THE EFFECTS OF INCORPORATING SCIENCE JOURNALISM ON SCIENCE

LITERACY

by

Kristina Jo Troge

A professional paper submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Science Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

July 2013

STATEMENT OF PERMISSION TO USE

In presenting this professional paper in partial fulfillment of the requirements for a master's degree at Montana State University, I agree that the MSSE Program shall make it available to borrowers under the rules of the program.

Kristina Jo Troge

July 2013

DEDICATION

To my husband Caleb, who has big dreams and allows me to join him on the journey.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

This project was designed to investigate if incorporating components of science journalism into the daily schedule in a chemistry and physics classroom would impact an ELL student's science literacy skills. Interaction with current science news, article writing, and monitoring student progress were included in the treatment units. Student writing samples and communication demonstrated improvement in multiple components of science literacy as measured in this study.

INTRODUCTION AND BACKGROUND

Divine Savior Academy (DSA) is a parochial school serving students in grades PreK-12. Founded in 2004, the school is located in Doral, Florida, which is part of Miami-Dade County. Doral's population has grown 77% in the last 8 years and future projections predict similar growth. The largest racial group in Doral is Hispanic, which comprises 79% of the population. Adding to this dynamic is the relatively high income of most of Doral residents (City of Doral, 2012). All schools in Doral must continually adjust to the influx of new students, who typically speak English as their second language. It is common that parents who choose to send their children to private and parochial schools expect their children to meet high academic standards and attain excellent English language skills.

As a new science instructor at DSA, I quickly identified the majority of my students as English Language Learners (ELLs). The science courses I taught included middle school science in addition to high school chemistry and physics. In the first week of school, I learned each of my classes contained a variety of ELL levels. Some students began formal English instruction in elementary school, some had been in the United States learning English for a few years, and others had arrived earlier that week. Through informal observations comparing interactions with students and their written work, I noted that while most of my students possessed basic conversational English skills, their writing and academic vocabulary needed improvement. As a science instructor, I began looking for ways to instruct both science content and science literacy. It was my hope to help this group of students to develop the skills needed in order for them to be successful at the university level and in the community. When I read about other teachers implementing components of science journalism in *The Science Teacher*, I thought that using science news articles with my students would be an excellent way to develop science literacy skills while encouraging engagement and personal interaction with science topics.

The purpose of this study was to determine the effects of implementing components of science journalism on science literacy. In order to identify and investigate particular skills in my students, I articulated four sub-questions: what effect does science journalism have on ELL's ability to understand and express scientific ideas in academic language; what effect does science journalism have on ELL's ability to evaluate and use sources; what effect does science journalism have on ELL's ability to contextualize scientific issues and information; and what effect does science journalism have on ELL's attitude toward science?

CONCEPTUAL FRAMEWORK

Every year the challenge of educating English language learners (ELLs) is faced by teachers across the United States. The National Center for Education Statistics (2012) reported that between the years 1980 and 2009 the number of school-aged children who spoke a language other than English at home rose from 4.7 million to 11.2 million. As teachers initiate ELLs into an academic world of English, they are challenged with providing necessary skills to learn the new language and succeed in school. Middle and high school educators face the additional task of incorporating language instruction into their content courses for students who enter a school at an age past the initial literacy instruction stage. In addition, many middle and high school settings have structured periods where each teacher interacts with a group of students for only a short part of each day. As ELLs navigate their secondary school years, many educators now look beyond the scope of high school and see the need to develop skills ELLs need for literacy in an English speaking society (Echevarria, Short, & Powers, 2006).

ELLs come from varied socioeconomic, cultural and literacy backgrounds. As with English-speaking students, ELLs function at different levels of each of the four basic language domains of listening, speaking, reading, and writing in both their native language and in English. The acquisition of language is a complex process, and in order to effectively instruct ELLs with appropriate language input, teachers must assess each student's level of English proficiency. The organization Teachers of English to Speakers of Other Languages (TESOL) provides standards for instruction and describes the five levels of language proficiency as starting, emerging, developing, expanding, and bridging (2006). It is critical that a student's basic speaking skills and ability to carry on a conversation in English not be mistaken for the academic language skills needed to be successful in a classroom setting. Such misunderstandings can lead to inappropriately assessing ELLs or even withholding necessary instructional aide (Cummins, 1984). Academic language proficiency includes skills and vocabulary for specific content knowledge of formal and technical writing. While academic and conversational English are distinct and can be distinguished in both receptive and expressive modes, they are also intrinsically connected because it is daily language that allows students to build academic language and understanding (Coleman & Goldenberg, 2010a).

Some common misconceptions teachers have concerning effective instruction for ELLs include the assumptions that simply exposing students to the language will result in learning or that effective instruction for ELLs is the same thing as nonverbal support

(Harper & de Jong, 2004). Ideally, literacy skills should be developed in both languages as well as instruction in the content knowledge required of all students. Intensive vocabulary and academic language instruction is necessary for ELLs to be able to comprehend content input and express themselves in English (Goldenberg, 2008; Coleman & Goldenberg, 2010b).

Special considerations have been developed in the instruction of science to ELLs. Multiple models of instruction for ELLs have been developed, but the common points of effective academic and social language teaching include adjusting instruction for comprehensible input, interaction, practice of language skills, and assessment of both language and content knowledge (Echevarria, Richards-Tutor, Canges & Francis, 2011). In addition to group discussion and assessment, the use of accessible performance tasks can also be effective in understanding ELL student growth (Castaneda & Bautista, 2011; Colbern & Nguyen, 2012). Effective science and literacy connections can be made by instructors with supports such as graphic representations, prompts, and using language in both social and academic contexts (Lee & Fradd, 1996). Providing students with opportunities to practice academic language skills such as describing, analyzing, comparing, and explaining can be authentically incorporated into science classrooms through journaling or writing about science (Lee, 2005; Huerta & Jackson, 2010). ELLs can also be effectively assessed while implementing peer reviews or modified instructions on performance tasks.

