Using science news articles in the secondary science classroom: The effect on students’ summative assessment scores and attitudes toward science.

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☐ Checking this box indicates that the IRB Consent form is appended to this document.

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ABSTRACT

Previous research in education suggests that science literacy has historically been lacking, despite its undeniable importance in the sciences. In 2005, only 18% of 12th grade students were considered to be proficient in science (National Center for Educational Statistics, 2006). Many teachers report using science news in their classrooms to promote science literacy, but few do so frequently. Promoting students’ capacity for reading science news and enhancing science literacy skills are exceedingly important in the 21st century. This research seeks to investigate how the use of science news reports in the secondary science classroom to supplement and reinforce key concepts affects students’ summative assessment scores and their attitudes toward science. Student attitudes toward science were measured with the Attitudes Toward Science Inventory (ATSI) both before and after a five-week period of using science news articles. Four class sections of a high school biology class served as experimental groups and two sections served as control groups. Paired t-tests of the ATSI total scores revealed a statistically significant increase in student’s enjoyment of science in one class section. Another section of the experimental group saw a significant decrease in test scores. Student interviews provided additional data, which often contradicted the ATSI findings because interview responses were overwhelmingly positive regarding the use of science news articles. Students reported that the articles usually helped them prepare for tests, and made them more interested in how science is conducted in the real world. Because of the high correlation between student attitudes and achievement, further research is needed to determine the most effective ways to employ science news such that it promotes a positive attitude toward science as well as reinforces basic scientific concepts.
Chapter 1

INTRODUCTION

Background

Few would argue that humanity’s reliance on science and technology is growing, thus making these highly important topics for formal education. Despite rapid and influential advances in science and technology, many high school students appear bored and disinterested in their science classrooms. This problem may be the result of a missing connection between the science curriculum and students’ daily lives and interests. To improve scientific literacy and increase enthusiasm in the classroom, teachers must form and strengthen this connection. Science is relevant and important to students’ lives, and it is the duty of science teachers to use all possible resources to illustrate how science impacts all of us.

News media is the most common channel for the general public to learn about scientific research. Articles and videos from newspapers and magazines online and in print are invaluable sources of information and are widely available. Because they are mostly free and easily accessible, students should be provided opportunities to engage with these media sources. Using media reports may play an important role in connecting classroom learning materials with students’ lives and interests, both with ongoing scientific research and new discoveries. Use of current news media may be an excellent way to demonstrate the relevance of concepts covered in class to the current and future lives of students. Because young people are increasingly reliant on technology in their everyday lives, the use of online science news in the classroom may also enhance student interest in science. The potential benefits of using current news media extend beyond the connection of science class to daily life. Utilizing scientific news in the secondary
classroom may help promote both science literacy and media literacy, not to mention critical reading and critical thinking skills.

**Problem**

Much of the literature on the topic suggests that science literacy has not been emphasized in science education in the past (Liu, 2009; Norris & Phillips, 1994; Norris *et al.*, 2003). To address this problem, many teachers report using media reports in the classroom to encourage discussion, provide examples where needed, and demonstrate the connection between science, technology, and society. A majority of these teachers report positive student reactions to using media reports (Kachan *et al.*, 2005), but little research exists on the quantitative and qualitative effects on students. It may be important to understand how the use of science news reports in the secondary science classroom effects students’ interest in, and attitudes towards, science. Furthermore, can an effect on summative assessment scores be demonstrated? These are the topics this project seeks to address.

**Research Questions**

This study is guided by two fundamental research questions: (1) does the increased use of science news articles in the secondary science classroom have an effect on students’ attitudes toward science? and (2) does the use of science news articles increase student test scores? It is my own expectation that the answer to both of these research questions is yes.
Rationale for the Study

The importance of science literacy is indisputable. Science literacy allows people to comprehend research in many fields, be it in biomedical science or engineering, and to understand how it relates to them. Science literacy also helps individuals to make well-informed decisions in all aspects of their lives. Because many scientific fields are continuously advancing, science literacy is increasingly necessary and there exists a greater demand for scientifically literate people (Liu, 2009). For these reasons, it is exceedingly important to make high school students informed of salient and current scientific issues. Including more science news in the science classroom may make this possible. However, examining the effects of using more science news on student attitudes and test scores are important first steps.

Definition of Terms

Science literacy – Literacy with regard to science. Understanding scientific explanations of the natural world, the ability to evaluate evidence and explanations, understanding the way in which we develop scientific knowledge, the ability to take part in scientific experimentation and discussion (National Research Council, 2007). Furthermore, science literacy is the ability to connect science to everyday experiences and use scientific information where needed (Feinstein, 2010).
Chapter 2

REVIEW OF LITERATURE

Introduction

Science affects our day-to-day lives more than it ever has before. Given that media reports of scientific research are the most common way that people encounter, explore, and scrutinize scientific research, it’s profoundly important that secondary students are given opportunities to engage with science in the news and learn to critically evaluate it as well (Norris, Phillips, and Korpan, 2003). Reading and evaluating scientific news in the classroom may be helpful for teaching science while simultaneously teaching critical reading skills, critical thinking skills, and promoting both media literacy and science literacy. Furthermore, news articles covering scientific concepts can influence peoples’ opinions by the way in which they describe and organize stories (Norris et al., 2003), adding importance to learning to read with an analytical and skeptical mindset.

