Penning a Science Narrative: How Do Writing Tasks Impact Science Standardized Tests?

A Quantitative Research Study

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Abstract

Given the trend towards greater weighting of standardized test scores in America’s public schools, the researchers of this study found a need existed to describe the plight of U.S. students’ failing scores on these tests and explore alternate test preparation instruction that might raise those test scores. The researchers used quantitative methodology and empirical instruments, including control/experimental groups, a pre-test/post-test model, and a t-test analysis to determine whether or not Science test scores would be positively impacted by the implementation of writing prompts into a State aligned Science learning unit. The researchers were particularly interested in whether or not scores of female students would be impacted. Based on total subject and sex-specific data analysis between the two groups, the researchers found a significant difference between the post-test scores of the control group and the experimental group that received the writing instruction. Due to subject selection and the standardization of content we assert that these study findings can be generalized and replicated.

Background and Problem Statement

American schools have employed standardized tests for more than 100 years to measure student achievement and teacher/school accountability. The importance and frequency of standardized testing will only increase in future years, as evidenced by the U.S. Department of Education’s No Child Left Behind Act, which measures individual states’ academic progress at the K-12 levels. Under this program, the Department of Education assesses Adequate Yearly Progress (AYP) through standardized test scores. To meet AYP, each school system and the state must meet the following criteria: “95% Test Participation, Academic Performance (Annual Measurable Objective i.e., standardized assessments), and Second Indicator” (Georgia Department of Education, 2005). In an op-ed piece written for the Atlanta Journal Constitution in 2005, Education Secretary Margaret Spellings noted that:

“Testing has been a valuable part of the educational process since the days of Socrates…It lets teachers and parents know how kids are doing and lets students see the rewards of hard work. That’s why assessments are part of the No Child Left Behind Act. The law’s emphasis on high standards and accountability has led to a sharp focus on results” (U.S. Department of Education, 2005).
Overview of the Problem

With U.S. twelfth-graders ranked third lowest in science achievement among industrialized countries (U.S Department of Education, 2005), educators, researchers, parents, and politicians are searching for solutions. For many state education systems, the solution has been and will continue to be measured in terms of student achievement on standardized tests. Designed by “test experts,” these tests seek to assess students’ mastery in core curriculum subjects. According to the National Association of Educational Progress (NAEP), a non-profit think tank that produces “The Nation’s Report Card” based on national assessment test scores of students in fourth, eighth, and twelfth grades, only fifty-three percent of 8th-graders in Georgia scored basic proficiency or higher on the National Science Assessment in 2005.

The State of Georgia requires that students demonstrate competencies in a variety of fields in accordance with the Federal No Child Left Behind Act. To this end, the state of Georgia has developed a series of End-of-Course Tests (EOCT) to determine mastery in eight content domains (Georgia Department of Education, 2006). Veteran teachers report that these EOCTs mirror their counterpart, the Georgia High School Graduation Test (GHSGT) and that student achievement on the EOCTs is an indicator GHSGT performance. The Georgia Department of Education places high stakes on EOCT success in its EOCT purpose statement: “EOCTs assess student achievement in the Georgia Performance Standards in the designated eight core courses and provide diagnostic data to improve student achievement” (2008). The State of Georgia does not award a regular high school diploma to students who do not pass the GHSGT.

Beginning in the 2005-06 academic year, Georgia introduced the final four content domains high school EOCTs. These content domains include Biology, Physical Science, Ninth
Grade Literature and Composition, and American Literature and Composition (Georgia Department of Education, 2005). The EOCTs are state-standardized and administered upon completion of each course. Each test counts as the final exam and fifteen percent of a student’s grade for the course. The physical science EOCT includes the following domains: (1) chemistry, atomic and nuclear theory/periodic table; (2) chemistry, physical reactions and properties of matter; (3) physics, energy force and motion; and (4) physics, waves, electricity, and magnetism (Georgia Department of Education, 2006). Research further shows that the trend towards mastery tests such at EOCT will not soon abate as administrators, superintendents, and local educational agencies (LEAs) seek to achieve the standards set forth by No Child Left Behind and other national and state legislation.