Science literacy is an overarching goal for many science educators, as it provides the context of life application to science content. Science educators work with the operating definition that a scientifically literate person can ask questions and relate

STEM (science, technology, engineering, and mathematics) topics to their own life. This includes the skills to search effectively and analyze multiple credible print and internet sources, make sense of and relate the concepts, methods and explanations discussed in STEM news, and contextualize new STEM information in terms of societal impact (National Research Council, 1996). Teaching students the skills of science literacy equips them with life skills necessary to evaluate and make informed decisions now and in the future.

The concept of science literacy has been debated and developed over time. Some say science education should emphasize appreciation and application of technology or health instead of stressing content deemed inapplicable to general populations (Shamos, 1995). Others emphasize the nature of science literacy as a collective effort of society and issues pertaining to it (Roth & Lee, 2004). Regardless of perspective, the essence of science literacy is the ability and willingness to gather, interpret, synthesize, and apply information that has been obtained through some method of research. The reasoning behind developing such skills in our students is based on the current state of society. The public is constantly barraged with scientific claims, and many do not know how to manage or interpret this information (O’Neill & Polman, 2004). Once students can interpret and evaluate the information available, they can communicate their judgment and perspective about any issue (Lemke, 1990). When students have developed a sense of science literacy, they become empowered adults who can voice an educated perspective into their community.

Scientific journalism addresses each component of scientific literacy. In two recent studies, McClune and Jarman (2010; 2011) found that effective science instructors can develop analysis and interaction with science news to increase science literacy skills. Students exposed to a variety of topics included in science news can identify issues and subjects they feel are interesting or personally relevant. Incorporating information technology-based research tools and developing a sense of how media reports the news can instruct students in evaluating new sources (van Eijck & Roth, 2007; Antilla, 2010). In addition, a study by Guzzetti and Bang (2010) showed increased student interest in science and achievement when students were involved in science literacy tasks. Science journalism is a way students can interact with relevant topics, analyze, synthesize, and evaluate science. In doing so, they prepare themselves for society and leadership (Polman, Newman, Farrar, & Saul, 2012).

When instruction of ELLs includes elements of science literacy, they are able to interact with academic language in a context outside their science textbook. Listening to, reading, and writing science news provides ELLs an opportunity to practice language skills in authentic daily tasks. Student discussion about science news topics provides additional occasions for students to express their thoughts, opinions and connections they have made with their lives and how science impacts society. The integration of science journalism components into traditional coursework enriches literacy for all students and supports ELL's English language development.

METHODOLOGY

The students involved in this study were ELL high school sophomores, juniors, and seniors enrolled in chemistry and physics classes (N = 27). The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained. The project took place during three consecutive units between late January and early April. Treatment was implemented as short lessons incorporating science journalism into the regular class schedule. Throughout all units, course material outlined in the school curriculum was taught in the remaining time during each class.

In the non-treatment unit, I collected data for comparison to data from the treatment units. Without discussing components of science journalism, I asked all students to write a science article connected to their course subject area of chemistry or physics. I also asked students to read a science article on their own and analyze it in their journal.

During the two treatment units, I implemented three strategies to give all students implicit instruction in science journalism: using read aloud/think aloud (RATA) sessions in class, communicating through an article progress board, and implementing writing conferences with peer edits. RATA sessions were conducted to allow students to experience and identify what a scientifically literate individual does as they encounter academic text. During the RATA sessions, I modeled my thinking processes as I read, questioned, contextualized, and evaluated a selected news article aloud. RATA sessions were also used to analyze and make credibility assessments of article sources. After initial RATA sessions, students were encouraged to comment or journal about the topic or one of the components of science journalism. A white board at the back of the classroom was converted into an article progress board during the treatment units. A portion of the article progress board was designated for students to share thoughts and questions they deemed worthy of reading about. Another part of the board was marked with spaces for each stage of writing in its natural progression. When students made headway in the steps toward completing their article, they moved a name card from the stage completed to next stage. This visual representation of student work allowed both students and the instructors to see the development of each student's article. The last strategy employed in the treatment units was to provide opportunities for writing conferences. After discussing effective and constructive criticism, students edited and revised two other articles and then contributed to small group discussions about peer articles. Science Article Filtering Instrument (SAFI) sheets were provided to guide student writing conferences and provide possible talking points (Saul, Kohnen, Newman, & Pearce, 2012). I conducted individual writing conferences with students as requested by the student.

Data for the treatment units were collected through pre- and post-unit interviews, a pre- and post-unit survey, student journal reflections, article writing, and peer assessment notes (Table 1). Eight students out of 27 were randomly selected and asked to participate in the Troge Science Journalism Interview that assessed their thoughts on evaluating sources of information, their perceived value of contextualizing scientific information, and their attitudes toward science (Appendix A). Students were randomly selected using sticks. This is a procedure commonly used in our classroom. Selected students were asked if they would agree to being interviewed and were told participation or nonparticipation would not affect their grade. If they agreed, that student was interviewed before the non-treatment unit and again after the final treatment unit. Typical interviews were conducted during student break times, and students were given the choice to choose their interview time. After notifying students their answers would be recorded, I saved all responses electronically. Student answers were used to summarize representative opinions of overall student thoughts and attitudes toward science journalism. The data gathered were used to support conclusions made by other sources of data in the project.

