Examining 8th Grade Students Disciplinary Literacy of Science Material

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Examining 8th Grade Students Disciplinary Literacy
of Science Material

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BY
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THESIS
SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
Master of Science in Education: Curriculum and Instruction

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

2018
YEAR

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Examining Eighth Grade Students Disciplinary Literacy of Science Material

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Abstract

Education standards are shifting to reflect a skills-based, rather than a content-centered, curriculum that focuses on students being literate across all disciplines. This study focuses on the skills of critical thinking, close reading, and text-based writing as it applies to the scientific and historical disciplines. Eighth grade students engaged in a text-based writing assignment that required evaluation of multiple sources to support their claims. Student responses were analyzed textually and verbally as it related to the content. Findings included the ability to identify students’ struggles and successes with close reading, writing claims, evaluating evidence for importance, and connecting documents to strengthen evidence. The findings can inform teachers’ approaches as they related to the findings with some examples including problem based learning, interdisciplinary learning, career based learning, differentiation within the classroom, and disciplinary literacy within science.
Acknowledgements

I would like to thank Dr. Bickford, Mrs. Reid, Dr. Taylor, and Dr. Wherle for their expertise and guidance during this process. Thank you for pushing me to look deeper at my educational practices to help me grow as a teacher researcher. I would also like to thank my husband, Darin, and my daughter, Lyanna, who gave me flexibility, love, and support throughout this process.
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Examining 8th Grade Students Disciplinary Literacy of Science Material

Currently, education standards are shifting from students understanding a broad scope of content to addressing specific skills that are interdisciplinary across content areas. Enhancing discipline specific understanding and literacy skills allow students to have access to authentic learning experiences that will prepare them for future careers or college. The outcomes that teachers desire for students have shifted as well. What do teachers want students to take away from their classrooms when they leave? Outcomes include, but are not limited to, the ability to ask and answer their own questions, critically think about and purposefully use the best available evidence when making decisions, and being informed, globally-thinking citizens who can think for themselves while considering the wants and needs of the world and its other residents. How as teachers can we accomplish such lofty aspirations? The creation of educational experiences in the classroom that focus on inquiry and allow students to make claims and back them up with evidence may provide the answer. Allowing students to interact with real world information from events that have occurred will allow us to see which information they feel is most or least important when using evidence to support their claims. This will also allow us to see what gaps occur in their understanding or if any misconceptions occur as a result of working with the information. The purpose of this study is to see if and how eighth grade students use close reading, collaborative discussion, and text-dependent writing strategies to construct a claim from a set of documents that surround a period of scientific innovation.

Literature Review

Disciplinary literacy is a skill that all teachers should use within their classroom. Students can learn to become adept at using disciplinary literacy across all classes so they are able to apply these skills to future careers. Nationally, learning standards have been shifting to favor a
college and career readiness approach across all content areas because it is discipline-specific and focuses on critical thinking.

State and National Initiatives

The development of more rigorous education standards was a response to the perceived notion that American students were falling behind other countries. The idea of creating national standards was a way to ensure that all students, regardless of where they were from, were being prepared for college and careers. There was a push to develop standards that would raise achievement scores and in turn give students the skills that are necessary for college and career readiness. This shift began in the fields of math, reading, and language arts with the development of the Common Core State Standards (NGA & CCSS, 2010). Quickly following were the Next Generations Science Standards (NGSS Lead States, 2013) and the C3 Framework for Social Studies (National Council for the Social Studies, 2013). These collective standards, which align with the best practices for critical thinking (Anderson & Krathwohl, 2001; Benassi, Overson, & Hakala, 2014; Bloom & Krathwohl, 1956), call for students to gain higher order thinking and problem-solving skills that can be cultivated and adapted to real world situations. The following initiatives include standards that focus around the content of this study.

Common Core State Standards Initiative. Nationally there has been a push for teachers to increase the rigor of texts that students are exposed to so that they graduate high school with an education that allows them to be college and career ready. To accomplish this seemingly daunting task, forty-two states, the District of Columbia, and four territories have adopted the Common Core State Standards Initiative (NGA & CCSS, 2010). Increasing the expectations for reading performance is not limited to states that have adopted the Common Core State Standards. Giving students access to move up the staircase of text complexity is an
INTERNATIONAL-VALUED GOAL. Reaching that goal begins with teachers knowing how to select and evaluate texts for their complexity. Teachers need to understand what the text has to offer, who is reading the text, and the task for a lesson to work (Fisher & Frey, 2015). CCSS calls for a relatively balanced split between literary texts and informational texts. Also, the CCSS specifically created reading and writing standards for science and technical subjects. These reading and writing standards originate from best practice discipline-specific literacy.

Next Generation Science Standards. Along with the development of more rigorous reading and writing standards with the CCSS came the development of more specific science standards in the form of the Next Generation Science Standards (NGSS). The development of these standards included a triadic approach by focusing on: Cross-Cutting Concepts, Disciplinary Core Ideas, and Science and Engineering Practices (NGSS Lead States, 2013). The Cross-Cutting Concepts are ideas that can be integrated within scientific disciplines as well as across disciplines to other fields such as reading, writing, social studies, and math. Disciplinary Core Ideas are the essential concepts that students should be able to explain and understand by the time they finish a specific grade band. The Disciplinary Core ideas are what most people would think of as content standards in any other field of study. Science and Engineering Practices are skills that are noted to be important within the field of science specifically developing and using models, analyzing and interpreting data, and constructing explanations (NGSS Lead States, 2013). For most educators, grade level specific standards are prescribed for teachers to follow; however, the middle school standards are written as a grade level band, which means that within the sixth, seventh, and eighth grade science courses all of the standards are covered (NGSS, 2013). Since school districts develop curriculum using the standards, they can be flexible and meet the needs of both their students and the district. For the scope of this study the types of
tasks and texts will be explored fall within the Middle School Earth and Human Activity band with specific focus on the standard (MS-ESS3-2), which covers content regarding catastrophic events and the development of technologies that mitigate their effects (NGSS Lead States, 2013).

**C3 Framework for Social Studies.** Expectations for Social Studies have also shifted to reflect a skill driven rather than content driven curriculum. The C3 Framework has four dimensions that show emphasis on similar skills as the Next Generation Science Standards. In Dimension One it asks for students to be proficient in developing questions and planning inquiry. Dimension Two focuses on Disciplinary Tools and Concepts, which are similar to NGSS Disciplinary Core ideas that give teachers content to focus on. These are listed as broad topics and include Civics, Economics, Geography, and History. The research process is the focus on Dimension Three that asks students to gather and evaluate sources along with developing claims and using evidence. Close reading is a key feature of Dimension Three. This pedagogical task connects back to the Scientific and Engineering Practices in the NGSS standards. Dimension Four asks students to communicate and critique conclusions and based on those conclusions take informed action. Text-based writing and speaking and listening are key features of Dimension Four. The common thread is that standards in the field of reading, writing, science, and social studies are all shifting to skills based curricula that are intended to give students success towards future careers and college readiness (Carnegie Council on Advancing Adolescent Literacy, 2010; Nokes, 2017).

**Pedagogy**

This study will focus on disciplinary literacy in science class through close reading, text-based or evidentiary writing, and collaborative discussion. It will analyze how students establish value to the sources that they draw from to collect evidence and how well those written claims
are supported by evidence. This will be measured by formal and informal assessment over the course of implementation.

**Disciplinary literacy.** Science-based literacy is an integral part of the science curriculum. Analyzing and interpreting charts and diagrams is also a significant component to understanding science and technical subjects. This manifests in the professional world through presentations, specifications for machinery, and procedures contained within manuals, just to name a few real-world examples of what students may encounter once they leave high school (NGA & CCSS, 2010). Reading can also deepen the understandings students create by providing a contextual relationship with the concept being taught. This can help motivate students to engage in more inquiry based investigations to understand concepts that relate to them and provide authentic assessment of science practices (Glynn & Muth, 1994; Odegaard, Haug, Mork, & Sorvik, 2014). Reading and writing are skills that are intertwined. It is very difficult for teachers to give writing instruction without giving students exemplar texts to read and analyze first (Glynn & Muth, 1994).

Close reading, which is another focus strategy and a disciplinary task, is meant to be used as an approach to allow students to read texts that are at a higher level of text complexity and help students to create meaning from what they read. According to the Common Core State Standards, students must be able to closely read, discuss, and write about complex informational texts. When science is taught through inquiry-based instruction, this practice minimizes the use for text-books that in turn decreases the amount of time students have for reading and writing within the content area of science. According to the 2009 National Assessment of Education Progress, 30% of eighth graders performed at the proficient level in science (Lapp, Gran, Moss, & Johnson, 2013). This statistic informs teachers that there needs to be an increase in the
importance given to literacy within this specific content area. Teachers need to allow exposure
to a wide range of genre types within the scientific discipline so students will understand
scientific discourse and have a real-world viewpoint of what scientific writing is used for. Close
reading also enables students to develop a sense of stewardship when learning about human
impacts to make students globally thinking citizens. This strategy also allows students to
become investigators of the text and requires students to infer, use text structure to increase
comprehension, read for author’s purpose, and assess how valid their claims are. Teachers need
to be able to create text dependent questions to draw students back into the text to find answers.
This technique also compels the teacher to choose texts that can work together so that students
can create intertextual connections (Lapp, Gran, Moss, & Johnson, 2013).

Close reading positions students to view scientific claims in an objective light. The most
challenging reading is when we translate how the meaning of what we read fits in to our
everyday life. In other words, to make text-to-text and text-to-world connections, to make a
once-seemingly abstract idea into something concrete, to make a seemingly irrelevant set of
knowledge into something meaningful, and to do so by closely scrutinizing the material for
details (Pennell, 2015). When students are required to explain, elaborate, and defend one’s
position, it forces learners to integrate knowledge in new ways into their existing background
information. The use of collaborative discussions can be used to deepen the meaning of the text
which is another one of the big four strategies emphasized (Pennell, 2015).

Students will engage in the close reading of primary sources that all center around the era
of the Space Race during the 1950s and 1960s. This will require students to engage in repeated
readings of the text to answer text-dependent questions that relate to each primary source.
Students will also engage in collaborative discussions as they go through the primary sources to
enhance their understanding as well. Graphic organizers will be provided to help students organize their thoughts and keep track of their evidence. These tasks specifically relate to the Common Core State Standards (R1.8.1 and R1.8.3) focused on text evidence and analysis within informational texts.