National and regional educational trend data suggests that superintendents, administrators, and parents continue to place high regard on standardized tests. Experts believe that this trend will continue to gain widespread, national support. “Rightly or wrongly, standardized measures of assessment determine the extent of local schools’ success in preparing students for their futures – whether those futures be entry into colleges, technical schools, or the job market” (Weller & Weller, 1998). In the Southeast, all states require either comprehensive or end-of-course tests; a few states require both. The tests measure two key objectives: “whether high school graduates meet state standards for graduation and whether the high school curriculum has given students the skills to meet those standards” (Daugherty, 2004). An indicator of a school system’s progress is a high pass rate on these exams. Often, these tests determine a student’s opportunities for post-secondary academic and career endeavors and a school system’s supplemental budget.
Definition of the Problem and Study Purpose

The challenge facing local education agencies (LEAs) is how to ensure that students pass these important tests. In Georgia, the percentage of students who do not pass the Physical Science EOCT is reaching alarming levels. According to the Georgia Department of Education’s Standardized Testing brief, the statewide pass percentage for this test is 63%. That means that 37%, or more than one-third of high school students in Georgia did not pass the test (2008). With 66,959 students testing statewide, 24,775 students failed this important test and were in danger of not passing the required Science GHSGT to receive their high school diplomas. With other EOCTs in Georgia seeing pass rates in the high 80th to 90th percentiles (2008), the low pass rates on science EOCTs represent an incongruity of achievement and permanence of subject knowledge transfer. The above statistics collected at the national, regional, state, and local levels of education, provide the same rhetoric from similar sources: standardized tests are necessary to measure both a school’s academic progress and students’ academic achievement. The above results clearly show that alternative preparation is needed to increase the number of students who pass the Physical Science EOCT.

To justify an alternative instructional approach to address this disparity, I consulted a subject matter expert (SME) in the field of high school science. The SME for this research study is Chuck Bohannon, a Masters level (T-5) certified teacher, who possesses both gifted and College board AP endorsements. Mr. Bohannon also has more than five years of teaching experience that ranges from urban to rural learning environments with a wide demographic range of student ethnicities, genders, special needs, and learning levels. Mr. Bohannon’s content knowledge, as well as his total GPS and technology integration in his classroom, gives him statewide credibility. His methods include performance tasks designed to deepen and broaden
students’ knowledge base and blogs created to enhance student interaction. Bohannon has also conducted his own research of standardized testing challenges in middle school classrooms and produced his Master’s thesis in this field (Bohannon, 2007). Because sparse research exists regarding conclusions of how performance tasks, specifically writing tasks, impact knowledge transfer and achievement on Science standards, this study used employ empirical methods to determine such an impact, if one exists. To begin, I asked the question: How will alternative instruction using performance (writing) tasks aligned to the Georgia Performance Standards (GPS) impact test performance on a standardized 9th grade physical science end-of-course (EOCT) assessment? Then, I looked to regional and international scholarship for background research, rigor, and validation.

Literature Review

Given the sparse research that exists in the field of WAC research at the secondary school level, I needed to not only examine relevant research studies but also background information and a needs analysis that could provide my study with greater rigor and efficacy. I also positioned my bibliographic search to include content material that would be helpful to other researcher wishing to replicate this study. So, I began first with foundational linguistic material. In designing data collection instruments for this project, I found that we needed a comprehensive guide to clarify issues of style and form. Mary Clark’s *Structure of English for Readers, Writers, and Teachers* (2003) provided a grammatical foundation for the synthesis and evaluation of syntactic structures in American English. The text provides an in-depth study of the forms of communication: phonemes, morphemes, phrase, sentence, semantics, and discourse. Each chapter has exercise and additional resources for further study. There are several chapters specific to this study. Chapter 5 analyzes bibliographic research and employs graphic organizers
to present semantic concepts. Chapter 8 explains semantics in phrases and sentences. Chapter 11 gives students information on writing in different linguistic registers. Chapter 14 uses extended outline format to teach students how to present information in scientific writing.

Finally, several appendices give samples of the various writing types described in the chapters. I used this book as a resource for my research design and development because it contained snapshot views of basic and intermediate grammatical conventions.

