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April 3, 2017 by Inservice Guest Blogger (<http://inservice.ascd.org/author/admin/>)

Writing and STEM: A Crucial Combination

When we think about what a scientist or a mathematician looks like, we rarely see a pen or pencil in hand composing a report or writing an essay. No, we think of the more glamorous side of conducting experiments and solving intricate mathematical situations.

However, one must realize, Writing is a tool to make thinking more lucid. Think about it; to be able to put words onto paper, one must extract information and then be able to portray its meaning clearly via words on a page. Carly Fiorina (former executive of Hewlett Packard) sums it up, "The goal is to transform data into information and information into insight." Can a scientist or mathematician be considered successful with his/her theories if he/she has solved a complex problem yet cannot elucidate and interpret the solution in words? Root-Bernstein (2011) says, "Since words are our primary means of communicating, anyone who has not mastered their creative use is simply underprepared for any discipline, including STEM subjects."

This is why writing must be a significant part of a STEM curriculum. In fact, it should accompany every assignment or problem proposed. Not only does it make one career ready because writing is a big part of any profession, but it helps one organize thoughts and clarify thinking.

Why Write: Cements Learning

"How can I know what I think until I see what I say?" (E. M. Forester)

Over 40 years ago, Emig (1977) made a powerful case for the connection of writing to learning. By its very nature, she (1977) notes that writing as a process, the hand, eye and brain are simultaneously being used. The writing process also is occurring in both sides of the brain, according to Emig's research. Ergo, if the most effective learning happens when reinforcement occurs, coupled with a utilization of the left and right hemispheres, then writing through its innate reinforcing circle utilizing hand, eye, and brain, makes it a powerful tool for learning. (Knight, 2010)

She also notes that writing allows us to have our ideas immediately available for review and re-evaluation, which is a process that can lead us to reconsider and refine our ideas. In other words, to learn what we think by writing.

In 2004, a survey was done by College Board of 120 members of Business Roundtable, and one of the respondents commented, "My view is that good writing is a sign of good thinking. Writing that is persuasive, logical, and orderly is impressive. Writing that's not careful can be a signal of unclear thinking."

The writing piece is vital for helping students process their thinking and clarify their thoughts. It also gets them ready to tackle almost any career.



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Why Write: Career Readiness

Seventy percent of responding corporations from the aforementioned survey report that two-thirds or more of their salaried employees have some responsibility for writing. Another respondent noted, "All employees must have writing ability. Everything is tracked. All instructions are written out. Manufacturing documentation, operating procedures, reporting problems, lab safety, waste-disposal operations—all have to be crystal clear.....*everything* must be documented." (College Board, 2004) If STEM education pursuits are to be successful in our schools, we must be training our students to be career ready with excellent writing abilities.

How Now? Three Ways to Incorporate

First, all students should have a journal to house their work and process thinking. This also makes grading simple if the student just leaves his/her journal on the desks for quick checks.

Next, there are a plethora of writing-to-learn activities to incorporate into math and science classes.

- An easy strategy in math is to have the students fold the paper in half, doing the work on one side and then explaining the process on the other. This easy strategy doesn't require extra materials. Also, they can identify their mistakes as they write out their response.
- An approach used in English Language Arts can be easily transferred to science. Often, students must write argumentative papers in ELA. They usually begin with their opinion in the thesis and throughout the body, they give their reasons and explanations as support. In science, they can write paragraphs with the same type of formula: *Claim, Evidence, Reason*. This equates to easy grading for the science teachers (since this is a big bugaboo with the non-ELA educators), and also, students can identify if their thinking is clear and concise.
- Finally, writing can be incorporated into any activity requiring problem solving. Students are given a choice of four ways they must prove their work. First, they can give a definition, share a rule, sketch a picture or write out their work. Students can also be paired up and share these response to make sure they can speak through what they wrote. This is a nice addition to make sure their thinking is clear.

The demand for skilled workers in science, technology, engineering, and math (STEM) is only rising so we may remain globally competitive. Therefore, we must enrich our STEM curriculum with writing in every aspect of the day. It not only creates, enhances and empowers critically clear thinking, it gives our students confidence to be career ready.

Dr. Stephanie Knight is an experienced 7th and 8th grade English language arts educator. She taught in Title One schools for eight years—helping them grow from underperforming to excelling—and then in an independent school for four years. Knight is now is part of Grand Canyon University's adjunct faculty where she teaches graduate level education and reading courses.

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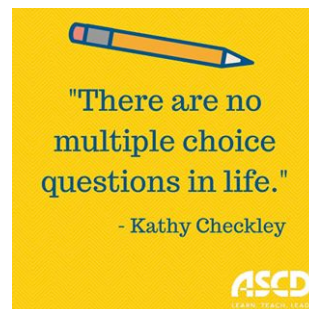


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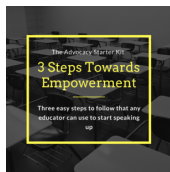
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