Table 1
Data Triangulation Matrix

Focus Questions	Data Source 1	Data Source 2	Data Source 3
1. What effect does science journalism have on ELL's ability to understand and express scientific ideas in academic language?	Pre- and post-unit Science Journalism Survey	Student journal and peer assessment notes	Pre- and post-unit article writing
2. What effect does science journalism have on ELL's ability to evaluate and use sources?	Pre- and post-unit Troge Science Journalism Interview	Pre- and post-unit Science Journalism Survey	Pre- and post-unit article writing
3. What effect does science journalism have on ELL's ability to contextualize scientific issues and information?	Pre- and post-unit Troge Science Journalism Interview	Student journal and peer assessment notes	Pre- and post-unit article writing
4. What effect does science journalism have on ELL's attitude toward science?	Pre- and post-unit Troge Science Journalism Interview	Student journal	Pre- and post-unit Science Journalism Survey

All students were given the Science Journalism Survey administered through the class Schoology website before the treatment and following the treatment (Appendix B).

The Science Journalism Survey contained items assessing each student's ability to understand and express scientific ideas in academic language, their ability to use and evaluate sources, and their attitude toward science. This survey contained multiple choice and short answer questions. Multiple choice questions were based on the following Likert scale: 1= *strongly disagree*, 2= *disagree*, 3= *agree*, 4= *strongly agree*. Short answer responses were grouped according to theme. Responses for each type of question were documented for frequency and compared for any changes following the treatment units.

Students used journal entries to record their thoughts about themes addressed in RATA sessions and their writing process during treatment units. This facilitated non-threatening communication in addition to verbal responses after RATA sessions. In addition, journal entries were used as a written assessment of each student's use of academic language, their ability to contextualize scientific information, and their attitudes toward science. I made note of important themes and quotes from each student electronically. Qualitative student responses from journals were used to support themes.

Students assessed each other's work and their own writing using the SAFI sheet. Using this tool, students analyzed and answered questions classifying the quality of the article's explanation of scientific ideas, use of sources, and relevance with context as: complete or nearly complete, needs improving, or absent. Quantitative data from these classifications were tallied from each treatment unit and compared. Students were also encouraged to leave additional comments for the author. These comments were tallied based on their subject and compared for change.

Copies of revisions and writing samples from each student were saved to assess progress in academic language use, evaluating and using sources, and contextualizing scientific information. Each student wrote an article before treatment, after the first treatment unit, and after the second treatment unit. All final drafts of student articles were analyzed and scores documented for comparison.

Academic language was evaluated based on three categories: vocabulary, syntax, and message. Vocabulary was assessed based on how appropriate vocabulary terms or science concepts were used and explained. Scores for vocabulary were evaluated based on the following scale: 0=*no evidence,* 1=*weak evidence,* 2=*strong evidence.* Scores for syntax were based on three elements: correct grammar, sentence or paragraph structure, and transitions. Scores for syntax were evaluated on the following scale: 0=*none or only one present,* 1=*two elements present,* 2=*three elements present.* Scores for the article's message were based on three elements: clarity and coherence, organization, and appropriate voice. Scores for the article's message were evaluated on the same scale used for syntax.

Evaluation and use of sources in student articles was based on three categories: number of appropriate sources referenced and used, number of websites listed at the end of the article, and number of vague references to sources within the article. Scores were attributed to these categories based on the following scale: 0=*no evidence,* 1=*evidence of one source,* 2=*evidence of two or more sources.* These numbers were tallied and compared for the three articles written by each student.

How students contextualized information according to type was classified into three categories: personal or immediate connection, local or connection with people near, and global or future connection. All connections students made within their three articles were tallied when present. Total connections were compared for each student's article and for the group.

DATA AND ANALYSIS

The results of The Science Literacy Survey items that questioned if students usually understand science terms or could infer their meaning from context indicated the number of students who *agreed* increased from 48% to 70% from the pre- to post-survey (N = 27). Students who *disagreed* with this statement decreased from 33% to 11% in the pre- to post-survey. One student shared a common struggle ELLs face when they wrote, "When I read about it I give my best to understand but sometimes I don't understand every term that the book shows me." When asked in the post survey if they felt more confident using science terms in their writing than they did before reading and writing science news in class, 74% of students either *agreed* or *strongly agreed*.

Peer assessment notes of first drafts written during the treatment units showed an increased frequency of comments about science vocabulary when successive treatment units were compared. During both sessions of peer assessments, students marked 31% of the article drafts they reviewed as *needs improvement* when asked if a clear explanation of science content was present. One student reminded another student through a peer review that, "terminology is hard to understand when you are not familiar with it." A journal entry written during the treatment units said, "I need to explain my terms and include words to make it sound clearer" and another student shared, "My article needs to have stronger words and more support."

The number of student articles demonstrating appropriate use and explanation of scientific vocabulary increased after each treatment unit (Figure 1). Analysis of student writing indicated 63% of students demonstrated *no evidence* and 26% demonstrated *weak evidence* of science vocabulary use and explanation in their first article (N = 27). After the first treatment unit, 56% of students demonstrated increased evidence they could use and explain scientific vocabulary. Following the second treatment unit, 44% of students showed growth in their vocabulary use and explanation in written articles and 78% of student articles included scientific vocabulary that was used appropriately and included explanation.

