Research Paper:

Writing-To-Learn Techniques Improve Test Performance

Marialena Popo

Department of English, City University New York

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Dr. Tara Pauliny

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Abstract

This paper explores concepts on writing-to-learn (WTL) as a tool to improve subject comprehension, retention, and test scores. It answers the question, "What is writing-to-learn and how do I apply it?" The findings are based on qualitative and quantitative data from several studies. The research examines WTL techniques and summarizes them for the reader.

Keywords: Writing-to-learn, writing-across-curriculum, writing-in-disciplines, study techniques, learning skills, comprehension, retention, mind maps, power writing, low-stakes writing, argumentative-driven inquiry.

Students historically utilize memorization to understand key terms and pass examinations on all subjects, whether in elementary school, high school, or college. Writing is often perceived as the skillset only useful for English or Literature related studies. While rote learning is the practice commonly used to master subjects across curriculums, students will comprehend and retain the most knowledge by utilizing multiple writing-to-learn techniques.
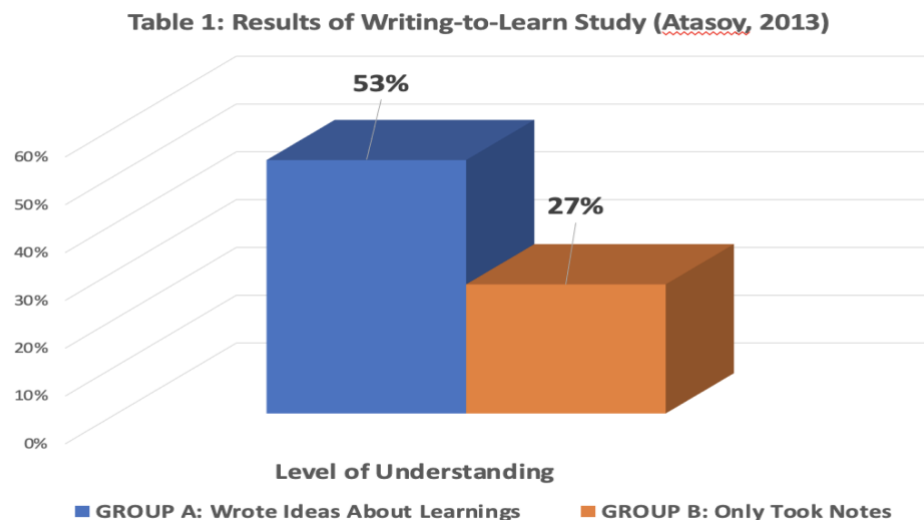
Writing-to-learn (WTL) can be defined as utilizing writing to grasp and retain new knowledge. There are several strategies, and they essentially fall into two main buckets. The first is the theory of writing-across-curriculum (WAC), which claims that writing related to specific subjects will provide learners deeper understanding. This may come in the form of reflective journals, answering questions to probe meanings, or writing one's understanding of a topic and sharing with a peer for feedback. The second theory is writing-in-the-disciplines (WID), which argues that becoming a writer in a specific discipline will make you an expert in that discipline whether it's mathematics, engineering, sociology, or other areas. Regardless of the acronym used to describe the practice, the objective is clear. Writing requires critical thinking skills which makes it the perfect tool for acquiring, comprehending, and retaining information of any kind (Figure 1).

Figure 1
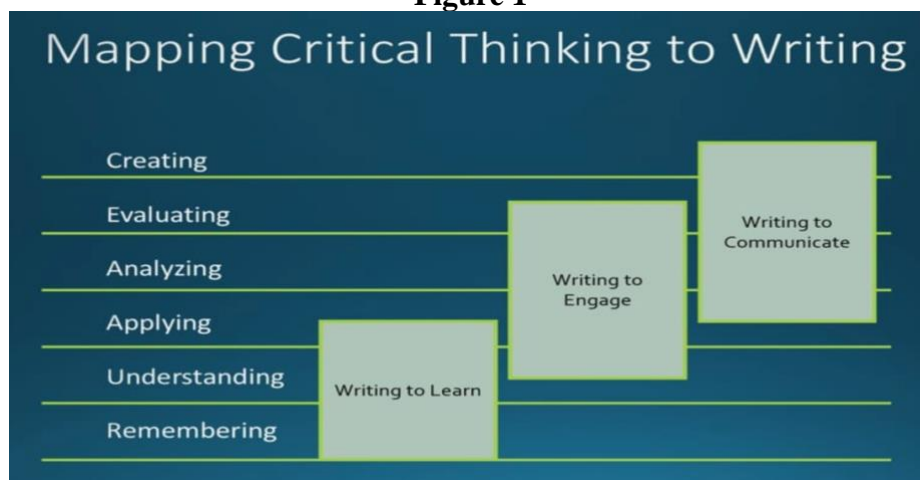
Note. From Kanwit, 2019. Indiana University.