Including some form of media literacy in education has been increasing in occurrence since the early 1990s; however, the number of students that see any instruction in media literacy is still small. This is perhaps due to a perceived lack of time caused by teaching for high-stakes tests, or a lack of technology access (Hobbs, 2005).

Liu (2009) offers a new idea of science literacy, which includes continuing engagement and involvement in science activities and media throughout one’s life. That new definition, combined with an increased emphasis on science literacy in secondary school curricula (Liu, 2009), seems to suggest a necessary duty of teachers to increase the use of real world science news media which is similar, or identical, to that which students are likely to encounter after graduation and into their adult lives.
Science Literacy, and its Varying Conceptions

Any conversation about science literacy must start with defining the term. A prerequisite to this, however, is determining whether to use “science literacy” or “scientific literacy,” and determining the difference. Liu (2009) notes that much of the literature on the topic uses both terms interchangeably, or without first defining them. Liu stresses that “scientific literacy” is often misused. Scientific literacy should be used when speaking of science as it pertains to literacy, that is, the “scientific nature of literacy in all forms.” On the other hand, science literacy is the term that should be used when speaking of literacy as it pertains to the subject of science, such as in this paper (Liu, 2009). Despite finding few other papers in the literature addressing this distinction, this paper will solely use “science literacy” to avoid any confusion.

Science literacy is especially hard to define and no widely accepted definition seems to be present within the literature, despite many papers describing science literacy at length. Norris and Phillips (2002) first aim to make readers aware of the distinction between the fundamental and derived senses of literacy. They define the fundamental sense of science literacy as the ability to read and write, the ability to interpret text, evaluate statements, and identify how portions of the text relate to others. The derived sense of science literacy is defined as being generally educated and intelligent with regard to science. Educators often overlook this fundamental sense and assume that their students already possess it (Norris & Phillips, 2002). This is also supported by another Norris and Phillips (1994) study finding that students are not being taught to critically interpret what they read, and tend to take many statements to be true when they should not. The ability to read science articles is not enough, and certainly does not qualify as science literacy (Norris & Phillips, 1994).
These two senses of science literacy are not always discussed in the literature, however Feinstein (2010) seems to be promoting a conception of science literacy that is aligned to the fundamental sense detailed by Norris and Phillips. Science literacy may be seen as the ability to recognize when science is relevant to oneself and the capacity to consume sources of scientific information so as to meet their needs. This would mean that obtaining an adequate level of science literacy is equivalent to being a “competent outsider,” that is, the ability to connect science to everyday experiences and use scientific information where needed, rather than being knowledgeable in scientific research and literature (Feinstein, 2010).

Numerous other distinctions within the topic of science literacy are made in the literature. Whether it’s identifying six elements of science literacy, pointing out three types of science literacy, separating the content dimension and reasoning dimension of science literacy, or detailing a continuum from nominal literacy to multi-dimensional literacy, the confusing and diverse conceptions of science literacy are pervasive in the literature (Liu, 2009). Regardless, Liu (2009) calls for a new conception of science literacy that addresses the reality of how people learn and that children spend more time outside of school than in school. Science literacy needs to be considered as “both a state and life long process, as both a personal choice and an economic necessity, and as both a personal enhancement and civic participation.”

Benefits of Science Literacy and Media Literacy

Despite the varying conceptions and definitions, the importance of science literacy seems to be easier to agree on. Very few people would disagree with the assertion that science literacy is a valuable quality. The case for science literacy includes several themes: It allows people to be well-informed about important information; it is used to make better decisions; it enables more
economic competitiveness for individuals and for a country; it has the capability of producing a more ethical world; and it is increasingly necessary due to perpetual advances in science and technology (Liu, 2009).

In the literature relating to media literacy with regard to science, it seems clear that students need to be taught basic media literacy skills in order to engage with mass media reports. In a study attempting to identify skills and prior knowledge necessary for understanding science in the news, Jarman and McClune (2010) conclude that some comprehension of how the field of journalism and reporting works is necessary for proficiency in reading science news. It seems that too often students may mistake news reports on science for the primary source. Furthermore, students are prone to overestimating the truth of articles and the statements within articles, even when the author doesn’t express the statements as absolutely true (Norris & Phillips, 1994).

Knowing more about how the media works allows readers to consider and understand the intent of the author (Norris & Phillips, 1994). Furthermore, readers may be able to interpret the intent of the sentence, the intent of the article, and the intent of the publication, or at the very least understand that such intentions exist (Norris et al., 2003). Students not only need to understand what’s being presented to them, but also how it’s being presented (Thier, 2005). However, discussions on journalism as a profession or as an industry seldom if ever take place in the secondary science classroom (Jarman & McClune, 2010).

Other benefits of gaining a proficient level of media literacy may be as simple as the ability to distinguish between science reporting and a scientific study. In addition, valuable components of media literacy include understanding that journalists are not scientists, understanding that media are often biased, and understanding the inherent limitations of science reporting (Jarman & McClune, 2010). These limitations may include the need to attract readers
more than the need to accurately report information, the relative scientific ignorance of journalists, or the necessity of making articles relatively short.