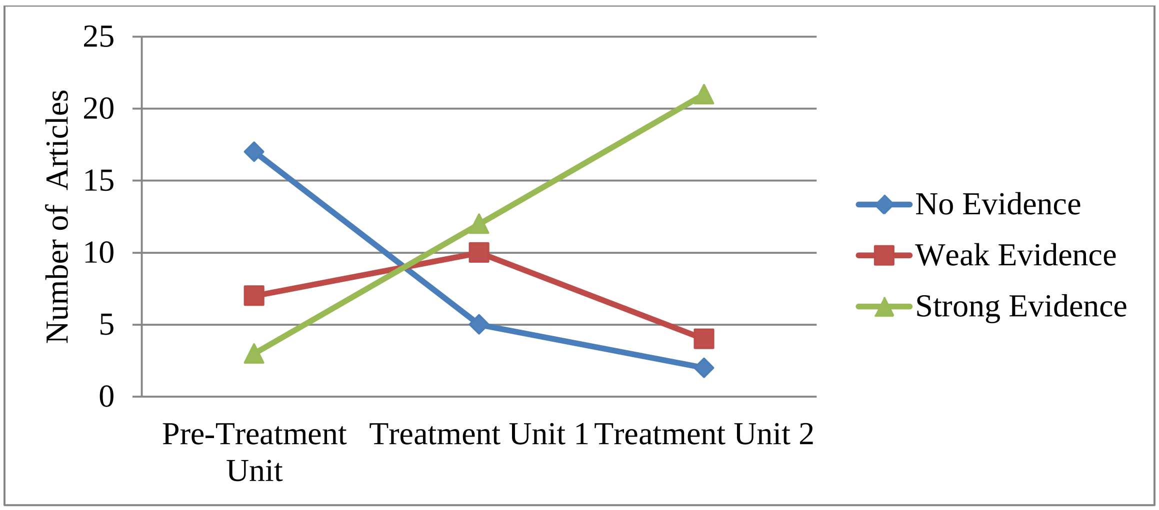

Figure 1. Use and explanation of science vocabulary in student articles, (N = 27).

The most frequent comment made in peer assessment notes was on the topic of syntax, which includes grammar, sentence and paragraph structure, and transitions. Multiple students shared the thoughts of one peer editor as they suggested in a note, “reread for grammar mistakes” and “work on sentence structure. Some of them are hard to understand.” Another student wrote about their writing process in a journal entry, “I would like to correct my grammar to let the reader know my purpose of why I am writing it.”

The number of student articles demonstrating the three syntax elements of correct grammar, proper sentence and paragraph structure, and transitions in article writing increased after each treatment unit (Figure 2). The percentage of student articles containing evidence of none or only one of the three elements of syntax decreased from 52% in the pre-treatment unit to 11% after the final treatment unit. After the first treatment unit, 37% of students increased their use of one of the elements of syntax and following the second treatment unit, 26% of students continued to improve their use of grammar, structure, or transitions. At the end of the final treatment unit, 30% of final drafts of student articles contained all three elements of proper syntax measured in this study.

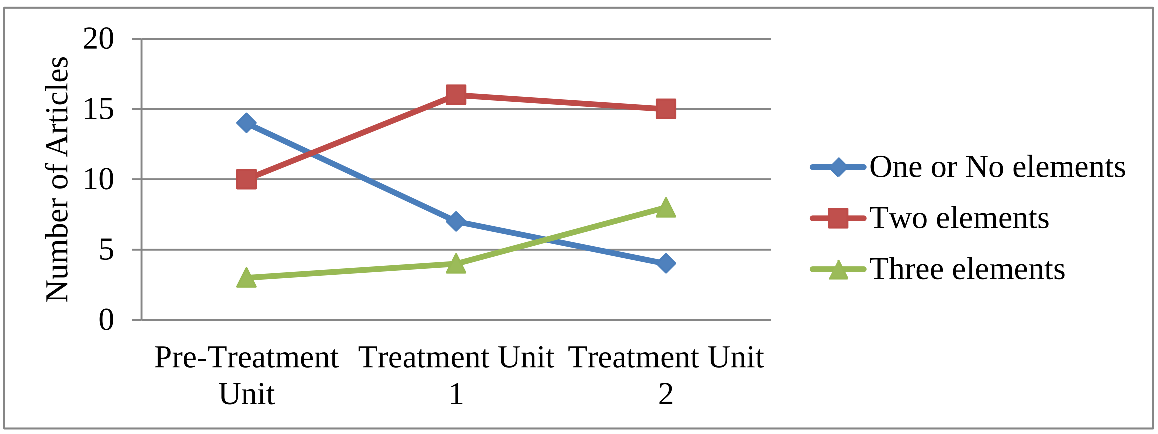

Figure 2. Elements of syntax present in student articles, (*N* = 27).

Although not as frequent a topic in peer assessment as syntax, student peer assessments included comments about the quality of article message such as, “make it more formal” and “work on organization of ideas.” One student asked another, “What are you trying to tell me?” In addition, a student summarized what they believed a quality science article message should include when they wrote in a journal entry, “Good science (writing) is narrow and explains the details.”

The number of student articles demonstrating clarity and coherence, organization, and appropriate voice as the three elements of a quality message in article writing increased after each treatment unit (Figure 3). Examination of pre-treatment unit student writing indicated 48% of the articles contained only one of the three necessary elements of quality message and only 7% contained all three elements. After the first treatment unit, 85% of student articles included two or more elements of quality message. Analysis of student articles after the second treatment unit showed no change in the number containing all three elements, but did show an increase in number of articles with two elements of a quality message present.

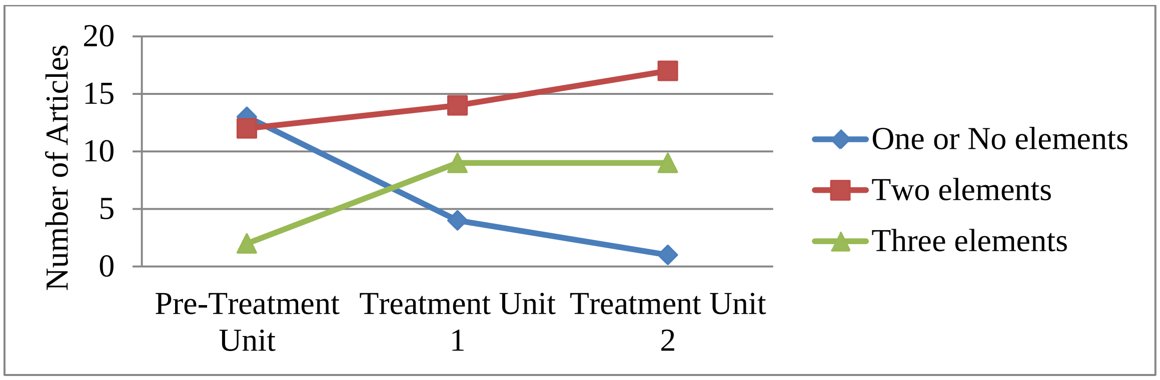

Figure 3. Elements of quality message present in student articles, (*N* = 27).