Scientific writing is a combination between exposition and argumentation. Students need to be exposed to both forms of writing to help them be ready for college and career demands and to challenge them to think in new and different ways. Writing is also an integral part of the science curriculum (Odegaard, Haug, Mork, & Sorvik, 2014). Students will be asked to make a declarative statement or claim and be able to support it with evidence from their research. An illustrative example would be for students to support claim(s) with logical reasoning and relevant or accurate data using credible sources (WHST-6-8.1A). Students not only need to be able to create and support their own claims, but they must also do so using content specific vocabulary (Odegaard, Haug, Mork, & Sorvik, 2014). Students can use precise language and domain-specific vocabulary to inform or explain the topic as an example (6-8.2D). Students will be asked to find information on a topic, instead of being given the information to interpret. The search for new, reputable information is now an important skill for all twenty-first century citizens (Fang & Pace, 2013). Teachers can accomplish this by giving students opportunities to conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration (WHST 6.8-7). Along with their exploration of a topic, students will need to draw evidence from informational texts to support analysis, reflection, and research (6.8-9) (NGA & CCSS, 2010). Students’ scientific writing can also be improved upon by giving students complex texts to read and draw evidence from.
Writing and reading comprehension are skills that have always been tied together through student achievement. Specifically, writing about a text improves reading comprehension. This is even further elevated when students are asked to engage in tasks that require analytic thinking and for claims to be backed up with strong evidence from the reading. Even though research shows that having students engage in cognitively demanding writing tasks from reading specific texts, students are given limited exposure to these types of learning experiences (Wang, Matsumura, & Correnti, 2016). Part of this is likely due to the teachers not modeling how to use evidence to support claims and providing students numerous opportunities to implement their developing skills. For students to improve their writing, teachers need to give formative feedback and plenty of opportunities to practice text-based writing. One pitfall to using this as a method is that teachers can design writing prompts that can be answered without engaging with the text at all. This allows for the student to stray from the text when formulating the answers to questions (Matsumura, Correnti, & Wang, 2015). Instead, teachers can give students a graphic organizer that helps them to support claims with multiple examples, checks for accuracy of information, and asks students to explain why this piece of evidence relates to or proves their claim. Another way to assist students to be successful when engaging in a text-based writing activity is to give written formative feedback as the students are engaging with the text. This kind of process is very similar to a traditional writing process approach. This can also be accomplished through student-teacher writing conferences as the students are working through the material (Wang, Matsumura, & Correnti, 2017).

Excerpts from textbooks, images, and primary sources will be used to compose a response to an essential question on scientific innovation during the Space Race. Students will answer text-dependent questions about each primary source and then develop an evidence-based
claim using understandings extracted from the best available primary sources. Students will organize their information using a graphic organizer that asks them to cite specific evidence and explain why it relates to their claim. Students will then engage in student-teacher conferencing to outline their essays. This task relates specifically to the CCSS standards W8.1.b and W8.2.b which references text-based writing using evidence. This also relates to the NGSS Scientific and Engineering Practices of engaging in argument from evidence and obtaining, evaluating, and communicating information. The C3 Framework for Social Studies is also represented by having students answer questions, evaluate sources, and communicate conclusions.

Science is, in its nature, a collaborative process where experts in the disciplines share ideas, refute ideas, and agree on ideas to build a better understanding of the world around us. Through this process, communication through all modes of language arts is critical. In the Common Core State Standards, students are expected to engage in collaborative discussions to deepen their understanding of the content. One strategy found to help increase student success with collaboration is philosophical discussions (Pennell, 2015). In doing so, students participate in a philosophical discussion to develop reasoning skills through speaking with others and listening to ideas (Pennell, 2015). As a group, students search for meaning to open ended questions and learn to come to agreement for the common goal of comprehension. As a practice, “This builds on the Vgotskyian notion that students will learn to think for themselves if they engage in the social practice of thinking together” (Murris, 2008, p.670). Teaching students to ask why with depth is an essential skill that will help them by increasing their critical thinking and argumentative skills. This strategy also works with students that struggle with reading comprehension because it allows for alternative ideas about the text through the process of inquiry.
Scientists and historians use collaborative discussion to communicate why, how, and what they understand effectively in science (Monahan, 2013). Scientists use speaking and listening skills to present ideas, negotiate, and justify claims in the public and private domain. Before beginning writing in the classroom, teachers can include strategies to allow students to practice real world scenarios by discussing in small groups through think-pair-shares with rival and fellow theorists. A think-pair-share is an activity where students first think by themselves about a question or topic, then pair with another student to share their ideas. Whole class discussion can be employed to tie all the student’s ideas together to help with organizing their ideas for writing. Using debate in class where students identify their claim, provide evidence to support their claim, point out counterclaims, and refute using even more evidence is another strategy that teachers can use to strengthen these skills. After debating, students write a reflection about how any of the information presented changed their own viewpoint from the evidence that they found and add any additional points to a graphic organizer. These skills also help students to develop a sense of I-ness or authority in their writing and allows for students to find their voice. So often, students write how they speak and if they are speaking about relevant topics using evidence it will help them to utilize that in their writing (Monahan, 2013).

By using collaboration in philosophical discussion students can work together to better each other’s arguments by providing feedback and different points of view (Chen, Lin, & Chen, 2014). It also allowed the students to reference research, telling other students why they made their claim and how they know. This builds the ability of students to comprehend what they are reading and writing about through clarifying and questioning of other’s ideas, which is at the core of the nature of science. Although this also has major roots in the CCSS, NGSS, and C3
Framework standards this is not a primary focus of this study and will not be analyzed or discussed specifically.

Assessment. The CCSS also includes a reader-task variable in its triadic system of text complexity, however teachers have been given little guidance on how to make decisions regarding this variable (Heibert & Pearson, 2014). Variables such as motivation, existing background knowledge, purpose, and experiences should all be taken in consideration when evaluating text complexity. Text complexity is not an inherent quality of the text, but rather it represents the relationship between the reader, task, and text. Other factors to consider include the amount of instruction that is given to students beforehand, the amount of text to be read, the mode of response students will create, and the depth of processing required. The actual content of the text is also a consideration that teachers need to think about. It is easier to match texts to skills, instead of forcing skills to a text with a given content. Students should also be given reading opportunities below, at, and above their reading level. Students should also be able to have choices in what they read. Flexibility in choice creates greater motivation and allows for students to tackle all levels of text (Wixson & Valencia, 2014). Teachers should start with the task and then match a text. Determine what students will do with the text and go from there, matching a task that works with the text that has been chosen (Wixson & Valencia, 2014). This is a dangerous risk to focus on measuring tasks while losing the component of the student as a reader (Fisher & Frey, 2014). Although the authors of the CCSS did not intend this interpretation, many teachers around the country are now focusing on measuring just the complexity of the texts they are using without much consideration to the task they are asking their students to do (Fischer & Frey, 2014).
Informal assessment refers to any task that students perform during the learning process that helps to modify teaching and learning (Emanuel, Robinson, & Korczak, 2013). It is meant to help inform educators about the problematic and positive elements of their instruction. There are many ways that teachers can use informal assessment in their classroom to monitor how well students understand and implement the skills that are being focused on during a specific unit. Informal assessment can be formative in nature, meaning that the teacher assesses the quality of student work immediately after instruction has been given or while it is taking place (Roskos & Neuman, 2012). This allows for the teacher to differentiate instruction if needed to mend gaps in student misunderstanding. This type of assessment feedback is most effective if the teacher can help students develop a growth mindset about their learning. The development of a growth mindset is especially important in the middle grades due to the social-emotional and academic transition (Barnes & Fives, 2016). When assessing with a growth mindset in mind (Dweck, 2010), it is important to design assessments that allow students to engage in challenging activities and prior to the assessment task provide the appropriate scaffolding to support students emerging independence, which is supported by the gradual release of responsibility model and Vogotzsky’s Zone of Proximal Development (Afflerbach, 2016). One rule of assessment is to make sure that students understand the expectations and components of the task you are asking them to do. Teachers should make sure that rubrics are clear and that students are able to use the rubric to self-assess their own work. Student-teacher conferencing can be a useful tool in modeling how to use the rubric (Barnes & Fives, 2016).

This study used several informal formative assessment measures. These included short written responses to writing prompts that asked for evidence to be employed to support claims. Formative assessments with written responses that required students to identify the strongest
piece of evidence to support their claims were also used to check for understanding. Student-teacher conferencing was held during class with the assessment rubric, which encouraged students to engage in metacognition (self-assessment) of their own work. This skill was revisited during the end of unit formal assessment. These informal assessments were linked to both the CCSS ELA standards in writing and reading (R1.8.1, R1.8.2, W8.1.b, W8.2.b) in the informational context as well as the Science and Engineering Practices (Constructing Explanations and Obtaining, Evaluation, and Communicating information) of the NGSS.

Formal assessments are used to measure mastery of learning outcomes that are set for a unit. Learning outcomes should in part be standard driven, so students are working towards mastery of content combined with academic skills. Formal assessments can also be standardized state and national tests (Emanuel, Robinson, & Korczak, 2013). Instead of teaching to these types of test, teachers should employ strategies such as giving students plenty of opportunities to read, build reading stamina giving less scaffolded support over time, provide challenging texts that are rich in content, support written responses with textual evidence, and engage students in writing in response to texts (Shanahan, 2014). By providing these types of experiences in the classroom we are, as content teachers, helping to teach students to read.

The end of unit formal assessment that was conducted for this study asked students to create a text-dependent writing essay that answers the essential question: Does war drive scientific innovation? This was accomplished by giving students primary sources and excerpts from textbooks. The students composed an essay citing evidence that supports their claim. Students were able to work in small groups and given prompts to discuss the sources. Students used graphic organizers for notes and to structure their essays. Student-teacher conferences took place with their writing and the assessment rubric in the same manner as the formative
assessments. Again, the goal of the student-teacher conferences was to encourage meta-cognition and self-assessment of their work. These classroom tasks were aligned with the CCSS (RI.8.1, RI.8.2, W8.1.b, W8.2.b), NGSS (Constructing Explanations and Obtaining, Evaluation, and Communicating information), and C3 Framework (answering questions, evaluating sources, and communicating conclusions). All three of these collections of standards emphasizes asking and answering research questions, using evidence to support claims from the text, evaluating evidence, and communicating results.