Another valuable skill for students to learn in the context of media reports and science is to use their own content knowledge to evaluate the article. Too often students evaluate media reports as stand-alone documents, rather than using their own content knowledge in their evaluation. Tsai et al. (2013) show that simply prompting students to read and evaluate media reports with their own content knowledge in mind improves those students cognitive achievement. Students who were prompted to read critically and use their content knowledge were better able to identify claims and data within science articles than those students who were not prompted (Tsai et al., 2013). This may suggest that students often possess a higher level of media literacy than they tend to use if they are not reminded to read critically and think about their content knowledge.

**Methods of Using Science News in the Science Classroom**

Within the literature related to using media reports on science in the classroom, the approaches to doing so are diverse. Numerous case studies, quantitative research studies, and teacher surveys exist examining the topic. Two themes seem to be prevalent. First, when teachers are surveyed it seems that a majority of teachers report using media reports in their science classrooms. However, the second theme is that few report using them frequently (Jarman & McClune, 2001; Kachan et al., 2005).

Kachan et al. (2005) reported that in a survey of science teachers the two most common sources for science news were newspapers and magazines, with the Internet ranking third, ahead of television and radio. However, their survey results are ten years old and it’s reasonable to
expect that you would get different results today (presumably with more teachers reporting using the Internet as a source). In that study, teachers reported that they most often used media reports to encourage discussion and provide examples. The most common goal reported among the surveyed teachers was to stress the importance of the connection between science, technology, and society (Kachan et al., 2005). This is very similar to another study finding that the most common intended use of newspapers in the classroom was to demonstrate the connections between the content and the students’ everyday lives (Jarman & McClune, 2001). The large majority of teachers were able to cite examples of positive student reactions to using media reports, while no teachers were able to provide examples of negative responses (Kachan et al., 2005).

A valuable method for incorporating current events into the science classroom may be having students keep a news blog. Ruget and Rosero (2014) used this approach in four college political science courses and conducted pre- and post-tests measuring student enjoyment and proficiency in media literacy skills. Students were required to follow the news from a particular country, keep a blog about it, and act as the class expert on that country during class discussions. The students reported that the news blog assignment contributed to their comprehension of class concepts and made the class more interesting (Ruget & Rosero, 2014). These results echo Tsai et al. (2013) who express the importance of teachers using science news in the classroom that directly relates to the content being covered in class, rather than stand-alone articles that may be interesting but have nothing to do with the current content being covered. The discussion component of this assignment was also important. Using media reports in science should focus on having students form arguments related to the science news while using their content knowledge to do so (Tsai et al., 2013).
Post and Sadler (2010) also seem to be in agreement that news or current events used in the classroom need to be directly tied to the content. In a classroom case study in which a science lesson was based around a popular current events topic, they reported that using current events in the science classroom helped students to see the effect of science in their own lives. In addition, students were much more able to appreciate the complexity of scientific issues (Post & Sadler, 2010).

Another valuable tool for promoting media literacy is providing students with a list of questions that helps them read the article more carefully. Potential questions might ask about the author’s purpose, the targeted audience, whether the author cited sources, or if any values are being promoted (Thier, 2005).

Current State of Science Literacy and Media Literacy

It seems to be a consensus in the literature that the current level of science literacy and media literacy in secondary school students is less than ideal (Daunic, 2011; Norris & Phillips, 1994; Norris et al., 2003). One prominent example is that many students seek statements of certainty in media reports of science. This happens at both the secondary level (Norris & Phillips, 1994) and the university level (Norris et al., 2003). Such statements of certainty seldom exist in science, and are sometimes falsely included in media reports (Norris et al., 2003). Most introductory science courses at the collegiate level do not focus on science literacy, but instead focus on covering content (Reynolds & Ahern-Dodson, 2010). And the total number of secondary students that receive any instruction in media literacy still remains small (Hobbs, 2005). Furthermore, students report that the science they learn in school is seldom relevant to their lives and futures (Danaia et al., 2013), and others agree (Feinstein, 2010).
These problems have caused desire for education reform among many. And due to rapid technological advances and globalization in the 21st century, there is an increased demand for scientifically literate people (Liu, 2009). Science teachers should begin to view themselves also as science reading teachers if they wish to see an improvement in student comprehension (Norris et al., 2003). Promoting students’ capacity for reading science news and obtaining valuable media literacy skills can be easily structured into simple educational units (Jarman & McClune, 2010). Science news should be much easier to access and use in the 21st century. Student surveys show that students have more access to computers and the Internet today than they did at the beginning of the century (Danaia et al., 2013).