I also used this text as a foundation for analyzing dialectal variations and placing the linguistic markers into a written discourse. This text provided my SME with a base for constructing writing prompts, short answer, and essay questions. This text also served as a student resource for bibliographic research and syntactic questions.

In terms of quantitative research, this study required both a needs analysis and a justification of importance. Several sources added to the validity and rigor of the study. Robert Jalomo in an article written for *New Directions in Community Colleges* lends credence to alternative instruction to reach entry-level writing students (2000). This article is particularly important, as most career level students who do attend a post-secondary institution, will attend a community or technical college. Jalomo contends that minority under-achievement on standardized tests has created a debate among community colleges as to the efficacy of student scores in regards to admission. Often, admissions counselors take into consideration other factors, such as grades in interest classes, teacher recommendations, and interest inventories in lieu of high test scores. However, Jalomo writes that students must still possess the basic requirements of their particular state. In this case, students must have passed the Georgia High School Graduation Test in order to complete any post-secondary track, even at a community or technical college. He further details a rationale for providing alternative instruction to ensure
that career level students can achieve passing scores on Science standardized tests. Upon admission, Jalomo suggests items such as student portfolios, self-assessments, and value-added assessments to measure student achievement. While the solutions focus primarily on post-secondary institutions, they are applicable to the high school instruction contained in my project as well because they give efficacy to the argument for administering and measuring standardized tests in America’s public high schools.

A regional article written for *The Clearing House* by the Weller and Weller team, asserts the need for alternative standardized test preparation. Weller relents that “standardized testing measures of assessment determine the extent of local schools success in preparing students for their futures.” Through action-based research, Weller & Weller advocate the Continuous Improvement Model. This process includes communication and cooperation between teacher, administrators, parents, counselors, and students. Weller also recommends the controversial paradigm of “teaching to the test.” While this term has profound negative connotations for many educators, Weller asserts that if the GHSGT is truly a measure for student success, then teaching the skills required to pass this standardized test is actually “teaching the test” and is a preferable means of instruction. Because the authors of this article are Georgia educators, I placed significance on their arguments and solutions for GPS-based instructional techniques. In developing the writing across the curriculum (WAC) materials with my study’s subject matter expert (SME), I used Weller & Weller’s insights to justify the test items contained on the pre- and post-tests for the learning unit being measured as well as the performance tasks used in the learning unit itself.

In *Review of Educational Research*, Bangert-Downs et al employ a meta-analytical methodology to examine writing to learn programs in secondary schools, grades 6-8 and their
impacts on student achievement. Also known as writing across the curriculum, writing to learn programs assume the interconnectedness of learning and writing as cognitive processes. This particular study investigated whether or not the specific context of writing to learn programs had efficacy to larger applications. Focusing on 48 school-based writing programs, the researchers examined texts focusing on the positive, neutral, and negative outcomes of writing to learn programs. To maintain validity, the study only addresses formal academic circumstances to examine study features and outcomes. The researchers used diverse search terms and input those terms into the following databases: Educational Resources Information Center (ERIC) for 1966-1999, Dissertation Abstracts database 1982-1999, Psychological Abstracts database in its entirety, and references in narrative reviews, book chapters, published bibliographies, and bibliographies of other relevant research studies. Of more than 140 documents found, forty-six were used to conduct the meta-analysis. Variables were characterized by length of the treatment in weeks, the number of writing assignments per week, and the minutes per writing task (when the writing took place in class). Further, entries were coded as either informational or personal, based on assumed student purpose. The measures of content learning included final grades, final examinations and standardized tests. The study found that 36 of the total number of entries studied produced a positive outcome. For my research purposes, this meta-analysis provided efficacy for my study and also provided comprehensive data on the plethora of information that exists in this part of the writing research field. More than 75% of the entries used for this meta-analysis came from dissertations. This led me to conclude an increasing scholarly trend in this area of research.