Content. The Full Option Science System or FOSS curriculum is currently being implemented to cover the Planetary Science standards. This system is a research based process developed by the Lawrence Hall of Science at the University of California at Berkeley for integrating science content with the problem-solving skills that encompass the scientific method. The goals of the curriculum are to promote science literacy for all students, provide efficient instruction, and allow for critical thinking for active global citizenship. These goals are achieved by allowing students to actively engage in investigations where they answer their own research questions; collect, analyze and interpret data; and make conclusions based on their own observations. One limitation of this curriculum is that it provides a resources book with selected articles that relate directly to the investigations that students are engaged in. Relying on only one source however, does not allow for overall literacy through reading and writing within science to be developed. Following only the resources book provided by the curriculum also limits the teacher from bringing in new articles of research being conducted and current event discoveries due to time constraints. Students should read a wide variety of sources that are classified as informational texts, this shift is prescribed by the CCSS as best practice by teachers. This
limitation could be mitigated by teachers pulling relevant and grade level appropriate informational articles to supplement the curriculum.

Textbooks are defined as a compilation of curriculum resources that are designed by commercial companies for use by teachers and students within the school setting. These materials are intended to be used by students, so they are closely correlated to reading levels being close to grade levels (Bryce, 2011). Textbooks that are adopted by state boards of education should be consistent with the intended reading levels of the students using them (Charkin, 1997). This implies that most textbooks come with an innate readability level such as a Lexile score that allows them to be compared with other textbooks easily. Another way that textbooks readability is determined is through the use of the Fry Readability Graph and the Flesch Reading Ease Formula (Charkin, 1997; Daniels, 1996). Until recent shifts in education towards a more active learning style, the textbook took center stage in being the main source of information for students (Daniels, 1996; Rice, 2002). There are challenges with students using textbooks as the sole vessel for information (Bryce, 2011). Science textbooks use academic vocabulary frequently, contain superficial information on a great span of topics, underplay controversial topics to remain objective, deliver information in an uninteresting way, and lack a reader-friendly style (Bryce, 2011; Warpole, 1999). Textbooks typically also have to be adopted by state boards of education or regionally by local school districts before they are purchased for use in school. Also, because of the relatively slow nature of how textbooks are published, it is difficult to highlight current scientific discoveries. It is important for teachers to supplement textbooks with other nonfiction texts to create a balanced curriculum for students (Bryce, 2011).

Primary sources are original textual and non-textual sources of information that were recorded during a specific time, person, or event in history (Library of Congress, n.d.) (Morgan
DISCIPLINARY LITERACY IN SCIENCE

& Rasinski, 2012; Ruffin & Capell, 2009). Examples can include new articles, speeches, diary or journal entries, advertisements, photographs, letters, articles, physical artifacts, etc. These documents give students a unique experience to view history from the time period it was experienced. Primary sources also allow the reader to interact with the text in a multitude of ways. Primary sources can help increase tolerance due to broadening worldviews and creating learning experiences (Morgan & Rasinski, 2012). By pairing primary sources with textbook excerpts, teachers can deepen the discussion about the content and help students realize that to truly develop understanding one must use more than a single source.

There are some limitations to using primary sources in the classroom. One limitation is students may not possess the background knowledge to comprehend the text. Another limitation is that the vocabulary can be obscure, making it difficult for students to understand the language. Teachers must use care when selecting primary sources for classroom use and provide scaffolding when necessary to help students to overcome these limitations so that comprehension can be accomplished (Musbach, 2001). Primary sources can also offer teachers a wealth of resources to design assessments that focus on text-based writing.

Primary sources can be utilized to blend content areas to create interdisciplinary units that focus around a historical or scientific topic. One specific example could be primary sources pulled from the era of the Cold War to bridge units within social studies and science. During the Cold War era, the race for space began. The Space Race is loosely defined as the period in time from the launch of the Soviet Satellite Sputnik in 1957 to the American Apollo 11 lunar landing in 1969 (Hardesty & Eisman, 2007). As these two great superpowers emerged victorious from WWII they quickly turned to confrontation during the Cold War. The race to the moon was viewed as the crowning achievement in global supremacy (Cadbury, 2006; Everest, 2005; &
Spencer, 2005). The two nations squared off in a stalemate, that encouraged espionage of the highest order. As the only two nations with atomic weapons and the means to deliver them, each government knew if they acted they would be met with retaliation and the loss of millions of lives (D’Antonio, 2007). During this study three important themes students will consider are the scientists involved, weapon technology, and space technology that were developed during this span in history.

On both the American and Soviet side, there were many scientists that made large contributions to the field of weaponry and space technology during the Cold War and Space Race. The Chief Designer of the Soviet Union was Sergei Korolev (Cadbury, 2006; Everest, 2005; & Spencer, 2005). As the innovator behind the Soviet Space program, Korolev’s identity was kept a state secret until his death. He was sent to prison in a Soviet gulag for six years before his tenure as Chief Designer for anti-Soviet behaviors (Cadbury, 2006; Everest, 2005; & Spencer, 2005). He was responsible for the development of the R7 rocket (the first ICBM) and the N1 (the Soviet lunar) rocket (Hardesty & Eisman, 2007). Operation Paperclip was an American Military mission that was tasked with removing German Nazi scientists from Germany before the Soviets could (Jacobsen, 2014). Wernher Von Braun was one of those scientists and was the developer of the German V2 rocket used in WWII. As the leading rocket scientist in the world he came to America with the dream of creating a space program with the goal of interplanetary travel. He was responsible for the development of the Redstone, Jupiter C, and Saturn V rockets that put the first American men into space (Cadbury, 2006; Everest, 2005; & Spencer, 2005).

Due to the rising tension between the Soviet Union and the United States, the development of weapon technology was the priority for these competing nations. During WWII,
the Germans achieved missile supremacy with the development of the V2 missile (Cadbury, 2006; Everest, 2005; & Spencer, 2005). This was the main reason that the Americans and the Soviets were rushing to intercept the German rocket scientists (Jacobsen, 2014). The goal of the dueling nations was to be able to deliver a 5-ton nuclear warhead to the opposing nation. Both nations created hydrogen bombs in 1952 with the Americans doing so ten months before the Soviets. Korolov created the R7 rocket the world’s first intercontinental ballistic missile. At the time, the Americans were still using the Redstone/Jupiter C rockets that were mid-range ballistic missiles. The response to the Soviet achievement was to create the Atlas and then the Saturn V rocket which took Apollo astronauts to the Moon (Hardesty & Eisman, 2007).

Space technology was developed at an unprecedented pace during the 1950s and 1960s. Both Korolev and von Braun wanted to do more than create weapons of mass destruction. Both scientists dreamed of creating space programs (Cadbury, 2006; Everest, 2005; & Spencer, 2005). The development of research satellites such as the Sputnik and Luna (Soviet) and Explorer (U.S.) was the first shift from weaponry to scientific investigation (D’Antonio, 2007). The Soviet rocket program featured the R7 launch vehicle and later for lunar missions the N1 which did not have much success. The American launch vehicles for Project Mercury were the Redstone and Atlas rockets. For Project Gemini, Titan II and Atlas Agena rockets were used. For the Apollo Program, the Saturn IB and Saturn V rockets delivered launch vehicles to the Moon. NASA also developed specific capsules for each program (D’Antonio, 2007). The Soviets designed the Vostok capsule for orbiting Earth and the Soyuz capsule for lunar missions (Cadbury, 2006; Everest, 2005; & Spencer, 2005).

Methods
This study was conducted in two phases. The first phase focused on frontloading specific skills necessary to analyzing documents. The second phase consisted of students composing an evidence-based essay related to scientific innovation during the Cold War. The primary methodology of this study is broken into three parts: participants, teaching procedures, and assessment.

**Participants**

The data pool consisted of students in all science classes this year, all students completed the text-based writing assignment as part of class work during the school year. Thirty different eighth-grade students (ages 13-15 years) were selected for the data sample. The students were selected based on the universal screening assessment (Measures of Academic Progress or MAP) for English Language Arts and Reading that the school district gives to all eighth-grade students. The median score for an average eighth-grade student that took the test was 221. For the sample, ten of the highest average scores (median score 244.5), ten of the median average scores (median score 220.7), and ten low average scores (median score 205.7) were selected for the sample. There were sixteen females selected and fourteen males selected within the sample group.

**Teaching Procedure**

The content that students were exposed to centers around the Space Race during the Cold War in the 1950s and 1960s. Specifically, it concentrated on the scientists that were instrumental in creating the manned space programs, the weapon technology that was developed or modified during this time, and the space technology that was created by both the United States and the Soviet Union. Students worked with primary sources, media sources (video and pictures), textbook excerpts, and a timeline to compose a text-based response. This response is intended to
answer the essential question: How did the Cold War drive scientific innovation in the 1950s and 1960s? The evidentiary written response to this question was the capstone activity for the project.

The content area literacy strategies that were implemented during this study include close reading, text-based writing, and collaborative discussion. Elements of this pedagogy are based on the research literature referenced previously. First, students needed to be given direct instruction on how to read like a scientist and historian. This was accomplished through mini-lessons with practice using resources from Reading Like a Historian developed by Stanford University. Formative assessment, specifically short written responses to claims and text-based questions, were used to monitor progress. Second, students needed to be given direct instruction on text-based writing. Students engaged in a practice text-based writing activity on the Cold War to build background knowledge in preparation for their capstone activity. Graphic organizers were used help students to develop claims and cite evidence as they progressed through their sources. Collaborative discussion was a strategy that students engaged in to enhance their understanding of the sources, but was not be a focus of this study. After frontloading essential skills, students engaged in their text-based writing assignment focusing scientific innovation during the Cold War.