Teaching and developing WTL skills are beneficial for both teachers and students, as it results in improved test scores reflecting subject mastery. In the study, "Effect of Writing-to-Learn Strategy on Undergraduates' Conceptual Understanding of Electrostatics," students were separated into two groups to learn a physics concept (Atasoy, 2013). The students in the control group used traditional forms of studying, which consisted of rewriting concepts from the text for memorization. A treatment was applied to the experimental group. These students were given writing prompts that asked them to explain electrostatics components and their relational significance. They were also asked to explain what they didn't understand and what they think they should learn to grasp more meaning. Students were placed in peer groups to review their findings, identify their learning, and then find solutions. The results were measured quantitatively and the students who using writing-to-learn techniques performed significantly better on their exam as seen in Table 1.

Table 1: Results of Writing-to-Learn Study (Atasoy, 2013)

53%

27%

Level of Understanding

■ GROUP A: Wrote Ideas About Learnings   ■ GROUP B: Only Took Notes
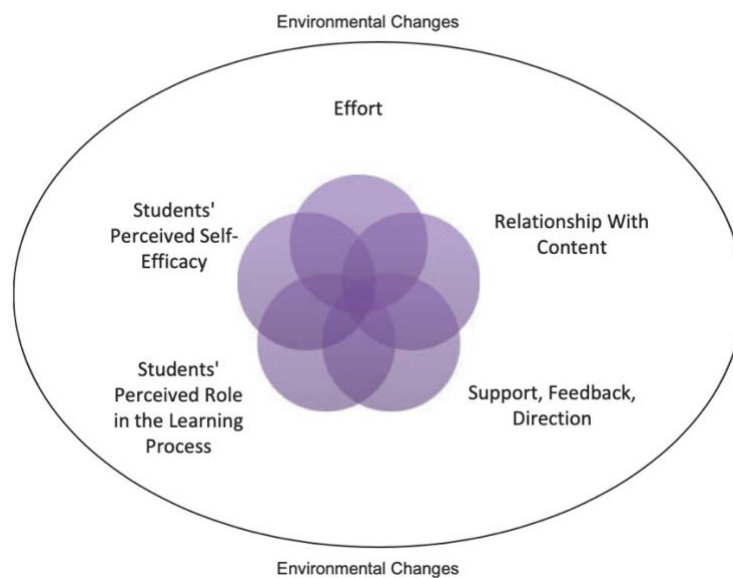
With writing-to-learn defined and its ability to improve knowledge retention illustrated, the focus becomes on the techniques that can be applied to put WTL into practice. The research

in over eight studies all agree on several aspects with the number one skill identified as, the ability to write. Learning-to-write is required to be good at writing-to-learn. Critical thinking, structure/logic of thought, argumentative writing, identifying the audience, quality of writing, all factor into enabling understanding of any subject. Several studies cited the importance of writing skills. "The Effects of Writing-to-Learn Activities on Elementary Students' Conceptual Understanding: Learning About Force and Motion Through Writing to Older Peers," studied the effects of peer writing between younger and older students (Chen & McDowell, 2013). Fourth graders were required to explain their learnings to 11th grade high-school students, who in turn would ask questions to probe and encourage deeper levels of understanding. This correspondence required the 4th graders, to master basic writing skills, so that they could communicate effectively to the older students. The study found that "as the quality of writing improved, so did understanding." The research evaluated 835 students studying science and found that their level of knowledge increased in both the younger and older students. Those that showed the most marked improvements were females, which generally have been shown to have better writing skills. These results make for a counterargument in that the practice of WTL may only show moderate improvements for some students, however, the researchers suggest further studies be conducted to determine effects on specific demographic groups.

Socioeconomic status and writing style are additional factors that contribute to writing abilities and should be considered when teaching these skills. "Beyond "Writing to Learn": Factors Influencing Students' Writing Outcomes," is a study that explored the impact of weak writing skills for social work students (Jani & Mellinger, 2015). The study suggests that individual experiences affect relationships with content, so additional steps are needed to improve writing techniques for people of diverse backgrounds. Figure 2 identifies the factors that

contributed to the students' writing outcomes. These steps not only improved their immediate studies, but also their ability to create compelling case work. Relating to the content, identifying problems, and solving them through writing builds confidence. Allowing people to draw from their culture is an important way to close the writing skills gaps.