To better understand WAC and its implications on my research, I turned to thirty-year veteran of composition instruction administrator, Art Young. In his article for the Conference
on College Composition and Communication (CCCC), Young uses an historical definition of WAC as a springboard to discuss the pedagogical strategy of poetry in cross-curricular learning units and to prove its significance through a case study at Clemson University. Young connects his WAC from his experiences as an English teacher to scientific applications, specifically Clemson University’s WAC program in Psychology. This on-going program includes faculty and student participating in both formal and informal writing situations. It uses poetry writing to describe functional writing techniques and purposes. Known as PAC (poetry across the curriculum), this program requires clinical students to record their insights and patient issues through poetry. Young answers the question “why poetry?” instead of prose or narratives by asserting the succinct nature and conventions of poetic discourse. Through his own teaching experience, he has found that students who use poetry to write outside or against their curriculum often express functional ideas in creative ways that allow for deeper understandings of content.

In using this article, I provided my research study with theoretical background for the use of poetry writing in a Science learning unit. I gave this article to my study’s subject matter expert (SME), who then decided to employ Georgia Performance Standards (GPS) poetry writing standards from the grade appropriate language arts curriculum to teach science concepts.

For further validation of need and value, I reviewed an article from the International Review of Education that presented findings of a comparative, qualitative research study between science curricula of American and Chinese secondary educational systems. The data analyzed was gathered from surveys given to visiting Chinese scholars to the U.S. form 1991-1994. The study reports several differences and similarities between the two systems. The results showed the following between the U.S. and China: shared educational goals of higher education and workforce preparation; differences between the Advanced Placement science content and
Chinese general education content; lower levels of science content knowledge of U.S. college freshmen; significantly (1-2 grades) lower content knowledge in U.S. secondary schools; and deeper scope in Chinese science curricula secondary and post-secondary levels including textbooks and teacher materials. A final intriguing finding was that in the areas of biology, physics, and chemistry, U.S. standards for middle grades were basic and introductory, mirroring the same standards as Chinese elementary schools. The findings suggest more rigor is needed in U.S. classrooms and more cross-disciplinary connections is needed in Chinese classrooms.

This study is significant due to continual comparisons in the media and general populous between Asian and American students on Science achievement tests. The common perception is that American students fall behind Asian students because our curriculum is inferior. I found this study pertinent to furthering my understanding of science curriculum standards in the U.S. and how scholars from the Far East rate our educational system in both goals and methods. I would have liked to know, however, how the interviewees were selected. This would have given the study final validity for me.

In the Review of Educational Research, Ochsner and Fowler provide a meta-analysis of writing across the curriculum (WAC) and writing in Disciplines (WID) literature up until 2004. The analysis compares texts and experiences both in favor of and in opposition to WAC and WID and proposes questions regarding the efficacy of these concepts and their costs to programs. After defining both WAC and WIDs within academic parameters, the researchers review the historical literature and make recommendations on how WAC and WID may be used to address diverse student writing styles. Noting specifically the complexities of measuring student achievement, the authors examine three categories of research: naturalistic studies, which typically depict one person's experience in detail; controlled studies of various types, such as surveys and instructional research involving relatively large numbers of people; and ancillary works of
scholarship often cited in support of WAC/WID. Using this research, the authors seek to determine whether or not WAC and WID programs have increased student achievement. This study relies heavily on historical research literature and presents no quantitative data either in support or in opposition to WAC and WID programs. The researchers pose a critical viewpoint towards their subject, but do not readily provide conclusive recommendations. Their examination of WAC and WID’s development in secondary and post-secondary learning environments was important to providing greater efficacy for my project and SME.

In a mixed methods research study published in the *British Educational Research Journal* researchers conducted a WAC study specifically within a Science curriculum. Three subject matter experts (SMEs) from language and science fields examined student essays based on writing prompts. The article addressed writing across the curriculum (WAC) principles and how science writing could be connected to writing practices in other disciplines. The authors recommended further replication of the study in more U.S. schools to provide reliability for their findings. The methods employed by this study show that qualitative instruments can be analyzed in quantitative ways. The correlation of the research findings is significant. For my research, however, I find the differences between the science essay topics more revealing. This confirmed for me the cognitive preferences that I took into account in developing Science writing instruction.

