't write accurate evaluation reports, then the board can't pick the best leaders for promotion and command."⁶

Although writing is important communication medium, it serves its most important function as a means of thinking. According to Dr. John Gage of the University of Oregon, writing leads to better thinking because it allows us to critically examine our own thoughts:

Writing is thinking-made-tangible, thinking that can be examined because it is 'on the page' and not all 'in the head,' invisibly floating around. Writing is thinking that can be stopped and tinkered with. It is a way of holding thought still long enough to examine its structures, its flaws. The road to clearer understanding of one's thoughts is travelled on paper. It is through and attempt to find word for ourselves, and to find patterns for ourselves in which to express related ideas, that we often discover what we think.⁷

Dr. Gage's assertion that "writing is thinking" is not just a metaphor. According to Dr. Richard Menary of the University of Wollongong (Australia), the act of writing is actually a unique cognitive process. Dr. Menary contends that writing is more than the simple physical expression of neural thought. The physical act of writing, when combined with neural processes, constitutes a distinctive form of thinking which advantages over neural processes alone. "These [written] vehicles thus afford us new cognitive transformations which would be either impossible or extremely difficult by relying solely on neural resources."⁸ Dr. Menary's proposition seems to embody the notion of author E.M. Forester when he wondered, "How do I know what I think until I see what I say?"⁹

Writing leads to better thinking, decision making, and problem solving because it organizes our ideas in ways our brain can use. We sometimes imagine the human brain is a computer which stores individual pieces of data, just like your laptop computer. However, our brain can't work that way because the space required to store the billions of details of everyday life would be astronomically large. To deal with this problem, our brain skips small details and instead looks for big ideas and the relationships that connect them. These ideas and relationships become mental models; our personal set of assumptions about how the world works. The process of writing forces us to put our disorganized ideas into coherent structures of actors and relationships which are useful as mental models.

Functionally the human brain operates more like a pattern recognition and comparison engine using mental models to make sense of the world around us. Our brain continually looks for emerging patterns in the environment, and then compares those patterns with stored mental models. When we come upon a new situation, our brain digs through its archives to find a mental model which matches or approximates the new situation. The brain uses the model to construct a story about the situation in order to discover what happens next. This process of story building is called mental simulation.

Writing as an Idea Simulator

We use mental simulation for much of our decision making and problem solving. When confronted with a problem or decision, we begin with what initially appears to be the best course of action. We then mentally simulate the likely outcome of that course of action using a mental model. If the mental simulation results in an undesirable outcome, then we analyze our course of action for the

problem, and then mentally simulate an updated course of action. We repeat this process until we arrive at a suitable outcome.¹⁰ Such was the case on January 15th, 2009 in what came to be known as “The Miracle on the Hudson.”

At 3:25pm flight 1549 took off from New York’s La Guardia airport under the command of Captain Chesley "Sully" Sullenberger. Two minutes after takeoff, at an altitude of only 3200 feet, the Airbus 320 Capt. Sullenberger passed through a large flock of birds, some of which entered and stopped both of the aircraft’s engines. The heavy Airbus began to rapidly slow down and lose altitude. Capt. Sullenberger needed to land immediately.

Capt. Sullenberger’s first course of action was the one that all pilots are taught from the beginning of flight training: turn around and return to the airport. He immediately made the request to air traffic control:

Sullenberger: Uh this is uh Cactus fifteen thirty nine [sic] hit birds, we've lost thrust in both engines we're turning back towards LaGuardia.

*Air Traffic Control: Ok uh, you need to return to LaGuardia? Turn left heading of uh two two zero.*¹¹

At this point Capt. Sullenberger ran a mental simulation of his flight path to LaGuardia airport. He recalled:

*I quickly determined that due to our distance from LaGuardia and the distance and altitude required to make the turn back to LaGuardia, it would be problematic reaching the runway and trying to make a runway I couldn't quite make could well be catastrophic to everyone on board, and persons on the ground. And my next thought was to consider Teterboro [Airport].*¹²