Figure 2. Factors influencing student social work writing outcomes.

Environmental Changes

Effort

Students' Perceived Self-Efficacy

Relationship With Content

Students' Perceived Role in the Learning Process

Support, Feedback, Direction

Environmental Changes

Note. From Jani & Mellinger, 2015. Journal of Social Work Education.

With writing skills established, new techniques can be utilized to improve learning performance. Power writing is one of them. This method consists of writing down ideas quickly to build subject proficiency (Fisher & Frey, 2013). Teachers create a daily prompt and conduct three, one-minute rounds of writing. These daily writings are shared with a peer for in-depth discussion and investigations are conducted on confusing concepts. This method not only increased student-led learning, but it also helped teachers identify a student's repeated errors in writing and understanding. A win-win for both student and teacher.

Mind maps are another WTL tool shown to deepen understanding and application of knowledge. "The Effects of Writing on Learning in Science, Social Studies, and Mathematics: A

Meta-Analysis," examined data across several studies (Graham et al., 2020). Like much of the other research, summarizing information was key to improving comprehension, however, making connections between summaries/notes was noted as particularly useful for remembering STEM related subjects. Mind mapping is the practice of linking concepts through images. For example, a main concept a student might learn may be about the brain in a biology class. The "brain" becomes the center bubble in a mind map, then additional bubbles, like the four "lobes", could be connected. The student might then add additional bubbles or squares with further definitions tied to each "lobe", and so on. A mind map provides a visual representation of the information and identifies relationships between data. A correlation was found between mind mapping and improved academic performance, making this another compelling tool to explore.

Argumentative-Driven Inquiry (ADI) was the primary WTL technique studied by Victor Sampson and his associates at Florida State University (Sampson et al., 2013). Their research utilized both quantitative and qualitative methods to measure student gains in learning through pre- and post-measurements. "The intervention took place over two semesters and consisted of at least eight laboratory activities in each course," said Sampson. The lab activities included intensive writing using the ADI method and the results suggest that utilizing this technique improves test scores. There are four main steps to using ADI as a writing-to-learn tool; learn how to use data as supporting evidence, learn how to argue that data, illustrate how the theory and the data connect, and refine one's writing based on teacher and peer feedback. The theory behind ADI is that to argue a subject, one must implicitly understand it.

Reasoning through low-stakes writing is the final technique suggested here as a primary WTL method that supports comprehension and retention. In the research, "Benefits of a Low-Stakes Write-to-Learn Assignment on Exam Performance (Stevenson, 2020)," students that

utilized low-stakes writing performed better on quizzes and exams. "Low-stakes" is reflective

writing that encourages students to think about the information they're consuming.

The primary researcher, Colleen Stevenson, conducted a between-subject, pre- and post-test

experiment, where students were given five assignments, fifteen key concepts, and six themes.

Figure 3 illustrates a student writing sample from that study.

Figure 3. Low-stakes Writing Student Sample

"In the last biology class, we were taught about non-specific and specific immune defense.

The skin of the human body is an example of non-specific defense: The skin protects the organism against chemical and physical influences. The acid mantle of the skin prevents germs from entering the body.

Regarding specific immune defense, we distinguish between macrophages, T-helper cells, B-Lymphocytes, and T-killer cells. We learnt how these different types of cells contribute to the functional process of specific immune defense.

However, I still do not understand how exactly the helper cells contribute to this process because the teacher passed over this too fast.

To solve my comprehension problem, I could review the corresponding pages of the text book chapter on immunology once again and participate more actively next class."

Note. From Stevenson, 2020. Teaching of Psychology.

The objective of low-stakes writing as a writing-to-learn tool is to help students make

connections between concepts and find learning deficiencies, much like power writing. This

study found that many students were overconfident in their knowledge and that low-stakes

writing is another method that helps teachers identify weaknesses. By using this introspective

learning method students additionally strengthen their reasoning skills. They self-determine what

they know, what they don't know, and how they can improve their understanding. To learn from

writing and reasoning, the writing process should also encompass high teacher expectations, in addition to reflections and sharing with peers (Wittek et al., 2017).

The human brain, with its short-term memory, is inefficient at memorizing large amounts of information. Whereas, improving writing skills, mind mapping, power writing, argumentative-driven inquiry, and low-stakes writing are all essential techniques that reinforce subject knowledge. By using these writing-to-learn techniques over the course of their classes, students will not only perform better on exams, but they'll be able to relax the night before the big test.

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