All of the students participating in the pre-treatment Troge Science Journalism Interview stated that evaluating information sources was important and were able to explain why it was necessary (*n* = 8). When asked what makes any source of information credible, 63% of responses included a reference to the credentials of the author or organization. When asked how they would identify a website as a credible source of information however, one student said they did not know, and 75% of the students responded by describing a quality website as one with a professional-looking appearance and without a ‘wiki’ or ‘answers’ in the site name. Student confidence and ideas about evaluating sources were additionally probed with items in the Science Literacy Survey before and after treatment units. When asked to rate their strength in finding quality sources of information before the treatment unit, 33% responded with comments indicating they were uncertain or thought their ability to find quality sources was insufficient. One student wrote, “I feel very unskilled, unless I use an online database provided by the school, but still these are very hard to use at times.” Another student responded, “I believe my skills in researching are fairly good because I like to find a lot of examples and sources that have quality information, instead of just grabbing whatever.”

In the survey following the treatment units, the number of students who *agreed* or *strongly agreed* when asked if they were able to find information about sources increased from 85% to 96%. Student responses indicating they knew background information about the organization responsible for published information used increased slightly after the treatment unit from 44% to 56%. In post-unit interviews, the same students were asked again how they would identify a website as a credible source of information. All students interviewed indicated that knowledge of the website author, publisher, or credentials was necessary to evaluate a site’s credibility. Student responses that indicated uncertainty or poor confidence in their ability to find quality sources decreased from 33% to7% in the survey following the treatment units. In response to this item one student wrote, “My skills in finding quality sources have improved a lot. Now I am able to tell when a source is reliable or not and when it is applicable to my topic.”

When asked to evaluate and use sources in their article writing, students showed improvement in both the number of sources used and in the manner they were used (Figure 4). The total number of quality sources used and referenced correctly and the total number of references listed at the end of an article increased from pre-treatment unit to the second treatment unit. The number of vague allusions to sources in articles without explanation or additional citation increased from pre-treatment unit articles to the first treatment unit article and then decreased after the final treatment unit.

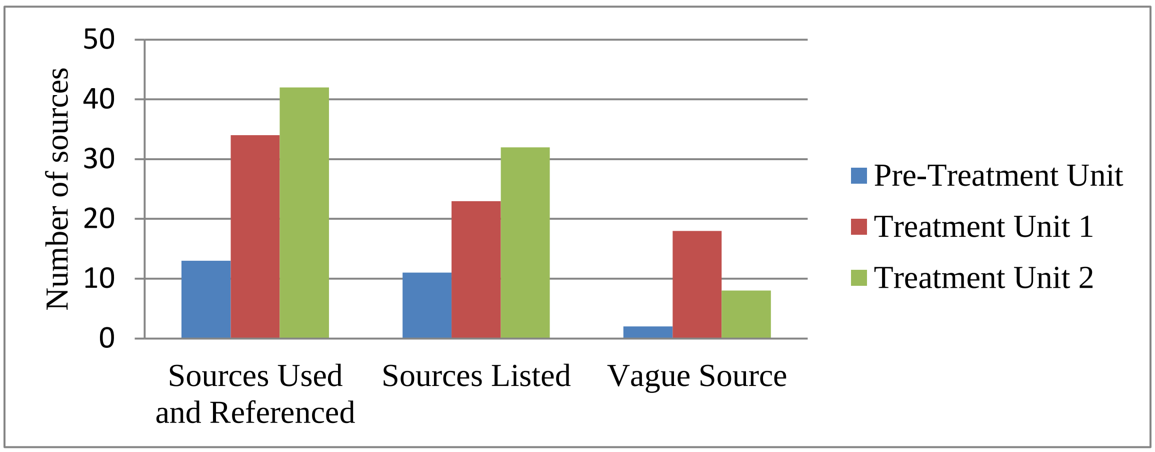

Figure 4. Sources present in student articles, (*N* = 27).

Data from students participating in the Troge Science Journalism Interview indicated that before treatment units, 75% of students connected with science related stories when they saw health-related or other issue that interested them personally. When asked if they usually think of how they or others may be affected by the science-related issue, 38% responded *sometimes* or *no* and 25% of the affirmative responses included an explanation or an example. Student articles written in the pre-treatment unit demonstrated the number of connections that were classified as personal/immediate was equal to the other two classification groups combined (Figure 5).

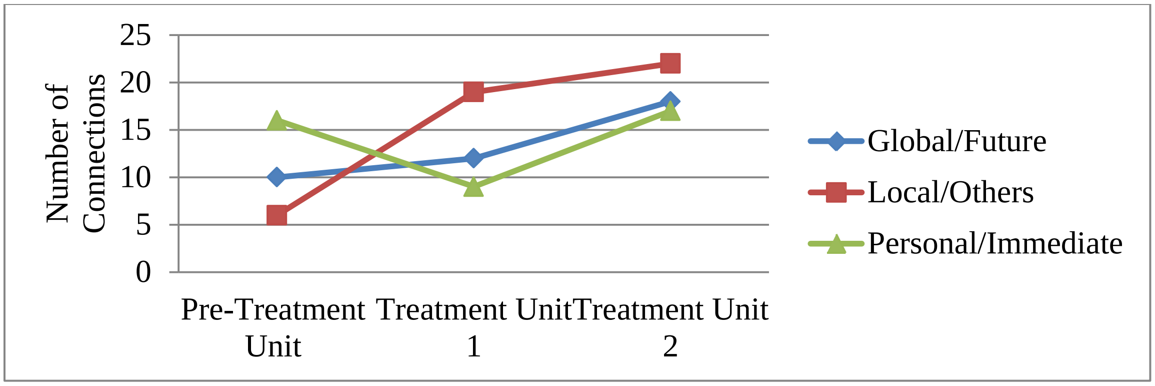

Figure 5. Number of connections by type, (N = 27).