Writing for *College Composition and Communication*, Dr. Alfred Powell from Georgia Southwestern University recognizes that writing is a process and a mode for learning and that writing and reading are interactive processes requiring students to cooperate in the act of learning. This possesses significance in a Science classroom as teachers and professors give students assignments that engage them in discipline-based reading and writing products.
Students also produce publication-drafts in the form of concept papers. Powell uses a student-centered constructivist method in deciding topics and timing. The idea of a project and its written description Success of this WAC opportunity is measured by qualitative student data that comes from informal interviews and formal course evaluations.

Powell provides a foundation for using WAC in a Science course. I found his description of his pedagogical application to be content specific and standards-based. His informal study regarding student attitudes towards is not described in-depth, due to the pedagogical focus of the article. I will use the information I gained from this article to help design the material treatment for the WAC experiment.

Methodology

This study employed a quantitative methodology with measured instruments that provided empirical data regarding the impact of performance tasks (writing) integration into a public school science curriculum. The study consisted of a control group and an experimental group. An SME administered pre- and post-tests to each group, reversing the tests to reduce treatment interaction and increase external validity. Test items were modeled on released GADOE test items, to assure GPS alignment. The experimental treatment was a series of writing prompts that were relevant to the Science lessons being delivered by the SME. A one-tailed t-test measured differences between the two groups and the outcomes of their post-tests. To add rigor and inter-rater reliability, three scorers graded the tests and performed data analysis checks after coding.

Subject Analysis

The target learner demographic for this research project and its accompanying instructional learning unit is 9th grade Physical Science students in rural-suburban Georgia public
schools. For this study, we chose 37 subjects that met the above qualifications. The selection process was not random, due to the limitations of the research setting. Two classes taught by the same teacher were chosen based on the criteria contained further in this section. According to this design’s SME, general characteristics of these students include: upper-medium to low socio-economic status, medium to low parent involvement, and high sociability within peer groups. The ethnic make-up of these students: 30% African-American, 13% Hispanic; 57% Caucasian, and 1% Mixed Race. The gender make-up of these learners was: 35% female, 65% male. Teachers, guidance counselors, and parents placed these learners on a general education track upon entering 9th grade. The demographic dispositions of these learners closely mirror the demographic averages published by the Georgia Department of Education for the 2008-2009 school year. The state numbers are: 43% African-American; 9.4% Hispanic; 45% Caucasian; and 2.6% Mixed Race. Statewide, 48% of students are female, while 52% are male. The selection process that culminated in the above demographics was a result of my consultation with the SME and reviewing student enrollment in a total of seven classes, or 218 students. From this pool of classes, two were chosen that best represented averages of student enrollment statewide in order to obtain a higher reliability rate for study replication. Special education students, who were taught by an inclusion teacher in the same classes as the study subjects, were excluded from this study in order to compare study results to state and national data, which also excluded special education students. This allowed me to add validity to the study and increase generalization.

*Entry Level Skills*

Entry skills for 9th grade general education level students include basic to proficient grade level language conventions, style skills, and content knowledge. These students possess
basic word processing and Internet navigation skills and basic to proficient expository writing skills. Note-taking practice is generally below basic level. For the proposed instructional unit accompanying this research study, students used these entry-level behaviors.

*Subjects’ Attitudes Towards Subject*

The research study’s target learning demographic encompasses auditory, visual, or kinesthetic learning styles. Students’ attitudes towards instruction, and education in general, represent wide-ranging life experience within a rural-suburban community situated within 50 miles of a major urban center. This unit’s SME reports that learner characteristics of these students include: high to low homework return rates, high need for classroom structure, increased need for feedback, and high technology appreciation. Therefore, an important component of an alternative instructional design must include vocabulary, language and technology delivered at students’ level.

Entry behaviors for the target learners include also higher instances of low self-esteem, in regards to meeting test and teacher expectations. In *Beyond Maladies and Remedies*, Dr. Hunt Riegel asserts that “many students who encounter difficulty in school have been characterized as having developed poor strategies for learning” (Riegel, Mayle, McCarthey-Henkel, 1988). The proposed instructional unit will differentiate instruction to provide authentic learning transfer for visual, auditory, and kinesthetic learners.