Assessment Procedure

The assessment procedure was implemented in two phases: informal and formal. During the informal assessment phase students participated in formative assessment tasks. This occurred during the first week of instruction to ensure students were developing the essential skills to complete this project. The first informal assessment was focused on close reading. After reviewing how to close read, students went through a passage multiple times each with
different purposes. Students answered a series of text-dependent questions and their articles were collected to check for annotation and highlighting. The score on the formative assessment was based on the number of correct answers to the text-dependent questions and analyzed for annotation and highlighting. Students also completed a formative assessment on writing claims with evidence. In their science class, the students had already engaged in writing conclusions based on claims backed up with evidence from their labs. The text-based writing activity was an extension of this activity. Students were given a series of texts related to the Cold War and students employed a graphic organizer to write their claim and to choose evidence from the documents that best supported the claim. This was practice on a smaller scale for their capstone project. They were given fewer sources and had to write one claim to back up with evidence. Students were assessed using a rubric with categories for: the clarity of the claim, the strength of evidence used, how the reasoning is connected to the claim, the number of resources used, and basic writing conventions. This rubric can be found in the Appendix. The purpose of these assessments was to progress monitor and identify students who needed more scaffolding with text-based writing and helped when setting student groupings for collaborative discussion during the capstone project.

The formal assessment was administered during the next week when the text-based writing activity was introduced. Students were given twelve documents that included primary sources and secondary sources. All students were given the same documents, videos, and images to view. All students were given the same graphic organizer that was used during the informal formative assessment activity. The Appendix section contains a representative sample of the curricular resources used in this study. Students were asked to answer the following prompt: How did the Cold War drive scientific innovation in the 1950s and 1960s? The rubric used to
assess their text-based writing was a slightly expanded version of the one introduced during the practice period. The Appendix section also contains a copy of the rubric used for scoring this study. It will measure the same categories: clarity of the claim, the strength of evidence used, how the reasoning is connected to the claim, the number of resources used, and basic writing conventions. Students who demonstrated the complex skills on this assignment wrote one clear claim with three strong pieces of evidence that are connected to the claim and other sources based on the students' explanation. Students were expected to back up each claim with at least three pieces of evidence from the documents and cite them properly. Connections between each claim and the evidence was sufficient reasoning for the claim. Students should have employed at least two different sources within each claim paragraph. Basic writing conventions and maintaining a formal style was also be expected. Text-based writing was an emerging skill for these students. The students had the opportunity to revise their text-based writing response after it was returned in class. This allowed students to move towards mastery of the skill with more practice.

Notes were taken during class whenever possible and immediately after class. Notes included observations about students' behaviors, particularly their responses to tasks, and direct quotes of students' comments. These observations were used to corroborate understandings extracted from students' written work. The quotes were used to illustrate meaningful patterns.

Findings

Students collectively appeared to have an emotional response to the text-based writing assignment in class. The response manifested in feelings of frustration, nervousness, and anxiety about how they would do on the assignment. One student in the sample group, Nathan [this and all subsequent student names are pseudonyms], verbalized the frustration when he remarked,
"This is too long and hard. I'm probably going to fail." Another student Julian articulated nervousness at the idea of doing the assignment independently when he mentioned in class, "This assignment isn't too bad since you let us read the documents in groups. It would have been way harder on my own." Some students appeared more concerned about what grade they were going to get on the final product than about the process of evaluating the evidence to formulate their responses. One clearly anxious student in the sample, Sebastian, asked, "How much is this going to affect my grade?" These comments are a sampling and are used to illustrate the frustration, nervousness, and anxiety that appeared to manifest. Some students expressed concern about receiving a low grade on the assignment, but did not take the time to go over and revisit the scoring rubric that was provided on day one of introducing the task. Another aspect of the assignment that contributed to students feeling frustrated was having a hard deadline and the time constraint of a week to complete the assignment. This could have made the final product less refined. If the revision process would have been added, it may have helped the students to create a more complex essay.

Scaffolding was put in place to assist and direct students in the skills of close reading and text-based writing. Graphic organizers with reading prompts, thinking prompts, and outlines were implemented as scaffolds for students while going through the documents. These three elements complemented each other and were especially designed to target students who may struggle with reading and writing along with anxious, confused, and/or frustrated students. Without providing the scaffolding, the students would have struggled a great deal more with the assignment as the students definitely needed focus and organizational strategies to be successful.

The students were grouped into three achievement bands based on MAP data collected during this school year. In the highest group, the average text-based essay score was 96% and
the accuracy score on the graphic organizer was an average of 90%. For the middle group the average text-based essay score was 74% and the accuracy score on the graphic organizer was an average of 80%. The low group earned an average score of 61% on the text-based essay and the accuracy score on the graphic organizer was 68%. The trend suggests that the higher the comprehension of the documents as measured by the accuracy check on the guided reading questions, the higher the score on the text-based writing essay.

Students that struggled with reading and writing had a higher likelihood to stop writing due to what appeared to be apathy and/or frustration. The students who had lower MAP scores scored an average of 61% on the text-based writing assignment and scored a 68% on their reading comprehension. The essays from this group of students was also considerably shorter in length than the other two groups of students. When asked why her essay was shorter in length, Harper reported that it was “too hard and I didn’t have enough time.” The students in the lowest group struggled more with the evidence portion of the writing. These students were able to write clear claims that followed one of two common themes.

After reading the document set the two most common claims that students made were that competition during the cold war drove scientific innovation in the 1950s and 1960s and the second was that the cold war drove scientific innovation by developing technologies to win the space race. Both of these claims are relevant to this specific document set; however, the casuistry of the students was demonstrated. The students’ claims were related to the topic, but were minimally complex and not very specific. The students performed adequately supporting claims with relevant evidence from the documents. An illustrative student example from Layla sounded like this, “The Cold War drove scientific innovation in the 1950s and 1960s by creating competition between the United States and USSR to be the first to take a man to the Moon and
bring him back.” Most of the students were able to find adequate pieces of evidence from the sources to support their claim.

The struggle for many students was finding the strongest pieces of evidence within the texts. More than simply finding the main point, this task required students to grasp the significance of all the points and determine which one is most significant. One student, Jaxon, stated the claim that the Cold War drove scientific innovation by creating new and better technological developments to explore space. The supporting evidence was that the NASA wanted to beat the Soviets and through Document Nine, “the current state of rocket technology and applied fields allows [us] to create an artificial Earth satellite in the next few years.” While this is related to the claim there were many other pieces of evidence in the documents that suggest technological developments specifically for space exploration. One example that could have been used instead was the development of Mariner 9 whose mission was to map the surface of Mars. The student could have connected that the creation of this satellite would allow for possible data collection. In Document Nine the purpose of the satellite the Soviets’ are planning on building is unclear and the reader cannot be sure that it would actually be intended for space exploration. There were very few students who were unable to produce any relevant evidence to substantiate claims, which suggests that students are able to analyze sources as long as the content is made accessible.

Another major struggle for the students was connecting documents to strengthen their evidence. For example, if a student wished to use Document Seven, which was a Chart of Federal Spending between 1958-1970, and connect it with Document One, the timeline, the student could then connect the documents to strengthen the claim that more scientific innovation took place between 1964 to 1967 and connect those specific developments. The students largely
did not see the connections between the documents and were not sure how to integrate
c connexions into their writing. The students may have struggled with the cognitive tasks of
synthesis and evaluation, which are both higher cognitive tasks than analysis on Bloom’s
Taxonomy.

The entire unit was based on the students close reading a diverse set of texts in order to
determine scientific and historical significance. They were then to communicate their findings in
the form of a text-based writing assignment. The students were the most successful at close
reading the documents and answering the reading and thinking prompts in the graphic organizer.
Students were encouraged by the teacher to go back and re-read the texts that were more
difficult. Out of the sample group, 82% of the students earned a score of 70% or better on their
accuracy score. Thus, the vast majority of students earned a passable score. Almost half of the
sample group, 53%, earned a score of 90% on their accuracy score when answering the
comprehension questions in the graphic organizer. This demonstrates that reading
comprehension itself was not a significant struggle. More than half the students were able to
complete this task with little difficulty.

Some of the texts were more difficult for the students to get through than others.
Documents Eight and Nine were specific documents that caused students to struggle. Their use
of technical vocabulary and length were likely the origin of students’ struggles. These
referenced letters from the heads of the United States and Soviet rocket programs. While the
students demonstrated an ability to analyze and interpret most of the other sources, the content of
these two documents was much more difficult which caused the skills of analysis and
interpretation to be tenuous at best.
The evidence used to support these claims tended to come more commonly from some documents more than using others. For example, the high student group did not reference using Document One, the timeline, at all where every student from the middle group listed it as very helpful for finding evidence. Few students, across all levels, used any of the photographs as evidence to support their claim. One student, Penelope stated that,

"I found documents 7, 10, 11, and 12 to be very unhelpful while writing my claim because they had little to nothing to do with how the Cold War contributed to scientific innovation. 7 was about budgeting and 10, 11, and 12 had to do with rocket design."

Another student, Isobel, stated,

"The documents that helped the least were 7, 10, and 11. Number 7 was a table and I couldn’t pull a lot of information out of it to form a full point. 10 and 11 were pictures and although they help me picture the information, it didn’t provide much information itself."

Documents eight and nine were also listed as documents that were unhelpful to students especially in the high group. These documents were the most relevant to developments in scientific innovation, due to them being written by the heads of rocket development for the Soviet and United States programs and detailing steps that had been taken to increase scientific innovation during this time period. Multiple students stated that the vocabulary was confusing and that they were too lengthy to be used easily.

Clear patterns, which were seemingly associated with ability, emerged when students were asked about the helpfulness of the specific documents. Another trend was that students in the high group were very detailed in referencing which documents were the most and least helpful. They listed multiple reasons why they did or did not use them as evidence in their
claims. The majority of students in the lowest group only listed one document for each category and did not elaborate on why they used or exempted it from their evidence. The middle student group listed more documents as being helpful or unusable, but did not provide as much elaboration as to why those documents were chosen.