Capt. Sullenberger ran a second mental simulation, this time of his flight path to nearby Teterboro Airport, and concluded that Teterboro was out of reach as well. Capt. Sullenberger ran a third mental simulation, this time to the Hudson River. He recalled, "The only viable alternative, the only level smooth place sufficiently large to land an airliner was the river."¹³ Upon deciding to land in the Hudson,

Capt. Sullenberger mentally simulated the landing to anticipate potential problems:

*I needed to touch down with the wings exactly level. I needed to touch down with the nose slightly up. I needed to touch down at a descent rate that was survivable. And I needed to touch down just above our minimum flying speed but not below it. And I needed to make all these things happen simultaneously.*¹⁴

One of the reasons Capt. Sullenberger was able to successfully save all the souls aboard Flight 1549 is because he had practiced engine failures previously in a flight simulator. Capt. Sullenberger was able to draw on his experiences in the flight simulator to rapidly and accurately simulate the likely outcomes of a return to La Guardia, a diversion to Teterboro, and ultimately a landing in the Hudson River. The richness of Capt. Sullenberger's mental models enabled him to make a good decision based on good mental simulations.

Unlike flying airplanes, most everyday situations do not have a computer simulator. However, we are effectively stepping into a simulator of ideas when we write. According to author Janet Emig, "Writing...connects the three major tenses of our experience [past, present, and future] to make meaning. And the two major modes by which these three aspects are united are the processes of analysis and synthesis."¹⁵ In other words, writing connects ideas and facts in a relational and temporal sense, creating rich patterns for use by our pattern-recognizing brain.

When we write, we are essentially composing a story through a series of mental simulations of facts, ideas, and relationships. Authors Chip and Dan Heath assert that "stories are like flight simulators for the brain."¹⁶ The reason is that it is we can't think about a story without mentally simulating it. Research suggests that mentally simulating an event activates the same parts of the brain as actually experiencing the same event. In one study, subjects who imagined tapping on their skin activated the area of the brain associated with tactile perception. Subjects who imagined a flashing light activated the visual perception area of the brain.¹⁷ In fact, mental simulation is so powerful it can actually improve physical performance. A study of more than 3,000 subjects revealed that mentally practicing tasks, such as playing a musical instrument or figure skating, delivered an average of 66 percent of the performance improvement benefits of actual physical practice.¹⁸

It is unsurprising that as we mentally simulate stories about ideas and relationships while writing, our mental models simultaneously become richer and more accurate. Our brain becomes better at simulating likely outcomes, which makes us better problem solvers, decision makers, and ultimately better thinkers. Like a pilot in a flight simulator, time spent writing is akin to practicing thinking in a

thinking simulator. Just as a pilot can replay a flight simulation to evaluate his or her performance, so too can writers critically examine their own thinking from multiple perspectives.

A Word on PowerPoint

To write coherently about an idea is to achieve an intimate understanding of that idea through mental simulation. Composing a coherent narrative requires the writer to unambiguously describe the nature of ideas and relationships; causal, corollary, or otherwise.¹⁹ One simply cannot write well without attaining a thorough understanding of the subject matter.

On the other hand, it is relatively easy to produce a PowerPoint presentation without clearly understanding the subject matter. Bullet statements can be cut, pasted, and rearranged to produce the illusion of thinking and understanding. PowerPoint briefings are often circulated within organizations as standalone communications, which can lead to misinterpretation of ideas. Retired Marine Corps Colonel T.X. Hammes lamented the widespread use of PowerPoint in an *Armed Forces Journal* essay entitled “Dumb-dumb bullets.” Colonel Hammes argues that writing is a better method of communicating ideas than passing around slideshows:

Most of the people who actually see the brief get an incomplete picture of the ideas presented. Some briefers attempt to overcome this by writing whole paragraphs in the briefing notes portion of the slide. Clearly, a paper is a better format than PowerPoint. If the concept requires whole paragraphs — and many do — then they should be put in an appropriate paper and provided ahead of time.²⁰

Empirical research supports Colonel Hammes’ idea that fragmented ideas, such as the bullet statements and briefing notes often found in PowerPoint, are not as effective as writing when it comes to learning. George E. Newell from the University of Kentucky examined how well students learned based on whether they took notes, wrote short answer responses to study question, or wrote complete essays. The three methods examined in Newell’s study provide a good analogue to compare PowerPoint against staff studies and similar written products. Note taking and short answer responses are similar to bullet statements and briefing notes from PowerPoint, respectively, while essay writing is similar to staff papers.