After the first treatment unit, six out of the seven first draft peer assessment notes on the topic of context include suggestions that the author use a different point of view or add a personal connection. During this stage of treatment, connections between science and personal or immediate connections dropped to 23% of the total connections included in student articles. During the second treatment unit, four out of six first draft peer assessment notes offered specific suggestions about expanding the author's perspective. One student recommended to another that they "get viewpoint of business guys, current energy providers, and environmentalists" to help contextualize the article. Interviews conducted after the treatments also indicated student ability to make connections, as all students responded *yes* and 75% of responses included an explanation or an example when asked how they or others may be affected by the science-related issue. Final drafts of student articles after the second treatment unit exhibited an increase in each type of connection made. One student wrote in their journal that they "can see how things affect the lives of people and populations."

When writing articles in the pre-treatment unit, 78% of students explained their science issue in one context or from one perspective (Figure 6). After the first treatment unit, 48% of student articles included two or more points of view or connections. Student peer assessment notes of first drafts during this stage had indicated that 58% of articles either *needed improvement* or were *absent* in the category of including viewpoints from more than one perspective. This assessment decreased to 43% as students assessed peer first drafts of articles in the second treatment unit. In a journal entry during the second treatment unit a student reflected, “since we began reading articles in class I’m better able to pick up on [science issues]…the articles we read in class all discuss specific news and explain specific implications.” After the final treatment unit, 85% of final drafts of student articles included two or more points of view or connections of a science issue.

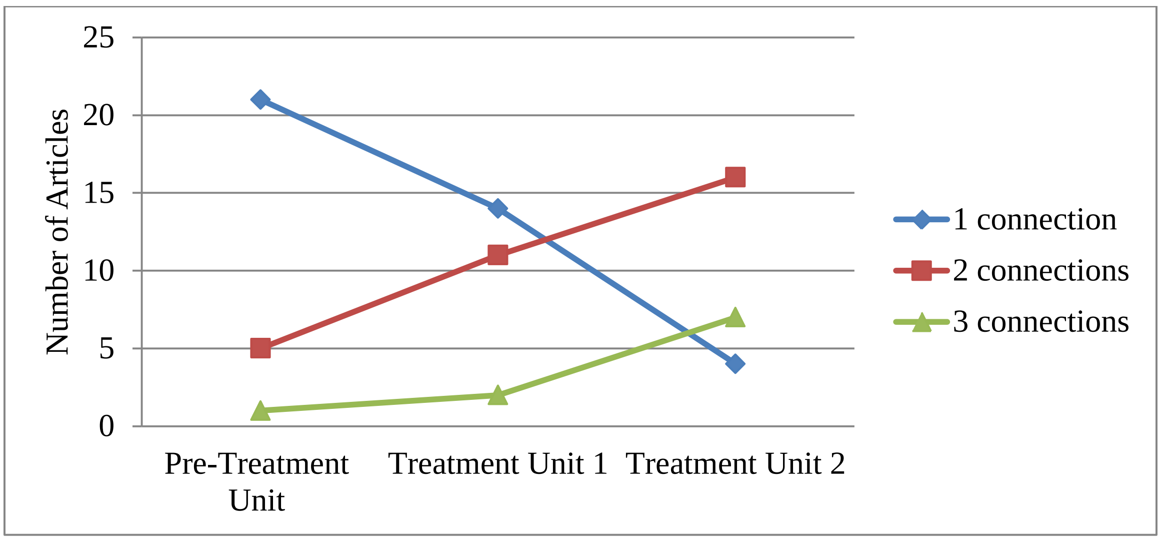

Figure 6. Articles with multiple connections, (N = 27).

Student attitudes toward science were probed in the pre-treatment unit Science Journalism Survey where one student shared, “Science is important to everyone's lives, because its improvements interfere [*sic*] in our way of living. Because of that, it is extremely important.” Items addressing student attitudes toward science learning comprised four questions on the survey. When asked if they enjoyed learning about science discoveries or something they didn't know before, 96% of students either *agreed* or *strongly agreed* both times the survey was given (Figure 7). Similarly, the number of students *agreed* or *strongly agreed* that learning more about science-related topics is interesting or fun changed little from the pre- to post- survey. The item addressing reading about science received more *strongly disagreeing* or *disagreeing responses* than other questions. This question also showed an increase in *agree* and *strongly agree* responses from pre-to post unit survey as well as a decrease in *disagree* or *strongly disagree* responses. Student interviews supported this data as 88% of responses indicated students would describe themselves as interested in science related subjects, and 63% said they tend to read science related articles online before and after the treatment unit.