**Discussion**

The students responded with anxiousness and frustration to the text-based writing assignment. This was probably in part to this being the first time these students were exposed to reading a multitude of primary sources and being asked to construct a claim that blended scientific innovation and historical significance. The students did not emote that they were inexperienced with any one skill that they were asked to perform. When looking at the student responses the students were able to close read and support claims with adequate evidence. The students just have not had many opportunities to practice this type of skill on this kind of scale. One recommendation to teachers attempting this type of activity in class would to first make this a more interdisciplinary activity. Blending this activity between science class, reading class, and social studies class would allow for students to make the connections to the skills and content being addressed during the text-based writing assignment. Since this was the first time the students were exposed to the activity, how they responded without much teacher intervention allowed for perhaps a more genuine assessment of the students' skills. Graphic organizers and outlines were given to help direct the students, but not much teacher support was provided beyond what could be accomplished in a typical classroom full of twenty-five or more students. The teacher should go over the graphic organizers for reading comprehension before moving on to the text-based writing outline. Allowing time for a revision process would also be prudent to see if a more complex essay could be completed. This could be accomplished through teacher-
student conferences, turning in a first draft for comments, or peer revision. These pedagogical choices, however, are all quite time consuming and take at minimum one or two full class periods. They are undoubtedly worthwhile, yet time is always a constraint. Overall, creating a more interdisciplinary approach to this project and more teacher intervention could have possibly created a more complex product.

Although scaffolding by the teacher in the form of graphic organizers and outlines were provided to students, there may have been too many documents for students to grapple with. Too many documents could have created issues with organization and focus and dampened students' motivation for or ability to engage in evaluation and synthesis. However, students can handle many documents when being asked to construct a text-based writing response (Strahan & Rogers, 2012; Wineburg, Martin, & Monte-Sano, 2011; Nokes, 2013; Monte-Sano, De La Paz, & Felton, 2014; Journell, 2017). Students need appropriate procedural implementation by the teacher to be successful (Bickford & Bickford, 2018). Procedural implementation is where students engage in a task repeatedly throughout the school year. Each time the students attempt the task the complexity or difficulty is increased (Bickford & Bickford, 2018). As this was the first time that students attempted this type of assignment there was not enough time within the scope of the study to drill all procedures for students to be successful. Students appeared more adept at the procedure of close reading than they were with choosing the strongest evidence to support a claim.

Students' reading ability did factor into their performance on the assignment. The students with the highest MAP scores performed better on both reading comprehension and the text-based writing assignment. Their papers were considerably more detailed and focused. This could be a result of understanding the documents after reading and being able to articulate their
findings through written expression. The students that scored in the middle range of the MAP testing scored well on reading comprehension, but scored lower on the text-based writing assignment. This could be related to the fact that those students were able to read the documents, but had some trouble fully understanding them and therefore did not add much detail or evidence to support their claim. Based on the teacher’s observations, students in this category were typically very focused in following the outline provided and did not provide elaboration on their ideas. Students with the lowest MAP scores also earned the lowest scores on both the reading comprehension task and the text-based writing assignment. Students’ reading comprehension impeded their ability to fully develop their ideas into a focused essay due to not understanding the information the documents contained. Students in this group may also have become frustrated by not understanding which caused them to lack motivation or perhaps it sparked apathy towards that assignment. They did not demonstrate learned helplessness as much as avoidance or submission of incomplete, inadequate tasks. Perhaps, students are judged on completion—and not competency—in other courses.

This feeling of apathy and frustration from the students in the lowest achieving group could have multiple causes. This assignment was at the high end of their zone of proximal development, but the type of assignment is developmentally appropriate for eighth grade students. These students MAP scores indicate that their reading levels are below the expectations of an eighth-grade student which may be the cause of their apathy or frustration. These feelings are common among groups of students who are trying a task for a first time. Even though this assignment was challenging, it is not an excuse for students to give up. Another aspect that could have attributed to increased apathy and demonstrable frustration are that the skills students were asked to engage in (synthesis, evaluation, creation) are at the higher
end of Bloom's Taxonomy of Critical Thinking (Anderson & Krathwohl, 2001; Benassi, Overson, & Hakala, 2014; Bloom & Krathwohl, 1956.). The students may also have lacked experience doing this type of assignment. Any time a person, student or adult, tries something for the first time there are growing pains. They look back at how it could be done better or if given a second change they would try a different approach. Even though there are factors that would increase frustration and apathy students had ample time to seek help and there was also an opportunity for revision.

Students at all levels were able to create a claim and support it by varying degrees and amounts of evidence. Students across all achievement levels made claims that supported the idea that scientific innovation did occur during the Cold War. Students arrived at their claims by analyzing the documents to see how they could connect any of the evidence from the documents to support their claim. The students have had direct instruction on analysis throughout the school year, especially in reading class. Students also engaged in evidence-based writing in science class throughout the school year; they developed claims about their experiments and then support them with qualitative or quantitative data from the experiment. They seemed to be adept at using text evidence from fiction sources to support different ideas that they write about in literature circles. The extensive exposure to the skill of analysis could have been a major part in why students across all levels were able to introduce a claim and then support it with adequate evidence from the provided documents. Although students were able to write claims, evaluating the evidence to use the strongest pieces of evidence did pose a challenge to most students.

Students struggled when asked to evaluate the evidence to find the most significant pieces to support their claim. This is unsurprising as this was the first time this school year that students were asked to engage in a high level of disciplinary literacy. The lack of exposure and
experience is probably the most contributing factor to the students struggle. After speaking with other teachers on the team and in other grade levels, the students have only engaged in this type of literacy activity a handful of times. The students this year are also not exposed to many primary sources within their social studies class. The most common form of sourcing for the students is through the text-book or from viewing different films. Another contributing factor to the struggle is that the task of evaluation is among the highest tiers of Bloom's Taxonomy of Critical Thinking when differentiating cognitive tasks. Even though the students struggled in accordance with the CCSS students should be engaging in these types of activities within the content areas. The CCSS also makes the recommendation that students should have similar portions of fiction and non-fiction texts to interact with when reading and writing. Many Reading and Language Arts classes focus primarily on fiction and students get less exposure to non-fiction sources. When non-fiction is taught within Reading and Language Arts class it is rare that it is presented to students with an interdisciplinary approach. The text-based writing task is a developmentally appropriate activity for eighth grade students to engage in and is prescribed by not only the CCSS, but the NGSS and C3 framework for social studies as well.

Another related task that was difficult for students to accomplish was connecting documents to strengthen their evidence and by proxy their claims. This again is also unsurprising because this is another skill that they have had very little exposure and practice with. Students also must understand the significance of each document from a historical and scientific perspective to allow for relevant connections to be made. The students are capable of making connections with fictional texts that they use in reading class and can also make connections to themselves or to the real world very easily. Since the historical achievements discussed within this assignment are in the past it makes it very difficult for students to make
personal connections to the time period. To put this in perspective for the students in this year’s class, there has been at least one human being orbiting the Earth in the International Space Station for their entire life. It is difficult for them to comprehend a time when humans were not sending humans into space and this in turn effects their perspective of scientific innovation. So, the students are at a deficit in the ability to make personal connections and making text to text connections within the sources provided for the assignment. The students also did not connect the evidence in a way to create a more sophisticated argument. The students understand using corroboration or evidence to help strengthen their claim, but part of this issue is that it takes more time and more readings of the sources to create and find those connections. Due to the time frame of the assignment, students did not go back into the texts as often as they could have to create a stronger argument. They were more concerned with getting the assignment done within the given amount of class time. The lack of time may have caused students to rush which resulted in underdeveloped arguments lacking corroboration.

The students achieved the highest scores on close reading of the texts. Over half of the students earned above a passing score on the reading comprehension portion of the assessment. This was probably due to the fact that close reading is a commonly practiced reading strategy endorsed as a good practice by most teachers. Since this skill has been taught extensively along with self-monitoring strategies the students were not as apprehensive about engaging in the task. This could be one of the strongest reasons that the students demonstrated understanding of the sources after each reading. Close reading for this set of students has been mostly reinforced with books, both fiction and non-fiction, but not as often with primary sources or informational texts. The results of their reading comprehension scores showed that the students were able to handle close reading of the documents even though they had less exposure to that specific type. One
pattern to note was that even though students were able to understand what they were reading, that did not translate into their written expression. The writing component of this task makes it more advanced. If students were given a tape recorder to capture their responses, they might be better able to articulate their findings with more detail and evidence. The task of writing slows the students down and makes them much more aware of their mistakes. Eighth grade students are probably quite aware of mistakes in their own writing which might cause them to write less detailed responses if they view their writing as inadequate (Nokes, 2011; Nokes, 2013; Wineburg, 2001; Wineburg, Martin, & Monte-Sano, 2011; Wineburg, Smith, & Breakstone, 2012).

Students responded to specific documents with unease and reported that they were difficult to use for evidence. Documents Eight and Nine were the most often referenced documents by students as difficult. This was probably due to the technical vocabulary used throughout the documents. The documents were from the heads of the United States and Soviet rocket programs during the 1960s. Both documents outlined the different technologies that would be instrumental to send a man to the Moon. Another factor was that the documents were the longest documents in the set by at least double the length. Students may have lacked the reading stamina to unpack all the information within the passages, which lead to students not being able to use the information as evidence within the writing. Based on the teacher’s (albeit anecdotal) experience in the district, the students were not exposed to reading primary sources within their social studies classes this year and likely did not have much experience in previous years. The lack of experience could have contributed to the students not understanding the speech and schema of contemporary Americans.
The students definitely pulled evidence for their claims from certain specific documents more than others. The most referenced source for the middle group of students was document one which was a timeline of the Space Race. The students were able to access it easily to pull out information and it was the easiest document to analyze and interpret. One downfall of the document was that some of the items referenced within the timeline did not have an explanation and if students used a piece of evidence that they did not understand it was very clear in their writing that there was a disconnect in comprehension (VanSledright, 2002). All grouped levels of students reported that the photographs (document ten and eleven) were not helpful as evidence to their claims. This could be that the students lack context to how rockets evolved from weapons used in World War II to the current rockets that are being developed to send missions to Mars. This could also be because they are not exposed to how to analyze photographs from a historical or scientific perspective. Visual literacy could be a skill that these students lack. This was a surprising result because research shows that students who are lower level reader rely on pictures to help them make meaning of the topic (Bickford, Bickford, & Rich, 2015). It could also be that these documents were not framed in a way that made them relatable to the other documents, so they were dismissed by the students. Students also were dismissive of documents eight and nine which were the most helpful when analyzed with the lens of scientific significance. As referenced above this was probably because they had more challenging academic vocabulary and students lacked the stamina to get through these longer documents.