*Tool Design and Instruments*

Because technology integration is a constant in the teaching repertoire of my SME, I chose to use two of his classes, both of which receive the same level of technology exposure in the everyday learning environment of a physical science curriculum. Therefore, the tool design for measuring impacts on student achievement was influenced by this technology. In this case,
the major technology integration is blog-based learning. In his classes, Chuck Bohannon employed technology integration in the form of electronic writing prompts taken from his class blog (experimental group). Generally for most lessons, Bohannon uses his blog for interactive note-taking. Students and parents use this blog to access in-class tasks, homework, study guides, class syllabus and schedules, resources, etc. The blog address is www.bohannon.edublogs.org.

Standardized test preparation for Georgia’s Physical Science EOCT delivered within a unit integrated with technology and writing performance tasks presented unique opportunities for both composition and technical educational objectives. Based on combined directed and constructivist instruction models, the learning unit for this study created both structured and cooperative learning environments. In developing the instructional product for this unit, then I worked with my SME to produce State approved pre-and post-tests (Appendices A and B respectively) that represent EOCT content and Georgia Performance Standards (GPS) aligned writing tasks that support the EOCT goals. The combination of tools represented a researched, multimedia approach to a test preparation unit, which enabled target learners to attain academic success on EOCT learning objectives. The experimental treatment for this study included writing prompts (Appendix B) that supplemented GPS aligned science lessons.

Presentation of Content

The EOCT alternative preparation unit used a blog as its foundational electronic content presentation methods. The unit was available online to both students and parents. Foundational use of these primary tools was a result of action research regarding learner attitudes and motivation, as well as agreement with expert opinion. Bohannon presented GPS aligned content contained on his blog (figure 1) in both groups. The experimental group also received the writing prompts and WAC instruction based on those prompts.
Program Structure

As a foundation tool and unit anchor, the writing prompts and tasks created for this unit were organized in a sequential and logical system. The unit encompassed nine instructional hours and one hour of assessment (pre- and post-tests). First, students took a pre-test, which consisted of sample EOCT questions. The SME administered two separate tests to his two participating classes and reversed the pre/post tests to reduce the effect of treatment interaction and increase external validity. The SME then taught both classes the required material. All learning materials and instruments were aligned to the Georgia Performance Standards (GPS), the state approved curriculum framework for public schools in Georgia. The experimental group received additional GPS cross-disciplinary instruction with the introduction of writing (performance) tasks into the learning unit. The control group received only the required GPS instruction. Students culminated the unit by taking a post-test, which was another sample EOCT.

The unit’s flow, from pre-test to post-test, followed a necessary sequential construction of lower-level thinking skills to higher level skills. The pre-test and post-test signified a beginning and conclusion for the unit, and also provided valuable research data on the efficacy of the proposed treatment and corresponding transfer of knowledge. The unit was divided into manageable, structured sections that maintain student interest and flow in a logical way and conformed to ninety-minute instructional blocks.

Variables

The independent variable for this unit was the performance-based writing treatment administered as an integrated component of the learning unit. The experimental group will receive this treatment, while the control group will not. The dependent variable is the outcome of the post-test scores that will determine what effect exists after presenting the alternative
learning treatment. I believe that I will control the technology element with the SME’s consistent use of a blog for instruction. Other variables include student learning styles and educational motivation, both of which are addressed to some extent by use of technology and constructivist methods as instructional tools. Regarding internal validity, I limited test/treatment interaction by transposing pre- and post-tests for both groups of subjects. I have attempted to control external validity through subject selection (non-random, but class demographics based on State averages).