Measuring Student Attitudes Toward Science

A strongly positive correlation between student attitudes and achievement highlights the importance of student attitudes toward science (Shah and Mahmood, 2011). Many studies have examined student attitudes toward science, using both qualitative and quantitative data. Researchers that intend to measure student attitude must develop a valid and reliable instrument for evaluation. Numerous such instruments exist in the literature, using myriad designs and sub-factors related to student attitudes (Shah & Mahmood, 2011). Despite the variety of measurement techniques, Gogolin and Swartz (1992) note that research into attitudes has suffered from a dearth of definitions. In the past, researchers have often confused and conflated cognitive “scientific attitudes” with affective “attitudes toward science.” Attitudes toward science (used in this study) may be defined as the feelings and values one holds with regard to science as a whole, the undertaking of science, science in school, or the influence of science on society at large (Gardner, 1975; Osborne, Simon, and Collins, 2003).
Perhaps one of the more prominent instruments used in measuring student attitudes, the Attitude Toward Science Inventory (ATSI) has stood up to scrutiny in the literature (Gogolin & Swartz, 1992; Weinburgh, 2000; Shah & Mahmood, 2011). The ATSI is a 48-item inventory utilizing a six point Likert scale. The 48 items are divided into six subscales of eight items each. The subscales include perception of the science teacher, anxiety toward science, value of science in society, self-concept in science, enjoyment of science, and motivation in science. The ATSI has proven to be a reliable and valid instrument in assessing student attitudes toward science (Gogolin and Swartz, 1992; Weinburgh, 2000).

Conclusion

Despite arguments over what we actually mean by the term “science literacy,” few people deny that it’s a valuable goal for students and people in general (Liu, 2009). Media literacy is also a valuable goal, both as a tool for increasing science literacy, and as a desirable skill in its own right (Daunic, 2011; Hobbs, 2005; Jarman & McClune, 2010). An emphasis on science literacy and media literacy seems to be historically lacking in science education (Liu, 2009; Norris & Phillips, 1994; Norris et al., 2003), although some improvement may be occurring in recent years (Daunic, 2011; Hobbs, 2005).

More frequent use of real-world news media in the science classroom seems to be beneficial for science literacy, critical thinking skills, and literacy skills in general. If this is the case, what do students think of it? How does it change their attitudes toward science? How does it affect their scores on summative assessments? The purpose of this study is to investigate these topics by using science news articles in the classroom as a way to connect the classroom topics to real-world examples and experiences.
Chapter 3

MATERIALS AND METHODS

Participants

The study was conducted at Vinton County High School in McArthur, Ohio. The Southeastern Ohio community is rural and predominantly white, with 32.9% of the population living below the poverty level (United States Census Bureau). This study took place in a freshmen-level general education Basic Biology class. Survey data were collected on all students willing to participate in six sections of the class, which amounted to 73 students in total. These students included 7 sophomores with the remainder of 66 being freshmen. Summative assessment data were collected on 99 students. These students included twelve sophomores, and one junior, with the remainder of 86 being freshmen. The gender distribution of the 99 students was 53 females and 46 males.

Procedures

All class sections received and completed an Attitudes Toward Science Inventory (ATSI) at the beginning of the study. The ATSI is a 48-item survey utilizing a six-point Likert scale (strongly agree, agree, weakly agree, weakly disagree, disagree, strongly disagree). The ATSI included six subscales: perceptions of the science teacher, anxiety toward science, value of science in society, self-concept in science, enjoyment of science, and motivation in science. These surveys were collected and the answers were entered into Microsoft Excel. Each students’ responses were summed for each subscale to give six attitude scores per student.

For five weeks, science news articles were incorporated into the Basic Biology instruction of four out of six sections. The other two sections served as a control group. Science
news was not previously included as part of classroom instruction at any time. Within the five weeks, the experimental classes covered six science news articles that were relevant to the current topic being addressed in the class. They were always used to reinforce key concepts of the curriculum with interesting and relevant examples, not to change the curriculum. For each science news article, the article was first read as a class (calling on students to read each paragraph). After reading the article, a teacher-facilitated discussion would take place. The teacher would verbally ask questions, elicit responses, and attempt to build on student answers in order to facilitate a discussion among students. The teacher would also ask and discuss how the article related to the class content. After the discussion, students would be given a few questions to answer about the article to be turned in. The reading, discussion, and questions took between 20 and 40 minutes, depending on the length of the article and the depth of its content.

At the end of five weeks, all students completed the initial survey again. The post-survey was entered into Microsoft Excel and compared with the initial survey. Students were asked to put the same “identifier” (a drawing, a password, a number, etc.) on both of their surveys so that each students’ surveys could be matched but remain anonymous. A paired t-test was run for each ATSI subscale to look for any significant difference in student answers between the initial survey and post-survey. The results of the paired t-tests addressed research question #1: does the increased use of science news articles have an effect on secondary students’ attitudes towards science?

In addition to the survey, ten students from the experimental group (at least two from each class) were interviewed and audio recorded to collect more qualitative data on student attitudes in order to further address research question #1. Students were chosen for the interview at random; if they declined, two more were chosen at random until enough interviewees were
found. Each interview lasted no more than 15 minutes. Interviews were audio-recorded sans identifiers and then later transcribed. Qualitative interview data were analyzed by identifying positive and negative statements, comparing and contrasting these items in order to place them into categories, and then identifying patterns among categories (LeCompte, 2000).

Finally, student scores from two tests occurring within the five-week period were collected to examine the quality and depth of student learning of the key concepts covered. The average test score of each student was evaluated in Microsoft Excel and compared with each student’s average of five tests taken prior to the five-week period of using science news articles. A paired t-test was used to determine if there was a significant change in test scores. The results of this t-test addressed research question #2: does the use of science news articles increase student test scores?

**Instrumentation**

All science news articles used in this study came from the online publication *Science News for Students* published by the Society for Science & the Public. Articles were selected according to relevancy to the topics covered in class and their readability.