The students reporting how helpful the documents were could be linked to literacy ability. The students in the highest group could articulate why they thought the documents were helpful or not and give specific details and suggestions for future document sets. They addressed the question of significance with certain documents and provided elaboration on their thoughts.
This could be that the students are more adept at writing and critical thinking. Also, these students tend to be conscientious of their grades and put forth the effort to attain higher scores. The middle group listed documents as helpful or not, but did not provide as many details to support their decision of why they used or did not use them. This group of students was able to discern which documents were helpful to their claim, but were not able or did not take the time to elaborate as to why. This could be a combination of both cognitive ability, diligence, and precision. The lowest group of students listed one document at most in each category of helpful and not helpful. Some of the students in this group did not even list documents at all, they just ignored that part of the assignment. This group of students did not provide elaboration as to why if they did list a document. This could be caused by general apathy towards their grades, the fact that they did not have enough time to complete the assignment, and possibly lower reading and writing skills.

In every class on different days, students often asked the same question, “Why are we doing this in science class?” This question creates a glaring reality for content area teachers. One wonders if teachers are collectively doing enough to promote content area reading and writing within our classrooms. The students in this study lacked the ability to connect reading and writing from reading class into classes like social studies and science. This leads to the question how much exposure to literacy are they getting outside their reading and language arts classes? All teachers are teachers of reading, writing, speaking, listening, and visually representing, but not all teachers accept this as part of their content. Teachers need to be aware that by not preparing their students for the technical writing and research tasks within different disciplines we are doing a disservice to our students. In this research study, students were able to prove that they could close read the documents and make claims supported by evidence, but they
were not able to write about the significance of the evidence they were using. They lacked skills of evaluation and creation. This is most likely due to lack of exposure and practice to these types of reading and writing tasks. Research shows that the only sure way to increase reading and writing ability is to engage in the activity more often. This is also the case for these types of reading and writing assignments. Students need to engage in critical thinking and evaluation tasks across multiple content areas so that students gain the skills they need to be successful. This is not to say that students do not need scaffolding. The best prescription might be to use a gradual release of responsibility model with students to build their confidence with these tasks. The lack of the interdisciplinary approach is also noticed by students’ responses. The more ways that teachers connect what they are teaching to other content areas the more relevant the content becomes and more understanding is gained.

This study did have some significant limitations. There was a very limited data pool to begin with. This study was conducted with one eighth grade class in one middle school. Also, a limited student pool should be mentioned. With only seventy-five to one hundred students to sample no grand generalizations can be made. The student population was also relatively homogenous in terms of diversity. Probably the most limiting factor in the study was that students had precious little experience with this form of inquiry. This study is also not replicable due to the students moving on and/or having different educational experiences if I would try this again next year. There was also no second rater to verify or proof my determinations. There is always a chance that I missed something and there was no check of inter-rater reliability. Students were also allowed to take the final writing essay home over the weekend to finish for more time. This could have led to external parental help outside of school and allows for student motivation to play more of a part than their academic abilities. I also did not quantitatively
analyze the data. I am certain that there is a correlation between reading scores and disciplinary literacy, but I am unsure of how strong that correlation is. Recognizing that there were weaknesses with this study does not discount the significant findings mentioned within the discussion. Knowing what I now know after this experience, there are some changes that I would recommend to teachers who would wish to implement this kind of activity within their classroom.

This activity is something that would work best as with an interdisciplinary approach where science, social studies, reading, and writing all intersect and students interact with the teachers across the subject areas. This allows for specifically targeted content literacy that matches with the CCSS and content standards for the subject. Also, students are working with an expert within each content area would be beneficial to students. I would recommend teachers model, provide feedback, and reteach skills as needed. Interdisciplinary instruction would also allow for targeted skills to be taught within the different content areas. This could allow for students to see how the same skills apply with different content. If teachers decided to take this on in their own classroom lacking the disciplinary support I would suggest that the documents be accommodated for academic vocabulary. This can be accomplished by providing definitions or synonyms for challenging words. These differentiated documents could be provided to all groups or to groups who need more scaffolding. Also, making captions and providing more descriptions for the selected images would allow for the students to draw more evidence from the images. Another differentiation strategy could include a supported reading small group led by the teacher while the other students are working on close reading the documents. This could be utilized by any student who would like assistance or a targeted group of students. Allowing time for a revision aspect of the project would also have been beneficial and would allow for the
teacher and student to see growth. This could include student-teacher conferencing or designing it as a draft-revision process. All of the suggestions are exactly that, suggestions. I compiled these after sharing my findings with other teachers on my team and other science teachers in my building to get a group perspective on how this assignment could become more accessible and beneficial for students.
References


Educational Performance Consulting LLC. (n.d.). *8th Grade English/Language Arts Argumentative Text-Based Writing Rubric with Research.* Retrieved from: https://1cdn.edl.io/kGNC8frfsgRyDkpNaAEXBoSaBibUke3OYrBqLX3ZFRpQlSf1.pdf


Appendix

1. Rubric

Name: __________________________  Period: __________________________

Essential Question: How did the Cold War drive scientific innovation in the 1950's and 1960's?

Directions:
1) Students will read the documents and complete the guiding questions graphic organizer.
2) Students will write a claim to answer the essential question listed above and provide evidence from documents for support.
3) Students will write a paragraph describing which documents they felt were the most helpful to making their claims and why.

<table>
<thead>
<tr>
<th>Content</th>
<th>3=Meets Grade level expectations</th>
<th>2=Approaching Grade level Expectations</th>
<th>1=Below Grade Level Expectations</th>
<th>Points Awarded</th>
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<td>W.8.1 Write Arguments to support claims with clear reasons and relevant evidence</td>
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<tr>
<td></td>
<td>□ Accurately cites strong and thorough textual evidence to support of what the text says explicitly</td>
<td>□ Cites some textual evidence to support analysis of what the text says explicitly</td>
<td>□ Inaccurately cites textual evidence or provides insufficient explanation of what the text says explicitly</td>
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</tr>
<tr>
<td></td>
<td>□ Accurately cites strong and thorough textual evidence to support inferences drawn from the text</td>
<td>□ Cites some textual evidence to support inferences drawn from the text</td>
<td>□ Inaccurately cites textual evidence or provides inaccurate inferences from the text</td>
<td></td>
</tr>
<tr>
<td><strong>Writing: Structure &amp; organization</strong></td>
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<td>W.8.1a</td>
<td>The writing:</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>□ Effectively introduces claims</td>
<td>□ Partially introduces claims</td>
<td>□ Fails to introduce claim</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Organizes reasons and evidence logically</td>
<td>□ Partially organizes reasons and evidence logically</td>
<td>□ Fails to organize reasons and evidence logically</td>
<td></td>
</tr>
<tr>
<td>W.8.1c</td>
<td>The writing:</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>□ Effectively addresses the prompt with a focused response</td>
<td>□ Addresses the prompt with some drift in focus</td>
<td>□ Does not address the prompt/lack of focus</td>
<td></td>
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<tr>
<td></td>
<td>□ Effectively supports the claims with logical reason and relevant evidence, demonstrates understanding of the topic</td>
<td>□ Supports claims with reasoning &amp; evidence, demonstrates partial understanding of the topic</td>
<td>□ Supports claims with insufficient evidence, fails to demonstrate understanding of topic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Creates cohesion and clarifies relationships among claims, reasons, and evidence</td>
<td>□ Partially creates cohesion and clarifies relationships among claims, reasons, and evidence</td>
<td>□ Does not clarify relationships among claims, reasons, and evidence</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Establishes and maintains a formal style</td>
<td>□ Does not always establish and maintain formal style</td>
<td>□ Does not establish or maintain formal style</td>
<td></td>
</tr>
</tbody>
</table>
Score "0" = no response, the response is too limited to evaluate, and/or the response is undecipherable
Overall Score

Note: This rubric was adapted from one in which multiple versions were found at various websites.

2. Sources/Documents

Document #1


Sep. 29, 1945: Wernher von Braun arrives at Ft. Bliss, Texas, with six other German rocket specialists.
Nov. 3, 1957: The Soviet Union launches Sputnik 2 with the first living passenger, the dog Laika, aboard.
Dec. 6, 1957: A Vanguard TV-3 carrying a grapefruit-sized satellite explodes at launch; a failed response to the Sputnik launch by the United States.
Jan. 31, 1958: Explorer I, the first satellite with an onboard telemetry system, is launched by the United States into orbit aboard a Juno rocket and returns data from space.
Oct. 7, 1958: NASA Administrator T. Keith Glennan publicly announces NASA’s manned spaceflight program along with the formation of the Space Task Group, a panel of scientist and engineers from space-policy organizations absorbed by NASA. The announcement came just six days after NASA was founded.
Jan. 2, 1959: The U.S.S.R. launches Luna I, which misses the moon but becomes the first artificial object to leave Earth orbit.
Jan. 12, 1959: NASA awards McDonnell Corp. the contract to manufacture the Mercury capsules.
Feb. 28, 1959: NASA launches Discover I, the U.S. first spy satellite, but it is not until the Aug. 11, 1960, launch of Discover 13 that film is recovered successfully.
May 28, 1959: The United States launches the first primates in space, Able and Baker, on a suborbital flight.
Aug. 7, 1959: NASA’s Explorer 6 launches and provides the first photographs of the Earth from space.
Sept. 12, 1959: The Soviet Union’s Luna 2 is launched and two days later is intentionally crashed into the Moon.
Oct. 24, 1960: To rush the launch of a Mars probe before the Nov. 7 anniversary of the Bolshevik Revolution, Field Marshall Mitrofan Nedelin ignored several safety protocols and 126 people are killed when the R-16 ICBM explodes at the Baikonur Cosmodrome during launch preparations.
Feb. 12, 1961: The Soviet Union launches Venera to Venus, but the probe stops responding after a week.
April 12, 1961: Yuri Gagarin becomes the first man in space with a 108-minute flight on Vostok 1 in which he completed one orbit.

May 5, 1961: Mercury Freedom 7 launches on a Redstone rocket for a 15-minute suborbital flight, making Alan Shepard the first American in space.

May 25, 1961: In a speech before Congress, President John Kennedy announces that an American will land on the moon and be returned safely to Earth before the end of the decade.

Oct. 27, 1961: Saturn 1, the rocket for the initial Apollo missions, is tested for the first time.