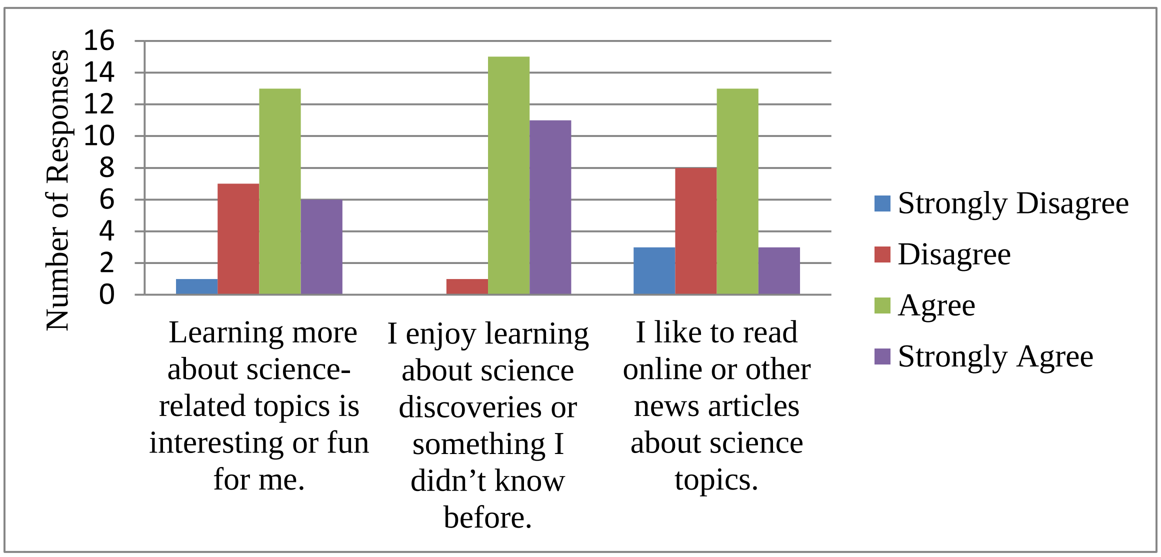

Figure 7. Student attitudes about science learning, (*N* = 27).

Survey participants also described their feelings toward reading and writing about science-related topics. Students expressed their preference for reading over writing in 41% of pre-treatment unit survey responses. One student typified the group sentiment when they wrote, “I enjoy reading about scientific discoveries much more than I enjoy writing science related topics.”

After the treatment units when asked to share their opinions through a journal entry about reading science news articles in class RATA sessions, one student wrote, “it is very beneficial because when we have something we don’t understand we can discuss and we can relate the news to stuff we are learning.” Other students shared, “It’s engaging” and “it’s helpful to read topics that are interesting to me. I enjoy it and I think people benefit.” When asked to describe their feelings on writing about science topics, 67% of students expressed negative feelings in the pre-unit survey, while 15% expressed negative feelings in the post-unit survey. In another journal entry, students wrote about the challenges they encountered as they wrote and their opinion of writing science news articles. A student wrote, “When I write a science thing I look for something I care about and I feel I need to know. The hardest part is trying to express what I feel because it’s hard to write in English.” Another student shared that writing a science article was, “developing your knowledge of a topic and writing and thinking skills, it’s like a win-win situation. Its writing and its science related.”

INTERPRETATION AND CONCLUSION

The research I have conducted provided some evidence that incorporating science journalism can develop ELL student use of academic language. This was made clear though the change in responses to survey items, student comments, and most importantly, in their writing. Listening to my students reinforced my awareness that ELLs can find scientific academic language challenging if not overwhelming. I believe RATA sessions have served as a model for coping with formal text by demonstrating how even native English speakers use strategies and context to decode words. I also believe improvement seen in the use of academic language in my students' writing was partly generated by completing multiple article-writing tasks. Successive increases in scores after each treatment unit showed that writing supported by peer reviews and modeled continually by professional news articles in RATA sessions led to continued improvement as it provided additional practice in the writing process.

Although student use and attribution of sources showed some improvement in student article writing, and most students reported through the survey they feel more comfortable working with information from resources, I believe they still can develop in this area. While students communicated their grasp of the reasons why credible sources are necessary, searching for and identifying quality sources remained a challenging step in the writing process for many of my ELL students. I plan to continue to model and allow students to practice source analysis in my science courses. I would also like to develop the steps in the process my students use to approach their research and select their sources because this skill is essential for further academic success and scientifically literate citizens.

The most important change evident from the number and variety of connections in student writing was the increase in my student's ability to contextualize scientific information. RATA sessions were based on varied topics and were often driven by student interest which provided ELLs with multiple opportunities to connect with science topics and reflect on issues from different perspectives. Contextualizing and applying scientific information in multiple settings or perspectives is a main goal in developing scientifically literate young people, and after these treatment units, my students have grown in this discipline. Student interview responses and journal comments indicated that they were able to find topics that were interesting and personally relevant, which in turn increased their motivation, interaction, and ultimately their ability to produce quality work.

VALUE

This study has benefitted my students by strengthening their writing skills, developing their scientific literacy, and creating an additional personal connection. One of the areas of concern for ELL high school students is their struggle with writing. I feel that in a small way I have been able to help them in this journey and contributed to their success. Through RATA sessions, I have also created an enjoyable environment in my classroom where students feel comfortable asking questions and discussing science topics that are interesting to them.

My study incorporating journalism into a classroom full of ELLs has changed me as an instructor and more specifically as a teacher to my students. Using science articles and writing has developed my appreciation for a solid tool that can be used to communicate with students about science regardless of their background knowledge or language ability. Strengthening my students' ability to investigate, analyze, and apply science in their lives gives me a satisfaction knowing I may have impacted their perspective on the world in a small way. In addition, I believe that no matter what classroom or context I teach in, continuing to incorporate the action research based process will continue to strengthen my teaching because my practice will continue to be informed by evidence and data.

I am also a better teacher for the students in my classroom right now. Listening to and learning from my students has allowed me to understand a little more about the academic and personal challenges they face as ELLs. With more understanding, I am able to meet the needs of my students though adjusting my instruction while maintaining high expectations for their performance.

REFERENCES CITED

Antilla, L. (2010). Self-censorship and science: A geographical review of media coverage of climate tipping points. *Public Understanding of Science, 19*(2), 240-256.