The Attitude Toward Science Inventory (ATSI) consisted of 48 items evenly distributed into six subscales, and all utilizing a six-point Likert scale. A version of the ATSI was originally developed for mathematics (Sandman, 1973), but has since been modified for use in science. The ATSI has been reported to have high construct validity and acceptable reliability coefficients (Gogolin and Swartz, 1992; Weinburgh, 2000). Students were informed that there was no risk or reward for completing the survey and they were given as much time as they needed. The teacher
exited the room while students were taking the survey so they would feel as comfortable as possible about giving honest responses.

Interviews were designed to examine student opinions and perceptions regarding the use of science news in the classroom. Students were clearly told that there would be no reward or punishment for agreeing or declining to do an interview. A broad outline of interview questions (Appendix B) was created but not followed strictly to allow for dynamic conversation. Interviewees were able to take the conversation in any direction they pleased in order to maximize the amount of data. Interviews were audio-recorded using a Macbook (no identifiers attached to maintain confidentiality) and later transcribed.
Chapter 4

RESULTS

Attitudes Toward Science Inventory (ATSI)

Each class period was evaluated separately in Microsoft Excel and repeated measures t-tests were run to look for statistically significant differences in total scores and in each subscale of the ATSI. Both negative and positive t-values were obtained. Because of the nature of the Likert scale used, lower scores on the ATSI represent a more positive attitude toward science. Thus, negative t-values represent attitudes toward science becoming more positive, and positive t-values represent worsening attitudes toward science. This is also true for all subscales, with the exception of anxiety toward science, where a negative t-value represents increasing anxiety.

Figure 1: Paired t-tests of ATSI total scores; t-values compared to critical values

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
<th>Period 4</th>
<th>Period 6</th>
<th>Period 7</th>
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<tr>
<td>n</td>
<td>14</td>
<td>9</td>
<td>11</td>
<td>14</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>critical value</td>
<td>2.16</td>
<td>2.306</td>
<td>2.228</td>
<td>2.16</td>
<td>2.179</td>
<td>2.201</td>
</tr>
<tr>
<td>t-value</td>
<td>-0.293</td>
<td>0.903</td>
<td>0.899</td>
<td>-1.364</td>
<td>-1.243</td>
<td>1.009</td>
</tr>
</tbody>
</table>

Periods 1 and 2 are the control group. Critical value is \( p < 0.05 \) (95% confidence level).

When examining the ATSI results as a whole (Figure 1), the t-tests showed that none of the class periods underwent a statistically significant change in their attitudes toward science. Most t-tests returned values that were well under the critical or significant values at the 95% confidence level. There did not seem to be a trend in scores among the control classes or the experimental classes. Among the experimental classes, two periods returned negative t-values and two returned positive t-values. The control classes were similarly divided – one negative t-value and one positive t-value.

When examining the separate subscales (Figure 2), the t-tests showed no statistically significant results in five of the six subscales: perceptions of the science teacher, anxiety toward
science, value of science in society, self-concept of science, or motivation in science. The only statistically significant result came in the subscale of enjoyment of science. The t-test showed a P-value of 0.014 in the fourth period class, which indicates a significant result at the 95% confidence level (P < 0.05). This shows a significant increase in enjoyment of science for the fourth period class. There also seemed to be a trend in the subscale of perceptions of the science teacher – five out of the six classes showed a positive t-value (although none were statistically significant), which indicates a decline in how favorably students view their science teacher and science teachers in general. However, there seemed to be no discernable difference between control classes and experimental classes.

**Figure 2: Paired t-tests of ATSI subscales, t-values compared to critical values**

<table>
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<tr>
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<th>Period 1</th>
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<th>Period 3</th>
<th>Period 4</th>
<th>Period 6</th>
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<td>critical value</td>
<td>2.16</td>
<td>2.306</td>
<td>2.228</td>
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<td>2.179</td>
<td>2.201</td>
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<td>Perceptions of</td>
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<td>1.756</td>
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<td>Science</td>
<td></td>
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</tr>
<tr>
<td>Motivation in</td>
<td>0.393</td>
<td>1.524</td>
<td>0.981</td>
<td>0.467</td>
<td>-0.369</td>
<td>-0.157</td>
</tr>
<tr>
<td>Science</td>
<td></td>
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</tbody>
</table>

*Periods 1 and 2 are the control group*
Student Test Scores

Results of the repeated measures t-tests run on student test scores (Figure 3) showed one statistically significant result. The average test grades in the 7th period class were significantly lower after the introduction of science news articles. The P-value for the 7th period class was 0.035, which is within the 0.05 value needed at the 95% confidence level. The trend among all class periods was in the negative direction as well, with all but one class period returning negative t-values, indicating decreasing test scores. Experimental classes seemed to have greater negative t-values than control classes, however, only one was significant.

Figure 3: Paired t-tests of student test scores; t-values compared to critical values

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
<th>Period 4</th>
<th>Period 6</th>
<th>Period 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>17</td>
<td>13</td>
<td>16</td>
<td>17</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>critical value</td>
<td>2.12</td>
<td>2.179</td>
<td>2.131</td>
<td>2.12</td>
<td>2.093</td>
<td>2.131</td>
</tr>
<tr>
<td>t-value</td>
<td>-0.68</td>
<td>-0.082</td>
<td>-0.292</td>
<td>0.528</td>
<td>-1.037</td>
<td>-2.321*</td>
</tr>
</tbody>
</table>

Periods 1 and 2 are the control group. Critical value is p < 0.05 (95% confidence level).