July 10, 1962: The United States launches Telstar 1, which enables the trans-Atlantic transmission of television signals.

June 14, 1962: Agreements are signed establishing the European Space Research Organization and the European Launcher Development Organization. Both eventually were dissolved.


Aug. 27, 1962: Mariner 2 launches and eventually performs the first successful interplanetary flyby when it passes by Venus.

Sept. 29, 1962: Canada's Alouette 1 launches aboard a NASA Thor-Agena B rocket, becoming the first satellite from a country other than the United States or Soviet Union.

June 16, 1963: Valentina Tereshkova becomes the first woman to fly into space.

July 14, 1965: Gemini 3, the first of the manned Gemini missions, launches with a two-person crew on a Titan 2 rocket, making astronaut Gus Grissom the first man to travel in space twice.

June 3, 1965: Ed White, during the Gemini 4 mission, becomes the first American to walk in space.

July 14, 1965: Mariner 4 executes the first successful Mars flyby.

Aug. 21, 1965: Gemini 5 launches on an eight-day mission.

Jan. 14, 1966: The Soviet Union’s chief designer, Sergei Korolev, dies from complications stemming from routine surgery, leaving the Soviet space program without its most influential leader of the preceding 20 years.


March 1, 1966: The Soviet Union’s Venera 3 probe becomes the first spacecraft to land on the planet Venus, but its communications system failed before data could be returned.

March 16, 1966: Gemini 8 launches on a Titan 2 rocket and later docks with a previously launched Agena rocket — the first docking between two orbiting spacecraft.

April 3, 1966: The Soviet Luna 10 space probe enters lunar orbit, becoming the first spacecraft to orbit the Moon.

June 2, 1966: Surveyor 1, a lunar lander, performs the first successful U.S. soft landing on the Moon.

Jan. 27, 1967: All three astronauts for NASA’s Apollo 1 mission suffocate from smoke inhalation in a cabin fire during a launch pad test.

April 5, 1967: A review board delivers a damning report to NASA Administrator James Webb about problem areas in the Apollo spacecraft. The recommended modifications are completed by Oct. 9, 1968.

April 23, 1967: Soyuz 1 launches but myriad problems surface. The solar panels do not unfold, there are stability problems and the parachute fails to open on descent causing the death of Soviet cosmonaut Vladimir Komarov.

Oct. 11, 1968: Apollo 7, the first manned Apollo mission, launches on a Saturn 1 for an 11-day mission in Earth orbit. The mission also featured the first live TV broadcast of humans in space.

Dec. 21, 1968: Apollo 8 launches on a Saturn V and becomes the first manned mission to orbit the moon.

Jan. 16, 1969: Soyuz 4 and Soyuz 5 rendezvous and dock and perform the first in-orbit crew transfer.

March 3, 1969: Apollo 9 launches. During the mission, tests of the lunar module are conducted in Earth orbit.

May 22, 1969: Apollo 10’s Lunar Module Snoopy comes within 8.6 miles (14 kilometers) of the moon’s surface.

July 20, 1969: Six years after U.S. President John F. Kennedy’s assassination, the Apollo 11 crew lands on the Moon, fulfilling his promise to put an American there by the end of the decade and return him safely to Earth.

Nov. 26, 1965: France launches its first satellite, Astérix, on a Diamant A rocket, becoming the third nation to do so.

Feb. 11, 1970: Japan’s Lambda 4 rocket launches a Japanese test satellite, Ohsumi into orbit.

April 13, 1970: An explosion ruptures the command module of Apollo 13, days after launch and within reach of the moon. Abandoning the mission to save their lives, the astronauts climb into the Lunar Module and slingshot around the Moon to speed their return back to Earth.

April 24, 1970: The People’s Republic of China launches its first satellite, Dong Fang Hong-1, on a Long March 1 rocket, becoming the fifth nation capable of launching its own satellites into space.
Sept. 12, 1970: The Soviet Union launches Luna 16, the first successful automated lunar sample retrieval mission.

April 19, 1971: A Proton rocket launches the first space station, Salyut 1, from Baikonur.

June 6, 1971: Soyuz 11 launches successfully, docking with Salyut 1. The three cosmonauts are killed during re-entry from a pressure leak in the cabin.

July 26, 1971: Apollo 15 launches with a Boeing-built Lunar Roving Vehicle and better life-support equipment to explore the Moon.

Oct. 28, 1971: The United Kingdom successfully launches its Prospero satellite into orbit on a Black Arrow rocket, becoming the sixth nation capable of launching its own satellites into space.

Nov. 13, 1971: Mariner 9 becomes the first spacecraft to orbit Mars and provides the first complete map of the planet's surface.

Jan. 5, 1972: U.S. President Richard Nixon announces that NASA is developing a reusable launch vehicle, the space shuttle.

March 3, 1972: Pioneer 10, the first spacecraft to leave the solar system, launches from Cape Kennedy, Fla.

Dec. 19, 1972: Apollo 17, the last mission to the moon, returns to Earth.

Document #2


Sputnik came as a surprise to most Americans - but it should not have, observes John Logsdon, Director, of the Space Policy Institute, Elliott School of International Affairs at George Washington University in Washington, D.C. “Our movies and television programs in the fifties were full of the idea of going into space. What came as a surprise was that it was the Soviet Union that launched the first satellite. It is hard to recall the atmosphere of the time. Fallout shelters, rabid anti-Communism, a sense of imminent danger from without and within,” Logsdon said. With the launch of the Soviet satellite, Logsdon said, the reaction was more fear than surprise, because it showed clearly that the United States was no longer safe behind its ocean barriers. “The claim that who controlled space would control the Earth seemed plausible, and the Soviet Union had taken the first step towards that control,” he said

Document #3


On that same evening of 4 October, Senate Majority Leader Lyndon B. Johnson ...heard the announcement of Sputnik I's launch on the radio...Johnson's mind kept returning to the heavens as he pondered the Soviet triumph. He recollected, “Now, somehow, in some new way, the sky seemed almost alien. I also remember the profound shock of realizing that it might be possible for another nation to achieve technological superiority over this great country of ours.” ...One of Johnson's aides, George E. Reedy, summarized the feelings of many Americans: “the simple fact is that we can no longer consider
the Russians to be behind us in technology. It took them four years to catch up to our atomic bomb and
nine months to catch up to our hydrogen bomb. Now we are trying to catch up to their satellite.”

Document #4


“...Finally, if we are to win the battle that is now going on around the world between freedom and
tyranny, the dramatic achievements in space which occurred in recent weeks should have made clear to us
all, as did the Sputnik in 1957, the impact of this adventure on the minds of men everywhere, who are
attempting to make a determination of which road they should take. Since early in my term, our efforts in
space have been under review. With the advice of the Vice President, who is Chairman of the National
Space Council, we have examined where we are strong and where we are not, where we may succeed and
where we may not. Now it is time to take longer strides—time for a great new American enterprise—time
for this nation to take a clearly leading role in space achievement, which in many ways may hold the key
to our future on Earth. First, I believe that this nation should commit itself to achieving the goal, before
this decade is out, of landing a man on the moon and returning him safely to the earth. No single space
project in this period will be more impressive to mankind, or more important for the long-range
exploration of space; and none will be so difficult or expensive to accomplish...”

Document #5

Source: David West Reynolds, Apollo, the Epic Journey to the Moon, 2002, pg 34.

Under the intense media scrutiny of an America waiting desperately for something to salve the national
pride, the Vanguard rocket was prepared for launch at Cape Canaveral. On December 6, 1957, the
slender, delicate instrument was fired, began to rise, and then sank back down on itself, crushing its
engines and erupting into a huge fireball. The pathetic collapse was carried live on television, right in
front of the world. This was what we were capable of, while the Russians rode the heavens.

Document #6

Source: Nikolai Petrovich Kamanin, head of the cosmonaut corps, Kamanin Diaries, December 21,
1968

In the last four years the U.S. has been ahead of us in manned space flights. But few people in the Soviet
Union know about it. It is only now when Americans have launched their Apollo-8 that it will be brought
home to everyone that we have yielded our supremacy in outer space... It is a red-letter day for all
mankind, but for us it is marred by a sense of missed opportunities and a regret that Frank Borman, James
Lovell and William Anders and not Valery Bykovsky, Pavel Popovich or Alexei Leonov are flying
toward the moon. ...In 1962... the U.S.S.R.'s authority as the top space power was unassailable... we had
no doubt that the U.S.S.R. will remain the front-runner in the Space Race. We had faith in our technology
and our plans had the backing of our country's leadership headed by [Soviet premier Nikita]
Khrushchev... but then we made a terrible blunder... haste brought about the death of [Soyuz 1
commander Vladimir] Komarov and that in turn created a tendency of hedging..."
Document #7


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Document #8


My dear Mr. Vice President,

This is an attempt to answer some of the questions about our national space program raised by The President in his memorandum to you dated April 20, 1962. I should like to emphasize that the following comments are strictly my own and do not necessarily reflect the official position of the National Aeronautics and Space Administration in which I have the honor to serve.

Question 1. Do we have a chance of beating the Soviets by putting a laboratory in space, or by a trip around the moon, or by a rocket to land on the moon, or by a rocket to go to the moon and back with a man? Is there any other space program which promises dramatic results in which we could win?

Answer: With their recent Venus shot, the Soviets demonstrated that they have a rocket at their disposal which can place 14,000 pounds of payload in orbit. When one considers that our own one-man Mercury space capsule weighs only 3900 pounds, it becomes readily apparent that the Soviet carrier rocket should be capable of

- Launching several astronauts into orbit simultaneously. (Such an enlarged multi-man capsule could be considered and could serve as a small laboratory in space.)
- Soft-landing a substantial payload on the moon. My estimate of the maximum soft-landed net payload with of the Soviet rocket is about 1400 pounds (one-tenth of its low orbital payload.) This weight capability is not sufficient to include a rocket for the return flight to earth of a man landed on the moon. But it is entirely adequate for a powerful radio transmitter which would relay lunar data back to earth and which would be abandoned on the lunar surface after completion of this mission. A similar mission is planned for our “Ranger” project, which uses an Atlas-Agena B boost rocket. The “semi-hard” landed portion of the Ranger package weighs 293 pounds. Launching is scheduled for January 1962.
The existing Soviet rocket could furthermore hurl a 4000 to 5000 pound capsule around the moon with ensuing re-entry into the earth atmosphere. This weight allowance must be considered marginal for a one-man round-the-moon voyage. Specifically, it would not suffice to provide the capsule and its occupant with a “safe abort and return” capability, a feature which under NASA ground rules for pilot safety is considered mandatory for all manned space flight missions. One should not overlook the possibility, however, that the Soviets may substantially facilitate their task by simply waiving this requirement.