Newell found that writing essays enabled students to, “produce a consistently more abstract set of associations for key concepts than did note taking or answering study questions.”²¹ Newell suggests the integrative nature of essay writing is responsible for the superior learning.

*[When] answering study questions...the writer can only consider information in isolated segments. Consequently, while a great deal of information is generated, it never gets integrated into a coherent text, and, in turn, into the students' own thinking. Essay writing, on the other hand, requires that the writers... integrate elements of the prose passage into their knowledge of the topic rather than leaving the information in isolated bits.*²²

Bloom's Revised Taxonomy of Learning (figure 1) supports Newell's theory, and provides an insight into why PowerPoint is not effective as a

medium for thought. Writing is a dialectic process of both analysis and synthesis.²³ Analysis, the breaking up of ideas into smaller ideas, sits in the middle of Bloom's Taxonomy. In contrast, synthesis, the putting together of ideas together to form larger ideas, mental models (patterns), and even new ideas, is the highest level of cognitive learning.²⁴

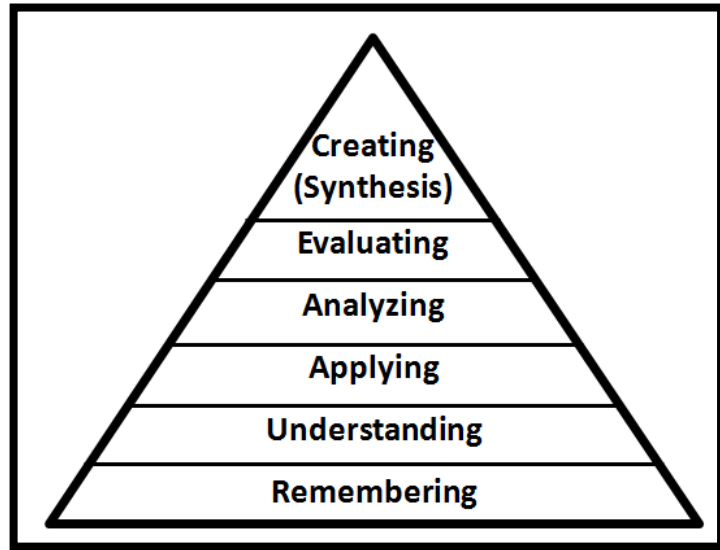


Figure 1 - Bloom's Revised Taxonomy (Adapted from Richard Overbough [Bloom's Taxonomy](http://www.odu.edu/educ/roverbau/Bloom/blooms_taxonomy.htm), http://www.odu.edu/educ/roverbau/Bloom/blooms_taxonomy.htm)

When we write, we are constantly

analyzing ideas in lower-order cognitive processes, then trying to make different ideas make sense in the higher order synthesis process. PowerPoint demands no such cognitive foray into the synthesis realm.

The bullet statements of PowerPoint are products of simple analysis; independent bits of data free of the context and the broad story arcs our brain needs to build mental models. Granted, a skilled briefer can provide the needed synthesis for the slides to make sense; however, unlike writing the medium itself does not force synthesis. Furthermore, the slides are often distributed as a standalone product, with no accompanying briefer to provide needed context.

This analysis/synthesis dialectic is central to thinking and decision making in a competitive environment. The great American strategist Colonel John Boyd called this process a "Dialectic Engine," which he describes in his essay "Destruction and Creation":

[W]e can forge a new concept by applying the destructive deduction and creative induction mental operations. Also, remember, in order to perform these dialectic mental operations we must first shatter the rigid conceptual pattern, or patterns, firmly established in our mind.