Student Interviews

The qualitative data gathered from student interviews were overwhelmingly positive in nature. Among the ten interviews, positive statements about using science news articles in the classroom numbered 64, while only eight negative statements and five neutral statements were recorded. Positive statements fell into six categories: relevance to class content, understanding of science in the real world, effect on test-taking, interest in science, enjoyment of science, and method of using science news articles. Negative statements fell into four categories: difficulty, relevance to class content, vocabulary, and method of using science news articles. Neutral statements fell into two categories: test taking, and interest in science.
Statements about the relevance of science news articles to class content showed that most of the students interviewed thought that there was usually a clear connection. Three of the ten students interviewed commented that they were confused about how some of the articles related to topics covered in class. Even the students who responded positively in this category often used the words “usually” or “most of the time,” suggesting that some of the articles were not so clearly related to class content. However, when looking at statements about their understanding of science in the real world, all students interviewed said that the science news articles increased their understanding of what real scientists do. The category of enjoyment of science showed similar results, with the overwhelming majority of students (nine out of ten) commenting that the science news articles increased their enjoyment of the class or their enjoyment of science in general. Seven out of ten students answered that the science news articles helped them to perform better on their tests. The remaining three students answered that there was no effect on their test scores. This was the largest number of neutral answers in any category. Other neutral answers were about the students’ interest in science. Two students said that their interest in science had not changed due to the science news articles, one because he or she “already liked science anyway,” and the other because he or she doesn’t like science “no matter what.”

Some students also commented about the method of using the articles in the classroom. Three students noted that they enjoyed popcorn reading and discussing the article as a class. However, one student thought that popcorn reading made the article more difficult to understand and another student said he or she would simply prefer to read on his or her own. Other negative statements included one student who said that the articles were just too confusing, and two other students who thought the vocabulary in the articles was too difficult or not explained well enough. Despite these negative statements, student interview data was positive overall, and
students talked very favorably about the science news articles. This was in contrast to the findings of the ATSI data and student test scores.
Chapter 5
DISCUSSION

ATSI Scores

The results from the paired t-tests comparing total ATSI scores were not enough to reject the null hypothesis that there is no relationship between using science news articles in the science classroom and student attitudes toward science. ATSI scores in all six sections were not statistically different before and after the use of science news articles, and there was no clear difference between the control group and experimental group. If students tend to respond positively to teachers using science news reports in the classroom, as they did in this study (student interviews) and in others (Kachan et al., 2005), why did student attitudes toward science not increase according to the ATSI?

One explanation may be end-of-year fatigue. This study took place very near to the end of the school year, with the final ATSI survey being administered with only three days of school left. It is very possible that student fatigue due to standardized testing (“testing fatigue”), preparing for final exams, and finishing final projects may have student attitudes in general lower than they would be at other times of the school year. This could also explain the trend of less favorable perceptions of the science teacher, especially when the teacher is introducing new materials and teaching methods near the end of the year. Furthermore, students are much more likely to “blow off” the final ATSI survey and not think seriously about their answers. Another explanation may be that six science news articles is simply not enough to detect a meaningful effect on student attitudes toward science, despite the fact that no science news had been included in this science classroom prior to the study.
Because student interviews were overwhelmingly positive in regards to using science news articles, the differences between interview answers and ATSI scores must be reconciled. Several explanations may resolve this discrepancy. First, it should be pointed out that liking the science news articles is not equivalent to the improving of an attitude toward science. It is entirely possible to have one without the other. A related point is that the interview questions did not perfectly mirror that ATSI. The interviews were meant to supplement that ATSI and gather more information; they were not meant to act as the ATSI in a verbal form. If the interview questions had more closely mirrored the ATSI questions, we may expect that the results would be in agreement. Second, it may be possible that not enough interviews were conducted. Because only about ten percent of the students were interviewed, their responses may not be an accurate representation of the class. However, the interviewees were chosen at random and the responses were largely positive and supportive of using science news articles.

Further explanation for the lack of significant change in ATSI scores may be hinted at by several of the neutral responses found in student interviews. Two students who responded that the use of science news articles had no effect on their interest in science implied that their attitudes on science could not be changed, regardless of what teaching methods are used in their science classrooms. This may be reflected in the ATSI data. Many students may have had positive attitudes toward science to begin with. On the other hand, many students may have an attitude that they will never enjoy science, and that attitude is very difficult to change. Perhaps another important point is that some individual students did show statistically significant improvements in their attitudes according to their ATSI scores. Unfortunately, if other students’ scores in their class trended in the opposite direction, it cancelled out any statistically significant effect when looking at whole-class statistics.
Next, given the above reasons for the lack of changes in ATSI scores, why did the fourth period class show a statistically significant increase in enjoyment of science? One possible explanation is that the fourth period class had a much higher percentage of students with Individualized Education Programs (IEPs). Many IEPs include varying teaching methods to aid student understanding and keep students on task. It may be the case that introducing this new teaching method was a breath of fresh air for these students who consistently need a change of pace. Conversely, the other classes may have already understood the content and viewed the science news articles as extra work. If this is true, it may imply that the use of science news articles can help students with IEPs to learn science, since there exists a high correlation between student attitudes and achievement (Shah and Mahmood, 2011). Even though it was not a statistically significant result, it is worth noting that the fourth period class was the only class to have a positive t-value when comparing their test scores before and after the use of science news articles.