A rocket about ten times as powerful as the Soviet Venus launch rocket is required to land a man on the moon and bring him back to earth. Development of such a super rocket can be circumvented by orbital rendezvous and refueling of smaller rockets, but the development of this technique by the Soviets would not be hidden from our eyes and would undoubtedly require several years (possibly as long or even longer than the development of a large direct-flight super rocket).

(continued on the next page)

Summing up, it is my belief that

a) We do not have a good chance of beating the Soviets to a manned “laboratory in space.” The Russians could place it in orbit this year while we could establish a (somewhat heavier) laboratory only after the availability of a reliable Saturn C-1 which is in 1964.

b) We have a sporting chance of beating the Soviets to a soft-landing of a radio transmitter station on the moon. It is hard to say whether this objective is on their program, but as far as the launch rocket is concerned, they could do it at any time. We plan to do it with the Atlas-Agena B-boosted ranger 53 in early 1962.

c) We have a sporting chance of sending a 3-man crew around the moon ahead of the Soviets (1965/1966). However, the Soviets could conduct a round-the-moon voyage earlier if they are ready to waive certain emergency safety features and limit the voyage to one man. My estimate is that they could perform this simplified task in 1962 or 1963.

d) We have an excellent chance of beating the Soviets to the first landing of a crew on the moon (including return capability, of course). The reason is that a performance jump by a factor 10 over their present rockets is necessary to accomplish this feat. While today we do not have such a rocket, it is unlikely that the Soviets have it. Therefore, we would not have to enter the race towards this obvious new goal in space exploration against hopeless odds favoring the Soviets. With an all-out crash program I think we could accomplish this objective in 1967/1968.

Document #9


Nº K-3/0194

5 August 1955

Top Secret
(Special Folder)
Copy Nº2

to Cde. N. S. KHRUSHCHEV

to Cde. N. A. BULGANIN
In connection with reports which have appeared in the American press that the creation of a small artificial Earth satellite will be achieved in 1957-1958 we report:

The current state of rocket technology and its allied fields allows [us] to create an artificial Earth satellite in the next few years.

An Earth satellite appears to be a projectile having a horizontal velocity of no less than 7.9 km/sec. With such a velocity the projectile will rotate around the Earth in a closed trajectory, an orbit, that is, it will turn into an artificial Earth satellite.

With the aid of a satellite equipped with the appropriate apparatus important data can be acquired which is needed for the further development of science and military technology about the atmosphere, cosmic rays, very high levels of the atmosphere, geophysics, mechanics, and radiophysics, and photoreconnaissance of territory can be conducted to acquire accurate maps correlated in a unified system of coordinates.

Special attention is being devoted in the USA to the problem of the creation of an artificial satellite.

There are several designs of an Earth satellite, of which [Wernher von] Braun's (the German designer of the FAU-2 rocket) interplanetary station and the design of a satellite weighing about 45 kg deserve attention.

[Von] Braun's design provides for the creation of a 7000-ton rocket (25 times the weight of an R-7 rocket). The launch of 12-14 such rockets will be required to create an interplanetary station in orbit.

A second design proposes the creation of a 45-kg satellite intended for scientific purposes based on existing rockets. The timeframe to accomplish this project is put at two to three years.

According to the recent press reports the US Government has decided to create such a satellite and perform launches during the International Geophysical Year (July 1957 – December 1958).[1]

In the Soviet Union a group of scientists and designers have conducted preliminary research on this problem and determined the technical possibility of creating the simplest Earth satellite based on the R-7 with a weight of 1.5 – 2 tons. The total launch weight of a fueled rocket with an artificial satellite is about 270 tons. The satellite will orbit the Earth in an hour and 40 minutes.

The flight of the satellite above the Earth's surface will be within the bounds of 200 to 700 km. Since according to current information an atmosphere still exists at such altitudes, although very thin, the satellite will gradually lose speed and the time of its duration at these altitudes will be 10-50 days. The satellite will burn up when entering the dense layers of the atmosphere. The solution of this problem will require a concerted effort of the many scientific and design organizations of the country which are being newly-involved.

It will be required to create a new design of the nose cone (satellite), but comparatively insignificant changes should be made in the R-7 rocket itself. The serious difficulty in the creation of the satellite will be in the development of the scientific apparatus for various research and the transmission of the data acquired from the satellite to Earth.

The launch of the satellite will be possible after development of the R-7 and the satellite nose cone, that is, in approximately 1957-1958.

The approximate cost of all the work associated with the creation of an artificial satellite (without considering the cost of the R-7 rocket) will be up to 250 million rubles.

At the same time it ought to be noted that the combined development of the R-7 rocket and the satellite will allow the development of the R-7 rocket to be viewed, if necessary, as a preparatory stage toward the achievement of an artificial Earth satellite.

Considering that the creation of an artificial Earth satellite will open new prospects in the development of science and military technology, [we] consider it advisable to begin work on its creation in the near future.
In the event of approval of our proposals the necessary measures will be prepared and submitted for your consideration within 1.5 – 2 months.[21]

M. KHRUNICHEV

V. RIAHIKOV

S. KOROLEV

Images

Document #10


Document #11


Document #12


3. Graphic Organizer

a. **Essential question**: General: How does war drive scientific innovation?
   Specific: How did the Cold War drive scientific innovation in the 1950’s and 1960’s?

b. **Supporting questions**
   i. Did American fear during the Cold War contribute to an increase in scientific innovation? Which primary sources suggest this?
   ii. Does being the most scientifically advanced nation automatically make it an undisputed word power? Which primary sources suggest this?
   iii. Why is competition important to scientific innovation? Use evidence from the documents to support your claim.

Directions: As you read the sources relating to the topic answer the prompts for each document and connect the document to a supporting question or another source document.
<table>
<thead>
<tr>
<th>Document</th>
<th>Reading Prompt Answers</th>
<th>Connections to other documents or a supporting question (i, ii, or iii)</th>
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<td>• What are some key scientific innovations that are noted in the timeline?</td>
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</tr>
<tr>
<td></td>
<td>• What are some important (milestones) events that are noted in the timeline?</td>
<td></td>
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<tr>
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<td>• What scientific triumphs can the Soviets claim?</td>
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<td>• What scientific triumphs can the Americas claim?</td>
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<td>2</td>
<td>• Why was the launch of the Sputnik Satellite met with fear by Americans?</td>
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<td>• What do fallout shelters, anti-communists attitudes, and a sense of imminent danger infer about the satellite launch?</td>
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<td>• How did many Americans feel about this Soviet triumph?</td>
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<td>• What does Johnson mean when he says, “in some new way, the sky seemed almost alien”?</td>
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| 4 | • What actions does President Kennedy want the nation to take in this race to space?  
  
  • When President Kennedy says, “if we are to win the battle that is now going on around the world between freedom and tyranny” Who/What is he referring to? Why do you think he specifically uses the world battle?  
  
  • Why does President Kennedy feel that space exploration is important? |
|---|---|
| 5 | • How does this primary source connect to the competition between the US Space Program and the Soviet Space Program?  
  
  • Imagine being at home and seeing this footage first hand. What would be your initial reactions? How would you feel?  
  
  • How does this primary source connect to the nature of scientific innovation/engineering?  
  
  • How does this primary source relate to the American spirit? |
| 6 | • How does this primary source convey the Soviet perspective of the Space Race?  
  
  • Why do you think only a few people in the Soviet Union know about the developments that the American Space Program has made |
| 7 | • What does this budget suggest about the amount of money spent on defense vs. space development during the Cold War?  
  
  • How does this relate to the timeline of scientific developments?  
  
  • Why do you believe there is an increase in the NASA budget some years and not others?  
  
  • Overall, what is the trend of the % of budget given to the department of defense? |
## DISCIPLINARY LITERACY IN SCIENCE

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| 8 | • According to Dr. von Braun what scientific developments need to be made to match or beat the Soviets in the Space Race?  
|   |  • What are the chances of the U.S. being successful in the following missions:  
|   |  Orbiting laboratory in space:  
|   |  Landing a radio transmitter on the Moon:  
|   |  Sending a 3-man crew around the Moon:  
|   |  Landing a crew on the Moon:  |
| 9 | • What are some of the reasons the Soviet scientists think a satellite in space would be a benefit?  
|   |  • What does this document say about the competition between the U.S. and Soviet Union in the Space Race?  
|   |  • What are some of the modifications that the Soviets will need to make to the current R-7 model of the rocket for this goal to be achieved?  |
| 10 | • Compare and Contrast Document 10 the US Mercury Redstone Rocket and Document 11 the Soviet R-7 Rocket  |
| 11 |   |
| 12 | • What are some major differences between the U.S. and Soviet Lunar rockets?  
|   |  • What are some differences between the U.S. and Soviet Lunar Landers?  
|   |  • Which rocket proves to be more successful and why? Use evidence from the infographic to support!  |
4. Outline

Scientific Innovation: Document Based Question Response

Name: ___________________________ Period: ___________________________

**Essential Question: How did the Cold War drive scientific innovation in the 1950's and 1960's?**

Outline:

I. Claim or Thesis statement
   a. Evidence point #1
      i. Cite it
      ii. Explain how it connects to the question
   b. Evidence point #2
      i. Cite it
      ii. Explain how it connects to the question
   c. Evidence point #3
      i. Cite it
      ii. Explain how it connects to the question

II. Choose one supporting question to answer
   a. Did American fear during the Cold War contribute to an increase in scientific innovation? Which primary sources suggest this?
   b. Does being the most scientifically advanced nation automatically make it an undisputed world power? Which primary sources suggest this?
   c. Why is competition important to scientific innovation? Use evidence from the documents to support your claim.

III. Sourcing Questions
   a. Which documents did you find the most helpful to making your claim? Why/Explain?
   b. Which documents did you find the least helpful to making your claim? Why/Explain?