Next, we must find some common qualities, attributes, or operations to link isolated facts, perceptions, ideas, impressions, interactions, observations, etc. together as possible concepts to represent the real world. Finally, we must repeat this unstructuring and restructuring until we develop a concept that begins to match-up with reality. By doing this...we find that the uncertainty and disorder generated by an inward-oriented system talking to itself can be offset by going outside and creating a new system. Simply stated, uncertainty and related disorder can be diminished by the direct artifice of creating a higher and broader more general concept to represent reality.²⁵

Boyd theorized that in a competitive realm, the competitor who could conduct this mental process of destruction and creation quicker and with more accuracy than the opponent would ultimately prevail.²⁶

Today, we refer to this as “getting inside our opponent’s decision cycle.” Boyd’s interplay of deduction and induction effectively describes the cognitive process of writing. Writing requires the author to fire up his or her dialectic engine, but more than that, it allows the author to critically examine the functioning of that engine as the results of the cognitive processes are put on paper. Boyd’s ideas fit together with Emig’s description of writing as a connecting process which connects past, present and future through analysis and synthesis.²⁷

Clearly, formal writing is the best way to promote clear thinking among Army officers. Furthermore, the Army’s current PowerPoint cut-and-paste paradigm is undermining the ability of our officers to synthesize and think clearly about critical issues. To solve this problem, Army leaders need to bring writing back to the forefront as a critical leadership skill.

Toward a Writing Renaissance

An obvious place to start a renaissance in writing is our officer education system. Although field grade officers are routinely required write in courses at the Command and General Staff College and the Army War College, company grade officer courses are less focused on writing. We need to remedy this by requiring officers to routinely write from the very beginning of their careers. Writing needs to be a part of every officer education course beginning at pre-commissioning, and continuing through the Officer Basic Course and Captain’s Career Course.

Professional journals are a fantastic medium for officers to share thoughts and experiences through writing. Commanders should encourage their officers to write and submit articles to these publications. Admiral James Stravidis encourages officers of all ranks to write for publication:

*Dare to read and develop your understanding. Carve out the time to think and form new ideas. Dare to speak out and challenge assumptions and accepted wisdom if your view differs from them. Have the courage to write, publish, and be heard. Launch your ideas and be an integral part of the conversation.*²⁸

Commanders should establish professional writing programs alongside their professional reading programs. The Army officer corps has a robust professional reading tradition. Our senior leaders publish professional reading lists to guide leaders in their reading endeavors. Many unit commanders also publish reading lists. Unfortunately, our professional writing ethic isn't nearly so robust; unfortunate because writing, when combined with reading, produces powerful thinking.

Research has shown that reading and writing together produces better thinking than reading or writing alone. In one study, researchers assigned 137 college students to read about a subject, write about a subject, or do both. The researchers found that students who both read and wrote did more critical thinking and were more willing to shift their perspective on the subject than students who only read or only wrote. The researchers concluded the reading and writing together form a "symbiotic" relationship which leads to better thinking.²⁹

Finally, we need to bring good writing back as a visible part of day-to-day Army operations. Cleaning up email is a necessary step. Leaders at all levels should demand clean, clear, and concise email correspondence. We need to integrate formal writing back into our staff work as well. Commanders should consider requiring staff officers to produce written papers to address key issues in lieu of cut-and-paste slide shows. Leaders should relegate PowerPoint to its rightful place as a secondary tool augmenting the primary communication mediums of writing and discussion.

The contemporary operating environment demands Army officers who can think creatively and critically. Writing can help Army officers build these thinking skills. Writing is more than a simple means of expressing thought; it is a means of creating thought. However, the decline of writing within the Army officer corps, combined with over-reliance on PowerPoint and email, is a threat to clear and critical thinking. Army officers must return to writing as a primary means of communicating. Whether in

professional journals, staff papers, or other venues, the return of writing to the forefront will ensure the officer corps has the communication and thinking skills necessary to effectively lead our Army.