**Student Test Scores**

In five out of six class periods, the results from the paired t-tests comparing student test scores were not enough to reject the null hypothesis that the use of science news articles has no effect on test scores. One statistically significant effect was found in the 7th period class: their test scores decreased. Furthermore, the test scores in the other periods seemed to show a trend of decreasing scores as well. As with the ATSI results, one possible explanation is end-of-year fatigue and testing fatigue. It may be the case that students are less likely to study near the end of the year, or they may simply have more tests to study for and more work to do than usual. It could also be that introducing science news articles gives students even more material to study.
for their test, although this was not the intent of the articles. They were simply meant to supplement the course content, not to change or broaden the curriculum. However, introducing new materials and new teaching methods at the end of the year may end up confusing students rather than helping them.

Student interviews also suggested that students thought the science news articles helped them to be prepared for their tests. This disparity may have several explanations. First, high school students may simply be bad judges of what helps prepare them for a test. They may think that because they enjoyed the articles they were better prepared for their tests, when this was not necessarily the case. Second, there was no attempt in this study to keep all tests at the same level of difficulty. Instead, taking average test scores before and after the treatment was meant to correct for any potential variance in difficulty among tests. Nonetheless, it’s possible that the tests taken later on in the study contained more difficult content than the tests before science news articles were introduced.

Implications and Recommendations

Despite the findings of this study lacking a strong positive or negative result, it’s definitely not time to give up on engaging students with science news. Many improvements could be made in this research. Further research should seek to find better methods for utilizing science news in the classroom as a way to improve science literacy. Eighteen percent of high school seniors were considered to be proficient in science in 2005 (National Center for Educational Statistics, 2006), so clearly more work needs to be done in this area. Possible improvements to this research could include: using more science news articles over a longer period of time, collecting more data on student test scores and attitudes, and conducting the
research at a different time in the school year to avoid any effect from end-of-year fatigue.

Further research on end-of-year fatigue and testing fatigue would be highly valuable, as it may have had a large effect on this study, and may affect students in every classroom.

The one class section with the most IEP students had the only statistically significant result on the ATSI. It is hard to believe that this is a coincidence. This may have some implications regarding the use of science news for struggling students and/or students with IEPs. Instructors of such students may wish to try using science news in their classrooms as yet another teaching method that helps in keeping students engaged and on task. Because IEP students tend to require even more differentiation than other students, it is worth noting that no one teaching method will work for all students. As is always the case in education, teaching methods must continually be varied, tried, and tested to find what works with each individual student. There is no perfect method or solution for helping students improve their science literacy. Further research could examine the differences between students with and without IEPs engaging with science news articles.

Even if no positive effect on student attitudes could be found, the use of science news in the secondary science classroom would still be valuable in its own right. The use of science news is still highly valuable for science literacy (Kachan et al., 2005). Students need to gain experience critically engaging with media reports of real world science, whether it is to gain critical thinking skills, science literacy, and media literacy (Jarman and McClune, 2010), or to serve as a stepping-stone for learning to engage with primary literature in college. At the very least, the student interviews conducted in this research suggest that engaging with science news articles was successful in getting students to gain familiarity with science in the real world.
Educators could increase their students’ interactions with science news media to increase student understanding of real-world science.

The principle focus of further research should be on improving student attitudes toward science and finding better methods to increase science literacy so that our populace is well informed, capable, and ready to take on the scientific and technological challenges of the 21st century. It may help to look into other forms of science news media. This study used science news articles printed on paper, but it is certainly conceivable that students in the 21st century would be more engaged by science news in digital form. The ready-availability of vast volumes of digital news has increased the opportunity for discussing media literacy in a classroom and also increased the need for more research in the field of media literacy (Daunic, 2011). Research into students engaging with online news, even on cellphones, may prove to be useful. Such changes may cause significant increases in student attitudes toward science, and thus cause significant changes in student achievement (Liu, 2009). More work could also be done in influencing state and local policy to include more media reports in the curricula, since little mention currently exists (Kachan, et al., 2005).
REFERENCES


Weinburgh, M. H. (2000). Gender, ethnicity, and grade level as predictors of middle school students’ attitudes toward science.
APPENDIX A

Attitudes Toward Science Inventory (Weinbugh, (2000), personal communication)