Data Analysis

The pre- and post-tests were scored by three raters, the primary investigator, the SME and another science teacher on-site at Cass High School, the site of the research study. Student scores were reported and recorded as numbers to maintain anonymity and to reduce researcher bias based on gender. Data from both pre- and post-tests was analyzed based on a significance of p< 0.05 in a one-tailed t-test. Mean and median were derived as well from an Excel template and reviewed by two researchers and one SME. I presented findings in Table 1 and will examine them further in the discussion section of this paper.
### Table 1. Data Presentation Categorized by Total Subjects and Male/Female Subjects

<table>
<thead>
<tr>
<th>Research Groups</th>
<th>Control Group Post-test Scores on 100 point scale</th>
<th>Experimental Group Post-test Scores on 100 point scale</th>
<th>Point Difference in Scaled Scores Between Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N= Number of Subjects</strong></td>
<td>16</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td><strong>Total Subject: Mean Pre-Test</strong></td>
<td>28</td>
<td>31</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Subject: Mean Post Test</strong></td>
<td>57</td>
<td>71</td>
<td>14</td>
</tr>
<tr>
<td><strong>N= Male Subjects</strong></td>
<td>10</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td><strong>Pre-Test</strong></td>
<td>25</td>
<td>35</td>
<td>10</td>
</tr>
<tr>
<td><strong>Post Test</strong></td>
<td>63</td>
<td>70</td>
<td>7</td>
</tr>
<tr>
<td><strong>N= Female Subjects</strong></td>
<td>6</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td><strong>Pre-Test</strong></td>
<td>32</td>
<td>23</td>
<td>-9</td>
</tr>
<tr>
<td><strong>Post Test</strong></td>
<td>48</td>
<td>72</td>
<td>24</td>
</tr>
</tbody>
</table>

Within the parameters of this research study, I aligned all learning materials and resources to the Georgia Performance Standards (GPS), the foundation of teacher and student preparation for public schools in the state of Georgia. Relevant terminology included: performance tasks, culminating assessments, and technology integration. These elements of instruction represented
an alignment to the required state standards. The local educational agency (LEA) for this study was Bartow County Schools, located in Northwest Georgia, approximately fifty miles north of Atlanta. Application of the results of this study outside of Georgia would need to include further review of statewide demographics of student populations, specific LEA demographic information, and technology-based learning opportunities within specific research study sites.

The total number of subjects who participated in this study was thirty-seven. I analyzed the data based on control group vs. experimental group post-test outcomes, given that the pre-tests for all subjects fell within a normative range of that indicated minimal prior knowledge of subject matter. I examined the mean scores of both groups and found that the experimental group that received the writing treatment scored fourteen points higher on the post-test than the control group who did not receive the writing treatment. The difference in these scores (71~57 respectively) represents the difference between failure and passage on an EOC standardized assessment. This fact gives the difference an increased significance based on the State’s expectations of student achievement on this assessment.

Next, I evaluated the differences between males and females within the control and experimental groups themselves. This analysis provided the most intriguing results of all the data collected. While both sets of female subjects within the control and experimental groups scored low (32~23 respectively) on the pre-test, the female subjects in the experimental groups outscored females in the control group by twenty-four points. The control group females posted a mean post-test score of 48, while the experimental group females posted a mean score of 72. Like the overall group outcomes, these scores represent the difference between no proficiency and basic proficiency on EOC standardized assessments. From this data, I extrapolated a significant p-value of (0.0000105) for the males in the experimental group and p= 0.00444 for
the females in the experimental group. Given the dual significance of statistics and assessment outcome, I concluded that by implementing the WAC instrument within a Science learning unit, the SME succeeded in raising student test scores on a standardized assessment that would make the difference between student failure and student success on that assessment. The nature of our study makes it available for replication; we hope to conduct this study again ourselves in the future with different grade levels of subjects to add further validity to our findings. Because of the demographic selection and situational setting, we assert also that this study may be generalized and applicable to other high schools in Georgia and throughout the Southeast as a tool to provide educators and students with strategies for increased standardized test achievement.
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Appendix A. Pretest
Is the Pen Mightier? 25
Appendix B. Post Test
Appendix C. Writing Prompts

Writing Prompt #2

Using Newton’s 1st and 2nd laws, describe the motion of the character. Indicate why you chose your movement. What is the net force on the skater? How heavy does the skater have to be?

C. Bohannon 2009

Writing Prompt #1

A spaceship is orbiting the earth. It is no longer accelerating. Explain using Newton’s 1st and 2nd laws, describe the spaceship’s motion. What must happen for the spaceship to turn?

C. Bohannon 2009