Endnotes

1. US Department of Education. National Assessment of Education Progress. *The Nation's Report Card: Writing 2007* (April 2008) by Deborah Salahu-Din, Hillary Persky, and Jessica Miller. <http://nces.ed.gov/nationsreportcard/pdf/main2007/2008468.pdf> (accessed February 20, 2011). P. 9, 37
2. Sam Dillon. "What Corporate America Can't Build: A Sentence." *New York Times*, December 7, 2004. http://www.nytimes.com/2004/12/07/business/07write.html?_r=1&pagewanted=print&position= (accessed February 20, 2011).
3. Jill Casner-Lotto and Mary Wright Benner. *Are They Really Ready To Work?* Report. (New York: The Conference Board, 2006), 14 http://www.p21.org/documents/FINAL_REPORT_PDF09-29-06.pdf (accessed February 21, 2011).
4. The National Commission on Writing. *Writing: A Ticket to Work...Or a Ticket Out*. Research Report (New York: College Entrance Examination Board, 2004), P. 4 http://www.collegeboard.com/prod_downloads/writingcom/writing-ticket-to-work.pdf (accessed February 20, 2011).
5. T.X. Hammes "Dumb-dumb bullets: As a decision-making aid, PowerPoint is a poor tool." *Armed Forces Journal*, 2009. <http://www.armedforcesjournal.com/2009/07/4061641/> (accessed February 21, 2011).
6. Larry Lust interview by Trent Lythgoe. Personal Interview (March 1, 2011).
7. John T. Gage "Why Write?" In *The Teaching of Writing: National Society for the Study of Education Yearbook*, by David Bartholomae and Anthony Petrosky, 8-29. (Chicago: University of Chicago Press, 1986), P.24
http://books.google.com/books?id=BJDzLsIIj6oC&pg=PA8&dq=John+T.+Gage&hl=en&ei=XVV0TcfuAovpgQfd54VG&sa=X&oi=book_result&ct=result&resnum=2&ved=0CCwQ6AEwAQ#v=onepage&q=John%20T.%20Gage&f=false (accessed March 6, 2011).
8. Richard Menary. "Writing as Thinking." *Language Sciences* 29, no. 5 (September 2007), 631. http://uow.academia.edu/RichardMenary/Papers/92516/Writing_as_Thinking (accessed March 6, 2011).
9. Donald M. Murray. "Internal revision: A process of discovery" In *Research on Composing: Points of Departure* ed. C. R. Cooper and L. Odell, 85-104. Urbana, IL: National Council of Teachers of English (1978). Cited in David Galbraith. "Writing as a Knowledge-Constituting Process. Report" (paper presented at the 3rd International Santa Barbara Conference on Writing Research, February 22-24, 2008). 138 https://secure.lsit.ucsb.edu/writ/wrconf08/Pdf_Articles/Galbraith_Article.pdf (accessed March 6 2011).
10. Gary Klein. *Sources of Power*. (Cambridge: The MIT Press, 1999), 53.
11. Federal Aviation Administration. "Full Transcript of Aircraft Accident, AWE1549, New York City, NY, January 15, 2009." FAA Memorandum dtd. January 15, 2009, 3. http://www.faa.gov/data_research/accident_incident/1549/media/Full%20Transcript%20L116.pdf (accessed March 6 2011).

-
12. Sullenberger, Chesley, interview by Katie Couric. *Sully On The Record* (February 8, 2009). <http://www.cbsnews.com/video/watch/?id=4778932n> (accessed February 21, 2011).
13. Ibid.
14. Ibid.
15. Janet Emig. "Writing as a Mode of Learning." *College Composition and Communication* 28, no. 2 (May 1977): 127. <http://www.jstor.org/pss/356095> (accessed February 21, 2011).
16. Chip Heath and Dan Heath. *Made to Stick: Why Some Ideas Survive and Others Die*. (New York: Random House, 2007), 213.
17. Richard J. Davidson and Gary E. Schwartz. "Brain mechanisms subserving self-generated imagery." *Psychophysiology* 14, (1977) 598-602. Cited in Mark R. Dadds et al. "Imagery in Human Classical Conditioning." *Psychological Bulletin* 233, no. 1 (1997): 91. <http://www2.psy.unsw.edu.au/Users/Mdadds/Publications/Dadds,%20Bovbjerg,%20Reed,%20+%20Cut%20more,%201997.pdf> (accessed February 20, 2011).
18. James E. Driskell, Carolyn Copper, and Aidan Moran. "Does Mental Practice Enhance Performance?" *Journal of Applied Psychology* 79 (1994): 481-492. Cited in Heath and Heath, *Made to Stick*, 213
19. Emig, "Writing," 126
20. Hammes, "Dumb-dumb bullets."
21. George T. Newell. "Learning from writing in two content areas: A case study/ protocol analysis." *Research in the Teaching of English*, 18, (1984) 275. Cited in Charles Bazerman et al. *Reference Guide to Writing Across the Curriculum*. West Lafayette, Indiana: Parlor Press LLC, 2005. 59 http://wac.colostate.edu/books/bazerman_wac/wac.pdf (accessed March 6, 2011).
22. Newell, "Learning from writing," 282. Cited in Bazerman et al., *Reference Guide*, 59.
23. Emig, "Writing," 127
24. Richard Overbaugh. "Bloom's Taxonomy" n.d. http://www.odu.edu/educ/roverbau/Bloom/blooms_taxonomy.htm (accessed March 1, 2011).
25. John Boyd. "Destruction and Creation." Unpublished Essay. September 13, 1976. 7 http://pogoarchives.org/m/dni/john_boyd_compendium/destruction_and_creation.pdf (accessed March 6, 2011).
26. Boyd, "Destruction and Creation," 7
27. Emig, "Writing," 127
28. Jim Stavridis. "Read, Think, Write, and Publish." *Proceedings*, 2008: 19. <http://www.usni.org/userfiles/file/Aug%20Pro/Stavridis%20Aug%2008.pdf> (accessed February 21, 2011).