<table>
<thead>
<tr>
<th>ATSI ITEM STATEMENTS</th>
<th>STRONGLY DISAGREE</th>
<th>DISAGREE</th>
<th>WEAKLY DISAGREE</th>
<th>AGREE</th>
<th>WEAKLY AGREE</th>
<th>AGREE</th>
<th>STRONGLY AGREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Science is useful for solving the problems of everyday life.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
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<tr>
<td>2. Science is something that I enjoy very much.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td>3. I like the easy science assignments best.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>4. I do not do very well in science.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td>5. Science teachers show little interest in their students.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td>6. Doing science labs or hands-on activities is fun.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td>7. I feel at ease in a science class.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td>8. I would like to do some extra or un-assigned reading in science.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
<td>6</td>
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<tr>
<td>9. There is little need for science in most of today’s jobs.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<td>10. Science is easy for me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>11. When I hear the word “science,” I have a feeling of dislike.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>12. Most people should study some science.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td>13. I would like to spend less time in school studying science.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<td>6</td>
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<tr>
<td>14. Sometimes, for fun, I read ahead in our science book.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>6</td>
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<tr>
<td>15. Science is helpful in understanding today’s world.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td>16. I usually understand what we are talking about in science.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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</tr>
<tr>
<td>17. Science teachers make science interesting for me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td>18. I do not like anything about science.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>19. No matter how hard I try, I cannot understand science.</td>
<td>1</td>
<td>2</td>
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<td>6</td>
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<tr>
<td>20. I feel tense or upset when someone talks to me about science.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>21. Science teachers present materials in a way that I understand.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>22. I often think, “I cannot do this,” when a science assignment seems hard.</td>
<td>1</td>
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<td>3</td>
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<tr>
<td>23. Science is of great importance to a country’s development.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>6</td>
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<tr>
<td>24. It is important to know science in order to get a good job.</td>
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<td>2</td>
<td>3</td>
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<tr>
<td>25. It does not disturb or upset me to do science assignments.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>6</td>
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<tr>
<td>26. I would like a job that does not use any science.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>6</td>
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<tr>
<td>27. Science teachers know when I am having trouble with my assignments.</td>
<td>1</td>
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<td>3</td>
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<tr>
<td>28. I enjoy talking to other people about science.</td>
<td>1</td>
<td>2</td>
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<td>29. I enjoy watching a science program on television.</td>
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<td>30. I am good at working science labs and hands-on activities.</td>
<td>1</td>
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<td>3</td>
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<tr>
<td>31. Science teachers do not seem to enjoy teaching science.</td>
<td>1</td>
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<td>3</td>
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<td>32. I like the challenge of science assignments.</td>
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<td>33. You can get along perfectly well in everyday life without science.</td>
<td>1</td>
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<td>34. Working with science upsets me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>35. I remember most of the things I learn in science class.</td>
<td>1</td>
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<td>36. It makes me nervous to even think about doing science.</td>
<td>1</td>
<td>2</td>
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<td>6</td>
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<td>37. I would rather be told scientific facts than find them out from experiments.</td>
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<td>6</td>
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<tr>
<td>38. Most of the ideas in science are not very useful.</td>
<td>1</td>
<td>2</td>
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<tr>
<td>39. It scares me to have to take a science class.</td>
<td>1</td>
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<tr>
<td>40. Science teachers are willing to give me individual help.</td>
<td>1</td>
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<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
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<tr>
<td>41. The only reason I am taking science is because I have to.</td>
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</tbody>
</table>
42. It is important to me to understand the work I do in the science class.  

<table>
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<tr>
<th></th>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>43. I have a good feeling toward science.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>44. Science teachers know a lot about science.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<td>6</td>
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<tr>
<td>45. Science is one of my favorite subjects.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<td>6</td>
</tr>
<tr>
<td>46. Science teachers do not like students to ask questions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>47. I have a real desire to learn science.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>48. If I do not see how to do a science assignment right away, I never get it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Key for ATTITUDE TOWARD SCIENCE INVENTORY  
Version A

The six attitudinal variables are:

Perception of the Science Teacher  = 5*, 17, 21, 27, 31*, 40, 44, 46*
Anxiety toward Science  = 7*, 11, 20, 25*, 34, 36, 39, 43*
Value of Science in Society  = 1, 9*, 12, 15, 23, 24, 33, 38*
Self-concept of Science  = 4*, 10, 16, 19*, 22*, 30, 35, 48*
Enjoyment of Science  = 2, 6, 13*, 18*, 26*, 28, 29, 45
Motivation in Science  = 3*, 8, 14, 32, 37*, 41*, 42, 47

The * indicates that the score will be reversed because the statements were worded in the negative. Higher numerical scores reflect more positive attitudes in all area except anxiety where a lower numerical score reflects a more positive attitude (less anxiety).
APPENDIX B

Interview Outline

1. Tell me what you thought about the use of science news articles.

2. Did you find it easy to relate the science news articles to the topics we were covering in class?

3. In what ways did the use of science news articles help you to learn the content?

4. What didn’t you like about the use of science news articles?

5. Do you think using the news articles helped you to perform on the tests?

6. Did the science news articles help you to see how the topics discussed in class are related to issues the real world?

7. Did the articles make the content more interesting?

8. How could I have improved the instruction?
A determination has been made that the following research study is exempt from IRB review because it involves:

Category 1. research conducted in established or commonly accepted educational settings, involving normal educational practices

Project Title: Using More Science News in the Biology Classroom

Primary Investigator: Kyle Martin Heckler

Co-Investigator(s):

Advisor: Ralph Martin
(if applicable)

Department: Educational Studies

Robin Stack, CIP, Human Subjects Research Coordinator
Office of Research Compliance

Date: Jan. 12, 2015

The approval remains in effect provided the study is conducted exactly as described in your application for review. Any additions or modifications to the project must be approved (as an amendment) prior to implementation.
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