Castaneda, M., & Bautista, N. (2011). Teaching science to ELLs, Part 1 and 2. *The Science Teacher*, *78*(3), 35-44.

City of Doral. (2012). *Doral statistics.* Retrieved December 1, 2012, from http://www.cityofdoral.com

Colburn, A., & Nguyen, H. (2012). Every word you speak. *The Science Teacher*, *79*(4), 58-61.

Coleman, R., & Goldenberg, C. (2010a). What does research say about effective practices for English learners? Part II: Academic language proficiency. *Kappa Delta Pi Record, 46*(2), 60-65.

Coleman, R., & Goldenberg, C. (2010b). What does research say about effective practices for English learners? Part III: Promoting literacy development. *Kappa Delta Pi Record*, *46*(3), 106-111.

Cummins, J. (1984). Wanted: A theoretical framework for relating language proficiency to academic achievement among bilingual students. *Language proficiency and academic achievement,* 2–19. Clevedon, Avon, England: Multilingual Matters.

Echevarria, J., Short, D., & Powers, K. (2006). School reform and standards-based education: A model for English-language learners. *Journal Of Educational Research*, *99*(4), 195-210.

Echevarria, J., Richards-Tutor, C., Canges,R., & Francis, D., (2011): Using the SIOP model to promote the acquisition of language and science concepts with English learners: Bilingual research journal. *The Journal of the National Association for Bilingual Education,* 34(3), 334-351.

Goldenberg, C. (2008). Teaching English language learners: What the research does—and does not—say. *American Educator 32*(2), 8–23, 42–44.

Guzzetti, B., & Bang, E. (2010). The influence of literacy-based science instruction on adolescents' interest, participation, and achievement in science. *Literacy Research and Instruction*, *50*(1), 44-67.

Harper, C., & de Jong, E. (2004). Misconceptions about teaching English-language learners. *Journal Of Adolescent And Adult Literacy*, *48*(2), 152-162.

Huerta, M., & Jackson, J. (2010). Connecting literacy and science to increase achievement for English language learners. *Early Childhood Education Journal, 38*(1), 205-211.

Lee, O., & Fradd, S. H. (1996). Literacy skills in science learning among linguistically diverse students. *Science Education, 80*(6), 651-71.

Lee, O. (2005). Science educations with English language learners. *Review of Educational Research, 75*(4), 491-530.

Lemke, J. L. (1990). *Talking science: Language, learning, and values.* Norwood, NJ: Ablex Publishing.

McClune, B., & Jarman, R. (2010). Developing students' ability to engage critically with science in the news: Identifying elements of the "Media awareness" dimension. *Curriculum Journal, 21*(1), 47-64.

McClune, B., & Jarman, R. (2011). From aspiration to action: A learning intentions model to promote critical engagement with science in the print-based media. *Research In Science Education, 41*(5), 691-710.

National Center for Education Statistics. (2012). *The Condition of Education 2011*. US Department of Education. Retrieved November 30, 2012 from http://nces.ed.gov/programs/coe/tables/table-lsm-1.asp

National Research Council (NRC). (1996). National science education standards. Washington, DC:National Academy Press.

O'Neill, K., & Polman, J. (2004). Why educate "Little scientists?" Examining the potential of practice-based scientific literacy. *Journal of Research in Science Teaching, 41*(3), 234-266.

Polman, J., Newman, A., Farrar, C., & Saul, E. (2012). Science journalism. *The Science Teacher, 79*(1), 44-47.

Roth, W., & Lee, S. (2004). Science education as/for participation in the community. *Science Education, 88*(2), 263-291.

Saul, W., Kohnen, A., Newman, A., & Pearce, L. (2012). *Front page science: Engaging teens in science literacy.* Arlington, VA: National Science Teachers Association.

Shamos, M. H. (1996). The myth of scientific literacy. *Liberal Education, 82*(3), 44-49.

Teachers of English to speakers of other languages (TESOL). (2006). Pre-K-12 English language proficiency standards. Alexandria, VA: TESOL.

van Eijck, M., & Roth, W. (2007). Rethinking the role of information technology-based research tools in students' development of scientific literacy. *Journal Of Science Education And Technology*, *16*(3), 225-238.

APPENDICES

APPENDIX A

TROGE SCIENCE JOURNALISM INTERVIEW

TROGE SCIENCE JOURNALISM STUDENT INTERVIEW

Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way.

1. Do you think it is important to evaluate information sources? Why or why not?
2. What do you think makes any source of information credible or not credible?
3. How can you tell if a website is a credible source of information?
4. When you read or hear about a science-related story in the news, what is your usual reaction?
5. When you read or hear a science-related story in the news, do you usually understand the main idea?
6. When you read or hear a science-related story in the news, do you usually think of people that might be affected by it?
7. Do you tend to read online or other news articles about science topics? Why or why not?
8. Would you describe yourself as interested in science related subjects? Why or why not?
9. How would you describe your attitude towards science?

APPENDIX B

SCIENCE JOURNALISM SURVEY

SCIENCE JOURNALISM SURVEY

Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way.

Please answer according to the scale below:

1= Strongly Disagree

2= Disagree

3= Agree

4= Strongly Agree

1. When I see science words in something I read, I usually understand them or can figure them out using the context.
2. Most of the time I use information I already know to try to understand the meaning of science words I don't know.
3. If I don't know a science word, I usually have to look up the meaning.
4. When I use a website or other source, I know background information about the organization or person that published that information.
5. I am able to find out the sources of information on the internet.
6. When I look for information online, I usually use Wikipedia as a source.
7. I like to read online or other news articles about science topics.
8. I enjoy learning about new science discoveries or something I didn't know before.
9. Learning more about science-related topics is interesting or fun for me.
10. I am more confident when using science terms in my writing than I was before I practiced reading and writing science news in this class.*

*included only in post unit survey