29. Robert J. Tierney et al. "The Effects of Reading and Writing Upon Thinking Critically." Abstract. *Reading*, 1989: http://www.bridgew.edu/library/cags_projects/lthomson/web%20page/Tierney.htm (accessed February 21, 2011).

Bibliography

- Bazerman, Charles, Joseph Little, Lisa Bethel, Teri Chavkin, Danielle Fouquette, and Janet Garufis. *Reference Guide to Writing Across the Curriculum*. West Lafayette: Parlor Press LLC, 2005. http://wac.colostate.edu/books/bazerman_wac/wac.pdf (accessed March 6, 2011).
- Boyd, John. "Destruction and Creation." Unpublished Essay. September 13, 1976. http://pogoarchives.org/m/dni/john_boyd_compendium/destruction_and_creation.pdf (accessed March 6, 2011).
- Burton, Chad M., and Laura A. King. "The Health Benefits of Writing About Intensely Positive Experiences." Abstract. *Journal of Research in Personality* 38, no. 2 (2004): 150-163. <http://generallythinking.com/research/burton-king-2004-the-health-benefits-of-writing-about-intensely-positive-experiences/> (accessed March 5, 2011).
- Casner-Lotto, Jill, and Mary Wright Benner. *Are They Really Ready To Work?* Report. New York, NY: The Conference Board, 2006. http://www.p21.org/documents/FINAL_REPORT_PDF09-29-06.pdf (accessed February 21, 2011).
- Dadds, Mark R., Tim R.H. Cutmore, Dana H. Bovbjerg, and William H. Redd. "Imagery in Human Classical Conditioning." *Psychological Bulletin* (American Psychological Association) 233, no. 1 (1997): 89-103. <http://www2.psy.unsw.edu.au/Users/Mdadds/Publications/Dadds,%20Bovbjerg,%20Redd,%20+%20Cutmore,%201997.pdf> (accessed February 20, 2011).
- Davidson, Richard J. and Gary E. Schwartz. "Brain mechanisms subserving self-generated imagery." *Psychophysiology* 14, (1977): 598-602.
- Dillon, Sam. "What Corporate America Can't Build: A Sentence." *New York Times*, December 7, 2004: http://www.nytimes.com/2004/12/07/business/07write.html?_r=1&pagewanted=print&position=.
- Emig, Janet. "Writing as a Mode of Learning." *College Composition and Communication* (National Council of Teachers of English) 28, no. 2 (May 1977): 122-128. <http://www.jstor.org/pss/356095> (accessed February 21, 2011).
- Encyclopedia Britannica. Battle of Blaklava. <http://www.britannica.com/EBchecked/topic/49744/Battle-of-Balaklava?anchor=ref271652> (accessed March 1, 2011).
- Federal Aviation Administration. "Full Transcript of Aircraft Accident, AWE1549, New York City, NY, January 15, 2009." FAA Memorandum dtd. January 15, 2009 http://www.faa.gov/data_research/accident_incident/1549/media/Full%20Transcript%20L116.pdf (accessed March 6 2011).
- Gage, John T. "Why Write?" In *The Teaching of Writing: National Society for the Study of Education Yearbook*, by David Bartholomae and Anthony Petrosky, 8-29. Chicago: University of Chicago Press, 1986. <http://books.google.com/books?id=BJDzLsIIj6oC&pg=PA8&dq=John+T.+Gage&hl=en&ei=XVV>

0TcfuAovpgQfd54VG&sa=X&oi=book_result&ct=result&resnum=2&ved=0CCwQ6AEwAQ#v=onepage&q=John%20T.%20Gage&f=false (accessed March 6, 2011).

Galbraith, David. "Writing as a Knowledge-Constituting Process." (Report presented at the 3rd International Santa Barbara Conference on Writing Research, February 22-24, 2008) https://secure.lsit.ucsb.edu/writ/wrconf08/Pdf_Articles/Galbraith_Article.pdf (accessed March 6 2011).

Hammes, T. X. "Dumb-dumb bullets: As a decision-making aid, PowerPoint is a poor tool." *Armed Forces Journal*, 2009. <http://www.armedforcesjournal.com/2009/07/4061641/> (accessed February 21, 2011).

Heath, Chip, and Dan Heath. *Made to Stick: Why Some Ideas Survive and Others Die*. New York: Random House, 2007.

Klein, Gary. *Sources of Power*. Cambridge, Massachusetts: The MIT Press, 1999.

Lust, Larry, interview by Trent Lythgoe. Personal Interview (March 1, 2011).

Menary, Richard. "Writing as Thinking." *Language Sciences* 29, no. 5 (September 2007): 621-632. http://uow.academia.edu/RichardMenary/Papers/92516/Writing_as_Thinking (accessed March 6, 2011).

Murray, Donald M. "Internal revision: A process of discovery" In *Research on Composing: Points of Departure* ed. C. R. Cooper and L. Odell, 85-104. Urbana, IL: National Council of Teachers of English (1978).

Newell, George T. "Learning from writing in two content areas: A case study/protocol analysis." *Research in the Teaching of English*, 18, (1984) 275.

Overbaugh, Richard. Bloom's Taxonomy. http://www.odu.edu/educ/roverbau/Bloom/blooms_taxonomy.htm (accessed March 1, 2011).

US Department of Education. National Assessment of Education Progress. *The Nation's Report Card: Writing 2007* (April 2008) by Deborah Salahu-Din, Hillary Persky, and Jessica Miller. <http://nces.ed.gov/nationsreportcard/pdf/main2007/2008468.pdf> (accessed February 20, 2011). P. 9, 37

Stavridis, Jim. "Read, Think, Write, and Publish." Proceedings, 2008: 16-19. <http://www.usni.org/userfiles/file/Aug%20Pro/Stavridis%20Aug%2008.pdf> (accessed February 21, 2011).

Sullenberger, Chesley, interview by Katie Couric. Sully On The Record (February 8, 2009).

Tennyson, Alfred. "Charge of the Light Brigade." In *Poems of the English race* ed. Raymond Macdonald Alden. New York: Charles Scribner's Sons, 1921. 119-120. <http://books.google.com/books?id=6jZDAAAIAAJ&dq=Poems%20of%20the%20english%20race&pg=PP1#v=onepage&q&f=false> (accessed March 6, 2011)

The National Commission on Writing. *Writing: A Ticket to Work...Or a Ticket Out*. Research Report, New York, NY: College Entrance Examination Board, 2004.

Tierny, Robert. J., Anna Soter, John F. O'Flahavan, and William McGinley. "The Effects of Reading and Writing Upon Thinking Critically." *Reading*, 1989: 134-173.

United States Army Training and Doctrine Command. *TRADOC Pam 525-3-0. The Army Capstone Concept: Operational Adaptability—Operating Under Conditions of Uncertainty and Complexity in an Era of Persistent Conflict*. Fort Monroe: United States Army, Dec 21, 2009.